EURO-MEDITERRANEAN REGIONAL PROGRAMME
for Local Water Management ME8/AIDCO/2001/0515/59763-P 016

Projet ISIIMM

General synthesis

MEDA Water

AGROPOLIS INTERNATIONAL

Institutional and Social Innovations in Irrigation Mediterranean Management

ISIIMM

"Promoting an integrated and balanced management of water resources by reconciling respect for the environment with economically viable irrigated agriculture» is the objective of a local dialogue operation between farmers, development professionals, scientists and various stakeholders. This concept has served as a reference for the Institutional and Social Innovations in Irrigation Mediterranean Management project (ISIIMM) led by Agropolis International (France).

ISIIMM is a Euro-Mediterranean regional project funded by the European Commission "EU-MEDA Water" involving six countries: Egypt, France, Italy, Lebanon, Morocco and Spain. The aim of the ISIIMM project was to share experiences, knowledge and build new perspectives for sustainable water management in Mediterranean agriculture, based on a common understanding of six key mechanisms: Social, Institutional, Historical, Agricultural, Territorial, Hydrological/Hydraulic.

A comparative, progressive and participatory approach was adopted between different stakeholders coming from the eleven selected study areas where water is a central topic issue to social and economic life.

The ambitious and challenging activities of the ISIIMM project were built upon a framework of regional network co-operation systems. Many multi-national and multi-sectoral teams worked together with the support and organisational efforts of project partners.

With a primary objective to help local rural communities adapt to the emerging problems resulting from pressures on water resources, two priorities guide the project: a) working with local irrigation organisations; and b) working with the development professionals.

Three main activities were developed with the participation of the target groups.

Diagnostics for action in each of the 11 river basins (national and local case studies) leading to new water-sharing behaviours and institutional innovations. This was focused on a statement of conditions and aims for each river basin and country using a participatory approach and based on existing documentation plus the scientific assessment of the ISIIMM experts.

Social and institutional innovations have been approached thought the ***concrete actions*** on the ground and a wide series of ***training workshops and exchange seminars*** complemented by field visits with farmers, managers of public organisations and canal managers. In total, 19 international workshops and seminars and around 35 local and national meetings and trainings were organised with participation of more than 1500 persons to enable the target groups to gain a wider vision of the problems in Mediterranean irrigation management and more references to solve them in more suitable ways. Concrete actions (SWaMMA (Solid Waste Management in Mostafa Agha) micro-project in Egypt, AIRMF *(Association des Irrigants des Régions Méditerranéennes Françaises)* in France, Irrigators association in Lebanon, wider stakeholder participation in decision making in Morocco, pluri-stakeholders involvement at regional and local level in Italy and Spain) have been initiated with local stakeholders and will be continued thanks to the strong relations developed.

An ***extensive information and data base system called OSIRIS*** has been developed to enable target groups to access information about the ISIIMM case studies and compare this with their own situations (www.isiimm.agropolis.fr).

In addition, a concerted effort was being coordinated to distribute this information through books, films, newsletters, guides and other media. ISIIMM has been contributed to mutual learning and knowledge transfer at local, national and regional scales.

The EU Partners are:

- In France: Chambre Régionale d'Agriculture du Languedoc-Roussillon (CRALR), VERSeau Développment
- In Italy: Autorità di Bacino dei fiumi Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione (ABAA), Fondazione Eni Enrico Mattei (FEEM)
- In Spain: Universidad Politecnica de Valencia(UPV), Unidad Sindical de Usuarios del Júcar (USUJ)

The MEDA Partners are:

- In Egypt: Center for Rural Development Researches and Studies (CRDRS), Egyptian Association for Sustainable Rural Development (EARSUD)
- In Lebanon: Chambre de Commerce, d'Industrie et d'Agriculture de Zahle et de la Bekaa (CCIAZ)
- In Morocco: University Cadi ayyad (UCAM), Association Al Majal

Scientific Partner:

- IRD

Lead Partner:

Agropolis International (France)
Avenue Agropolis, F-34394, MONTPELLIER Cedex 5
Contact person: Michel SOULIÉ, soulie@agropolis.fr
www.agropolis.fr

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ISIIMM project

General synthesis

Final Report by

Thierry Ruf
Jeanne Riaux
(IRD)

Institutional and Social Innovations in Irrigation Mediterranean Management

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PART I - INTRODUCTION

"To address and manage the current contradictions associated with local irrigation water management in Mediterranean watersheds using institutional solutions that take into account the site-specific social compromises"

This is the stated objective of the ISIIMM project as a response to the 2002 MEDA Call for Proposal "EuropeAid/113202/C/G/ on local water management in the Mediterranean region. ISIIMM includes six member countries – Egypt, France, Italy, Lebanon, Morocco and Spain – and eleven old hydraulic Mediterranean regions from these countries (Table 1). This project fits within the action framework IV of the Call for Proposal entitled « Irrigation water management ». It addresses the relations between the environmental or management policies and the adaptation practices of local communities, especially in water sharing and saving (Table 2).

Table 1. The ISIIMM Project Partners

Country	Partners	Regions / Cities	Management units (coordination)
France			
Project Holder (SP)	AGROPOLIS	Têt river basin (Perpignan, Pyrénées-Orientales) Durance river basin (Avignon, Alpes, Provence)	Agropolis Montpellier (project sponsor) ; Regional Chamber of Agriculture Languedoc-Roussillon – Montpellier (French coordinator)
Partenaire (DP)	Chambre régionale d'Agriculture du Languedoc Roussillon		
	VERSeau Développement		
	IRD Institut de recherche pour le développement (Development Research Institute)	Specific support to Morocco and Egypt (studies and research documents) and to Pyrénées-Orientales in France.	"Water Social Management" team in charge of scientific support as per a convention with Agropolis
Spain			
Development Partner (DP)	Acequia Real de Jucar en representación de la Union de Sindicatos de Usuarios del Júcar (USUJ)	Jucar river basin (Valence) Genil river basin (Grenade, Andalousie)	Université polytechnique de Valencia Centre Valencià d'Estudis del Reg (CVER)
Scientific and Academic Partner (SP)	Universidad Politecnica de Valencia –UPV Valencian Center Irrigation Studies (CVER)		
Italy			
Development Partner (DP)	Autorità di Bacino Alto Adriatico (ABAA)	Piave river basin (Venise, Alto Adriatico)	FEEM Venezia
Scientific and Academic Partner (SP)	Fondazione Eni Enrico Mattei (FEEM)		
Morocco			
Development Partner (DP)	Association Al Majal (« Espace »)	Haouz Office (Tensift and Oum er Rbia basin transfer) Ait Bouguemez valley	UFR economic analysis and development
Scientific and Academic Partner (SP)	Université de Marrakech, Faculté des sciences juridiques économiques et sociales		
Egypt			
Development Partner (DP)	Egyptian Association for Sustainable Rural Development (EARSUD)	Fayoum and Behera, comprising the ancient and new lands (Nile delta) Menia (middle Nile valley)	Center for Rural Development Research & Studies (CRDRS)
Scientific and Academic Partner (SP)	Cairo University, College of Agriculture, Giza- Center of Rural Development Researches and Studies (CRDRS)		
Lebanon			
Development Partner (DP)	Chambre d'Agriculture de Zahle (CCIAZ)	Litani high basin	Zahle Chamber of Agriculture (CCIAZ)
Scientific and Academic Partner (SP non contractual)	Office du Litani		

Table 2 – ISIIMM Project Scope of Action as per the MEDA CfP Nomenclature.

Scopes of action	Specific Points
IV. Irrigation water management	Adaptation of irrigation techniques as per the hydric techniques and resources available, environmental changes, institutional and economic reforms and techniques.
	Hydric resource sharing strategies between protagonists at three levels: regional, national and local.
	Facilitation of the participation of the end user and acting as a mediator in the relation with the irrigation authority .
I. Integrated management	Alternative forms of integration and of participation of the players.
II. Local management of resources and water demand in watershed zones and in islands	National and regional authorities in charge of water basins: elaboration of watershed plans and coordination of the different administrations, water-consuming industries, and local user syndicates for guidance to integrated water management through joint planning.
III. Fair water management as a scarce resource	Awareness raising and training campaigns for the local population.

In each region, there is a strong collaboration between the development partners – who work with the local water users syndicates – and the scientific and academic partners - who study water management issues at the collective level. For four years, these partners shared their experiences and knowledge in terms of institutions, organizations and water law and regulation. The exchanges took place at three different levels of understanding of social and institutional issues: national (State framework), regional (global situations of irrigated territories) and local (specific systems dealt with as specific case studies). A series of workshops – some including all the teams, others targeting specific exchanges – showed how important it was for water policies to be based on local realities and on the experience and know-how of Mediterranean rural societies. The information produced or collected during the project is available on the ISIIMM web site. The contents are useful for remote teaching to be used by all the players involved in water management in the Mediterranean region (Table 3). The Agropolis association coordinated all the phases of the project between 2003 and 2007. The links between research and development within the Euro-Mediterranean perspective continue and among the Project's outputs, the ISIIMM site is now administered by the IRD, the scientific partner for all the actions, and in charge of writing the current synthesis.

Table 3 – Horizontal themes of the ISIIMM project as per the MEDA Call for Proposal nomenclature.

Horizontal themes	**Expected results**
A: Reinforcement of the institutional power and of training	Creation of the conditions necessary for the Euro-Mediterranean education and training for professionals, research and education activities.
B: Exchange of information and know-how	Creation of the conditions necessary for a joint irrigation water management culture at the social and institutional levels, including remote-training using the Internet.
C: Transfer of know-how and techniques	Opening new perspectives in irrigation policies and enabling local innovations in each of the regions of the ISIIMM project.
D: Awareness-raising, mobilization, and promotion of population commitment	Producing communication products: Web site, productions of documents and documentaries.

The implementation of the ISIIMM project activities was divided into three main phases: the organization of knowledge; joint training; knowledge dissemination. In practice, these phases were initiated one after the other and then conducted co-jointly throughout the project. Work on site was considerable. It was conducted on several scales in the six countries and in the eleven regions. The issues addressed concerned first of all the local social organization at the scale of 20 inter-village systems considered as pilot cases or workshop sites. They were studied by the national teams and evolved as the ISIIMM mediation works and the exchange programmes progressed between 2003 and 2007. This concrete knowledge of the irrigation networks and of the communities that are linked to it have made it possible to work in two complementary directions. The first consisted in broadening the scope of observation of the pilot local system to the regional scale, bearing in mind that this is not just the hydrographic watershed (a notion that the ISIIMM will significantly reconsider), but also the political and administrative region, which is geographically distinct and offset. Within these dynamics, each ISIIMM national team further broadened its work up to the national framework by integrating elements of economic and agricultural policies and water governance. The second direction adopted from pilot field sites is the core of the project: to go beyond the local, regional and national references of each country to promote exchange of experience and the understanding of new situations, within different cultural, geographic and historical contexts.

Table 4 – Phases of the ISIIMM Project between 2003 and 2007

Phase 1 (months 1 to 12, then beyond):	**Phase 2 (months 13 to 36):**	**Phase 3 (months 37 to 48)**	**Post-ISIIMM**
Organization of knowledge	Mutual training	Knowledge dissemination	Maintenance of exchange and network tools
Collection and organization of *knowledge specific* to each case study.	Seminars organized on the different case studies on the sites, attended by groups composed of the players and scientific experts from the six countries.	*Dissemination* of knowledge, opportunities and new perspectives developed and pooled through the Phase 2 activities.	Updating of the tools implemented by ISIIMM. Integration of new regions in the knowledge sharing approach.
This calls for the commitment of the stakeholders; it begins with a joint meeting and ends with a final conference in order to present the results.	Each seminar dealt with a specific thematic issue and took place within a series so as to enable the the participants to work with players of different nationalities and from professional domains. The eleven local case studies started with forecasts and went into action. The OSIRIS system was built thus opening access to knowledge and training.	Books, guides, films and the Web site became permanent tools.	The IRD team ensures the animation of the site and proposes new joint research efforts in research-action in the Mediterranean.

The mutual training was reinforced during the project, with the concern of having the main efforts orientated towards the MEDA countries and respecting the idea of a mirror between situations instead of the idea of models. The first meeting took place between one team from the South and one team from the North, each inviting the other to understand on site the problems and issues of local water management and to consider new leads to solve the social and institutional tensions. Thus, Egypt and France worked together, then Lebanon and Italy, and finally Morocco and Spain.

Subsequently, the framework of the meetings was broadened through joint teams and multi-site participations. Several workshops followed on the subject of the European Water Framework Directive, of the specificities of the Mediterranean mountain communities, to which were added a meeting of the associations of irrigators in the Mediterranean, a meeting on integrated water management, and almost in an original manner, a meeting between the three countries from the South with Arabic being the working language.

ISIIMM brought its activities to an end in 2007 by means of a final conference, and the present synthesis takes into account all the work outputs, without being exhaustive in its report of all the events. The present text is one of the knowledge diffusion materials - as the third phase of the project – which, in fact, constitutes an element of continuity in the links established for the necessary taking into account of the human and social framework in order to manage natural resources such as land and water.

1. THE HISTORY OF IRRIGATION IN THE MEDITERRANEAN WORLD AND COMPARISON OF THE ISIIMM PARTNER REGIONS

How does one approach the history of Mediterranean irrigation, where is the entry point of knowledge about the water institutions in a project the likes of ISIIMM? The starting point for this historical positioning derives often from elements which are often felt but which are badly clarified. The Mediterranean links civilisations which have prospered on its shores, and everyone is very well aware that the context of hydraulic and agricultural development is rooted in a common history, which has been built not only from the exchange of technological and economic knowhow but also cultural, political and religious confrontations. All the partner countries and the 11 regions involved in the ISIIMM project have a centuries-old history of irrigated agriculture (fig. 1.1). The disposition of the networks and the founding of the institutions and rights are rooted in a thousand year- and at times two thousand year-long history (fig. 1.2).

Localisation des différents sites ateliers du projet ISIIMM sur fond de carte extrait de Guilielmo Blaeuw (1640)- "Europa recens descripta",

Figure 1.1. ISIIMM Workshop-sites on the map from Blaeuw, 1640. Europa recens descripta

1.1. ANCIENT HISTORY

It is admitted that the artificialisation of nature started beyond the framework of the Mediterranean in the Basin of the Tigris and the Euphrates, and gradually spread towards the Eastern Mediterranean. Irrigation operated from capped underground springs was later able to follow a similar course, if we are to believe in the diffusionist theory of the drainage tunnels, *qanats* in Arabic, which came from Persia 3,000 years ago. Known by terms such as *foggara, khettara, water mines,* they were adopted in almost all the countries to the South and the North of the Mediterranean in the course of the last three millenia, whether in the Egyptian oases or the Maghreb (fig.1.3.5), in France, in Spain, Portugal or in Italy. A good number of other hydraulic systems have been devised by human societies, such as the mastery of the floods of rivers and their tributaries which have indelibly marked Egyptian history (Fig. 1.3.1), or even the drying of the wetlands which the Etruscans were said to master to well before the height of Rome's glory. What else may be said of this unusual province of Fayoum in Egypt which equipped itself with a regulated network[1], to permanently irrigate vast and productive gardens, 2,000 years ago under the Ptolemaic Pharaohs (fig.1.3.1). This was the period when the oases were developed

[1] Le Fayoum is described by Martin in 1799 as a hydrographic basin (see figure 1.3.1), a notion adopted during the project ISIIMM by J. Feraud (Chamber of Agriculture of the *Pyrénées-Orientales*) and which will be developed in chapter 2 in the 2nd part on the innovations contributed by the project.

throughout Northern Africa. The Roman Empire showed its flair in the monumental aqueducts intended to service the large towns, as well as the development of watering systems for the Roman villas with their precise water holes set out along the edges of the supply canals. Thus, the Nîmes aqueduct functioned for six centuries on the complementarity of both urban and agricultural uses from the Ist to the 6th century A.D.

The three monotheistic religions which developed in the Mediterranean area associated water with their main rituals. From the 6th century, Islam renewed and amplified urban hydraulic development, especially in the Near East and in the Arabo-Andalusian region. Fez, Marrakesh (fig.1.3.5), Cordoba, Granada, Valencia (fig.1.3.6) and Seville were the places where the hydraulic sciences propagated, extending the principle of garden cities, as well as expanding the irrigated territories, into the surrounding rural world. The Water Tribunal in Valencia symbolised the art of judging access to water in a composite society where land became a private asset and water a common good. Irrigation was also to be the prerogative of the powerful, with a particular view to maintaining an army and enriching the political elite.

This Mediaeval boom also affected the Northern shores of the Mediterranean, so much and so well that a large number of canals were built at the end of the Middle Ages in France and in Italy, in the mountains as in the plains and the deltas. Here were local networks founded and managed by rural communities, as well as much larger systems initiated by rich and influential personages certain of whom were representatives of congregations (monasteries, abbeys) who managed landed and agrarian domains. The drainage and drying out of the land was concomitant with the appropriation of water by religious hospital establishments, which were parts of vast economic systems which included the breeding of transhumant herds with their large livestock populations integrating coastal plains in winter and the mountain pastures in summer where the production of irrigated forage was to assume importance. The State in Europe still seemed little concerned by the "hydraulics business", with the possible exception of the Catalonian kings – who as early as the 13th Century, through the Usages of Barcelona, assumed a primacy over the recognition of water rights in opposition to the ecclesiastical Lordships (fig. 1.3.2).

Thus, several hydro-agricultural and urban models and various technologies were invented and circulated, accompanied by adapted hydraulic organisations of networks and connected spaces, and run by specific institutions, at times close to the central powers, at other times set in local communities and sometimes also in the hands of private interests.

1.2. THE POLITICAL TENSIONS OVER WATER AND AGRICULTURE IN THE 19TH CENTURY MEDITERRANEAN

All civilisations and all political powers were active in the vast movement to dominate nature, land and water and left us lasting material and immaterial elements which would be the subject of the first comparative study, at the beginning of the 19th Century, with the book by François Jaubert de Passa. A French lawyer from the Pyrénées-Orientales, he was sent to Spain by the French public authorities, more especially to Valencia, to try to understand how the institutions who govern agricultural water may be useful for innovations on the social and political level (his work is still recognised in Spain today). He pursued his investigations and published his "Research into the use of watering among ancient peoples" in 1846, then militated for formal recognition for local institutions[2] which was to be materialised in 1865 in France by the law on the authorised syndicated associations (ASAs).

[2] Jaubert de Passa wrote: "The water regime is only as perfect as the ruling authority is shown to be enlightened and vigilant; it should organise individual rights in compliance with the law and in the general interest and with this aim in mind, look out for the renovation signals that new requirements bring... By seeking to improve upon the works of the ancients, care should be taken not to give into too hastily to the spirit of innovation which exalts the minds of certain and which may work against the march of the private administration of water and weaken the

During the first half of the 20th century, the Mediterranean gradually yielded to the new economic order imposed by the States of the North on the States of South, following the weakening of the Ottoman Empire. Egypt was the protagonist of a new geopolitical equilibrium by asserting itself as an emerging power after the episode of the French expeditionary forces followed by the British, from 1798 to 1805. The country was run by an enlightened despot of Albanian origin, Mehemet Ali, who in 1811 after having eliminated the former ruling class, the Mamelouks, and having recovered one third of the lands liable to flooding, undertook an unprecedented hydro-agricultural revolution by placing the Nile delta out of reach of floods. To convert the ancient overflow basins so as to provide sustainable irrigation and impose on the fellahs the tropical culture of cotton, the Viceroy of Egypt provided the help of a group of Saint-Simonian engineers who fled France where their liberal and sectarian spirit was under attack. Having come with the idea of digging a maritime canal linking the Red Sea to the Mediterranean, the Saint-Simonians were invited by Mehemet-Ali to design and build a dam on the Nile to raise the low water level and facilitate the extension of irrigation. They were to conceive the first modern hydraulic services for the study of large public works, to organise projects and prepare the re-installation of the *fellahs* in a re-modelled space and a state-controlled economy. But as exceptional as the dam project was, it nevertheless encountered technical difficulties. Tensions arose around the ideas of the Saint-Simonians to educate the requisitioned farmers to assist in the construction of the edifice. Rejected by Egypt, the Saint-Simonian group became involved in all the great industrial and colonial adventures of the 20th Century by applying the founding principles of social participation, scientific and technological rationality and the transformation towards a new world where the action of the elites was to be aimed at reducing poverty. A good number of these elements were to be the basis for the action of international financiers in the second half of the 20th Century to justify the financing and re-organisation of agricultural hydraulic engineering.

The Saint-Simonian current spread throughout Europe, particularly in Italy. In France, it introduced the school system and reinforced the principle of the engineering *grandes écoles*. Following the success of their analyses of networks and mobility, their followers created railway companies, then turned towards water supply networks. The *Compagnie de Suez*, the *Compagnie de la Générale des Eaux* then the *Lyonnaise des Eaux* are Saint-Simonian emanations. To the South of the Mediterranean, other disciples assisted in the conquest of Algeria and, under the reign of Napoléon III, were to vindicate, with a certain success, the French intervention as a modernising stage for the country, refusing the idea of direct colonisation of the land. However, a certain number of Saint-Simonians were to install themselves using an industrial agricultural model founded on rational hydraulics applied to farms of several hundreds of hectares. On their return to France, this orientation inspired ideas for the rationalisation of agricultural hydraulic engineering and the emergence of large agro-industrial companies in the South of France, especially in Camargue.

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policing measures which protect irrigation... The assembly of users appoints a special commission, whose mission is to prepare a new edition of the regulations. This is discussed, rejected or adopted (by the assembly); if the majority of those voting is favourable, it is submitted for approval to the administrative authority which, in its turn, modifies or completes it, in compliance with the general laws and the rights of the public authority. These reforms are therefore drafted and accomplished with caution; they are naturally subordinated to the social and agricultural institutions which govern each country; the essential, is that the regulations are conceived in such a way as always to be more powerful than the abuses; this is because the means of control and the rates of the fines are modified as society changes, as the working instruments develop and social needs or passions change supply or direction... It would be seriously careless to impose the same regulations upon all the agricultural associations, and to subject them to the same organisation. There are areas where water abounds, and there is urgent need to preserve the lands and crops with evacuation canals, with roads and other works of all types and there are others where water is scarce and it is important to collect it and conserve it carefully, to use it with constant economy. The needs of the land and the configuration of its surface therefore vary with every step and with them should also vary the means to irrigate, the method of distribution and the penalty for rural misdemeanours". (Jaubert de Passa, 1846, 6th part p 324)

The idea of hydraulic development was given new impetus North of the Mediterranean, in Spain, in Italy and in France during the 3rd Republic which set about building State-owned canals under the aegis of the services of *les eaux et forêts*, such as the canal de Manosque or that of Carpentras (workshop sites on the Durance). Republican France then became massively involved in the colonial period so deplored by the Saint-Simonians, whose organisation disappeared at the end of the 19th Century but whose ideas had a lasting influence on engineering schools, hydraulic engineering departments and private water companies. From this moment, the reciprocal influences between hydraulic models of the North and the South punctuate the history of the countries and specialist corporations, which reproduced standard ideals and took inspiration from a model for intervention created at a given period on one of the shores only to remodel and re-organise it on the other.

In Spain, hydraulic engineering was also the background for political claims and calls for the modernisation of the country and the State undertook a policy of heavy development in the form of dam building, the rehabilitation of canals, the construction of new networks and even the installation of pumping stations to widen the irrigated space beyond the edge of the former perimeters. The same can be said in Northern Italy from half way through the 19th Century and under Mussolini under the guise of "Bonifica Integrale", which was both a technical project and a political ideology to supervise the recently unified territory under the domination of the industrial kingdoms of the North (Piedmont-Sardinia; Lombardy-Veneto).

In Egypt, the country had seen its economy ruined by the cotton crisis which occurred just after the American Civil War known as the "War of Secession", in 1860-65. The bankrupt country then entered a phase of direct Western management oriented mainly around the control of the waters of the Nile, the conversion of new basins for sustainable irrigation and the construction of the first Assouan dam in 1902. The Ministry of Irrigation became a powerful ministry, organised as a pyramid and in military fashion with a decision centre in Cairo for the allocation of water and an administrative and technical system for the execution of plans and rotations instituted in the governorships and their subdivisions (*markaz*).

Thus, the 19th Century Mediterranean sketched out the technical and institutional mechanisms for the development of hydraulic engineering in the context of free trade, where East and West were to exchange their experiences one with another, and construct a framework of public policy, on the basis of legislative and statutory texts, granting the State a central role. But the North and South shores were to differ dramatically on the local institutional level. To the North, the ancient forms of water management within rural communities were integrated, recognised and actualised, and made sense in a society in full movement. To the South, the idea of accompanying social transformations in the Ottoman provinces petered out to the benefit of the colonial option, and recognition of the traditional forms of water management by the "indigenous" populations just did not happen. The right to associate for the management common goods is only granted to Europeans.

1.3. THE HYDRAULIC ENGINEERING EPIC OF THE 20TH CENTURY

The colonial design spread in the 20th Century to those countries which had remained on the sidelines of the dominant movement of the previous century. Morocco arrived late on the international scene, but after agreements between colonial powers, the country was submitted to the Protectorate and control of Spain in the North and by France in the Centre and the South. The question of water was an immediate preoccupation of the new authorities and it was brought under State control. An inventory of resources was systematically organised so as to determine the access to water for the identified indigenous groups (this was probably also a way of allying

these groups and possibly a way of dividing them). The objective was to find extra resources or to create new ones using dam reservoirs to facilitate the European colonisation of the lands.

While the colonial hydro-political model applied to the Western Southern shore, to the East, Egypt escaped rural colonialism, without so opening up to associative or syndicated institutions. They did not exist in the Nile flood management system and this solution was rejected as early as the 19th century despite the utopian ideas of the Saint-Simonians. Throughout the period of the conversion of the basins to sustainable irrigation, it was above all the public authorities which appropriated the powers of allocation, under the influence powerful members of the royal family and the large concessionaires of the irrigated lands.

On the North shore, the 20th Century started with geopolitical upheavals. To escape from the contradictions of the industrial and colonial development of the 19th Century and to draw attention away from the social and political disputes, a first World War broke out and concluded with the emergence of extreme political regimes. These in their turn committed themselves to policies of great hydraulic engineering projects. Italy and Spain experienced a comparable development where the State, weak in the 19th century, was to assert itself using such measures. However, Mussolini's despotism revised the old institutions and invented territorial administrations around the notion of the "bonifica integrale" of the land, where drainage counted as much as irrigation proper. Franco's Spain also seemed to mistrust associations of irrigators, but after several attempts by the government at managing the canals, it recognised the professional structures which had developed out of the long history of hydraulics.

In France, the Pétainist regime showed no interest in the question during the second World War. Later, as in other European countries, French economic reconstruction was in part based on the construction of large dams with multiple uses, industrial, energetic and agricultural. In 1955, the State created specialist companies, regional development companies (SARs) whose responsibility it was to undertake new large-scale hydro-agricultural schemes. The *Canal de Provence* company in the Provence region and that of the *Bas-Rhône-Languedoc* in the Languedoc-Roussillon region equipped their respective regions with new modern networks and were also to intervene in countries on the Southern side. Doubtless, it is more exact to talk of re-intervention since the men who participated in this new French hydraulic engineering era had founded their first professional experience in the Maghreb countries, where the associative question is of minor importance. The SARs are both engineering consultancies, organisers and executors of projects and managers of the networks built. In this respect, they function on the principle of the delegation of services by the State, and the contractualisation of the service of the new networks to user customers; these are encouraged to adhere by the individual treatment of the supply of water, but at the price of high economic charges modulated between the fixed subscription to the network and a variable consumption rate. In practice, the members subscribe freely for their operation independently one from the other.

Simultaneously, the former gravity-fed irrigation systems, structured in syndicated associations recognised to be of public utility, maintained their territorial prerogatives, with the principle of the general fixed contribution on all the land within a perimeter and internal regulations which fixed the conditions for access to water. These ASAs were also the subject of a policy of economic support to reinforce the installations and modernise the networks (85% subsidy possible) as much and so well that the Mediterranean regions in France have two powerful institutional models: the delegation of public service to a regional company which depends upon subscriber customers dispersed throughout the rural space and the management of a common asset on a delimited rural hydraulic territory, where all the owners are contributors to the system to which they are linked.

In the South, the countries gained their independence in the years 1952-1962, and there also followed various hydraulic periods where the State was prime contractor. Egypt, which had had a highly structured Ministry of Irrigation since the end of the 19th Century, pursued the transformation engaged at this time on all the land in the Nile valley and extended the hydro-agricultural space to the West of the Nile Delta, the province of the Liberation. Insofar as the agricultural land was now mainly cultivated in summer, the flooding of the Nile had become an economic danger and no longer a "gift from the gods". The government under Nasser sought to protect the valley from possible destruction and conceived the construction of the Assouan High Dam as a political symbol and an economic stake around Arabian socialism. In the ancient lands, it was to favour the peasant farmers, in the past highly exploited by the large landowners and the liberal cotton economy. In the new lands, the model is the large State farm directed by central planning. But in order to pay for the dam which was constructed by the USSR, Egypt supplied its cotton production and the State also applied a controlled crop planning scheme with cooperative supervision in each village. Water regulated by the High Dam was supplied by the Ministry of Irrigation to the farmers using a meshed hydraulic grid, but at the end of the distribution network, it was the farmers themselves who organised themselves around circles of *sakkias* to lift the water a meter or two and irrigate their fields set out around a small distribution canal, the *mesqa*. There was therefore a very powerful State institution covering the whole of the national territory as well as hundreds of thousands of local micro-institutions, the *zimam*, inside the village territory, generally not federated to any organisation whatsoever.

In Morocco, the context of de-colonisation favoured the reinforcement of royal authority. The new power set itself apart from the ancient models, that of the syndicated association of the privileged farmers (ASAP) for the colonials and that of the customary and tribal arrangements whose rights had been treated separately and in a segregated way. Hydraulic expansion was planned around new public authorities, the *Offices Regionaux de Mise en Valeur Agricole* (ORMVA) which applied an organised and rational model based upon three essential elements. The dam reservoirs were used to put an end to the flood regime and organise inter-basin transfers of the water collected. The new networks of concrete transport canals were generally established without relation to the former infrastructures. The reorganisation of the land took place by dividing it into regular strips and plots according to the principle of the "B" layout as opposed to the first experiences where hydraulic development was applied to the existing land framework, made up of parcels with variable shapes and sizes, muddled and with complex ownership status. This state-controlled large hydraulic engineering model enabled the one million hectare of irrigated land objective that King Hassan II had prescribed to be reached. However, this result took into account hundreds of thousands of hectares of small and medium hydraulic systems whose technical supervision was provided by the provincial departments of agriculture and not by the ORMVA. There, the former institutions remain on the basis of the customs, arrangements and arbitration introduced under the Protectorate.

1.4. DOUBTS ABOUT AGRICULTURAL HYDRAULICS AT THE END OF THE 20TH CENTURY

During the years 1990-2000, it was easy to see in the South that public investment in hydraulic engineering was running out of steam, in particular in the Mediterranean basin. It is true that the majority of the sites which could be developed had already been developed and it had become more difficult to find adequate sites, as it had become more expensive to invest in them. On a world scale, however, the accounts of a crisis in the profitability of State projects accumulated in the project evaluations. The weight of indebtedness of the countries in the South grew as a result of costly chronic rehabilitation schemes. Environmental warnings were declared in various basins

and deltas such as that of the Aral Sea and more generally, the problems of the salination of the land and the degradation of groundwater and surface water was pointed out. At a local level, the crisis of the large perimeters was concomitant with economic liberalism and access to individual means of pumping, whether mobile or fixed.

The financing organisations adopted a new strategy of reforms in the agricultural hydraulics sector by imposing on all the countries of the South, on top of the structural adjustment measures, the promotion of the participation of the users of the resources. In Egypt, as in Morocco, one demonstration followed another. The participative management of irrigation became an order from the highest level. Whilst the Moroccan services established, in record time, hundreds of agricultural water users associations on the portions of hydraulic and administrative territories defined in the offices, the Egyptian Ministry of Irrigation proceeded by more limited steps, hesitating over the size of participation and on the spatial units adapted to the irrigator associations. For the problem was not simple, since the peasant farmers' responsibility was only exercised at the level of the circles of *sakkias*, on a very small hydraulic mesh. As it happened, in the last decade of the 20th Century, the *sakkias* were abandoned to the benefit of small imported diesel pumps whose operation escaped all authority and regulations.

In the North, irrigation also took a new, more technical direction with the adoption of sprinkler systems and localised irrigation in the associative collective networks, as well as and more often, with the rise in individual drillings. Spain, France and Italy benefitted from a Common Agricultural Policy which favours the extension of irrigated agriculture through the set of direct subsidies for installations and crops. The institutions for the management of agricultural water differ in the three countries and react differently. In Italy and Spain, the trend is to seek national and European subsidies to convert the former gravity-fed networks into collective pressurised networks, and the cases of the Piave and the Jucar reflect these orientations. In France, things are a little different for the *Chambres d'Agriculture* and numerous syndicated associations of irrigators in the Provence, Alpes, Cote d'Azur and Languedoc Roussillon regions would like the interest of the gravity-fed canals as historical, cultural and environmental components of our heritage to be recognised. In this respect, they differ from the other French regions where gravity-fed irrigation is in the minority. But in any event, the question of agricultural water no longer finds itself limited solely to the domain of rural development or economic development.

Indeed, the debates about water have taken on a world dimension over the past 15 years, on the occasion of the large conferences on the environment, then more specifically on the water resource itself. Forums, conferences, professional meetings succeed each other around the same themes: climate crisis, critical thresholds, the fear of wars over water, public negligence, generalised waste. One of the conclusions reiterated at each conference are the doubts about irrigation, the hyper consumer of resources.

Confronted with the threat of a general shortage, the uniform message is for an ideal model for the integrated management of water resources (uniqueness of the resource), which, if democratically accepted, would provide the agreed terms for its optimised management, a blend of economic effectiveness, environmental conservation and the participation of the user populations of the said unique resource.

As irrigation is perceived as being responsible for the large hydric imbalances in the world, the effort should concentrate on this careless consumer and national water policies throughout are committed to limit its share, by insisting on three key areas:

- Express the scarcity of water in terms of demand management with a view to limiting the uses between types of irrigated agriculture, agricultural activities and other economic activities and have it paid for at the competitive market rate.
- Introduce new institutions at the hydrographic basin level, with the authority to regulate and the organise allocations.
- Introduce agricultural water user associations to alleviate the costs of control and make local populations gradually responsible for paying the correct price for their water.

The integrated water resource management model is based on rather uncertain bases defined in Dublin in 1992 and reproduced in analogous terms for 15 years. The first critical element is the very definition of the relevant hydrological territory, the catchment area whose contours are never obvious (see chapter 2 on the territorial dimensions). The second element is the question of the unit of the resource and the administrative authority in charge of it, whereas the composite rural societies in a given territory treat water in its plural form, according to its origins, its access, its use and its re-use (see chapter on the social dimensions). The third element is the fixing of an economic value for water while this resource is a complex economic asset which may be shared according to four conditions: the market, the toll, the common asset and the public asset, where in reality, these four forms co-exist in the same water management space, particularly in agriculture (see chapter 4 on the institutional dimensions).

CONCLUSION

The comparative history of irrigation in the Mediterranean and in the 6 countries and 11 regions covered in the ISIIMM project would indicate that each space has built a local institutional and economic compromise as a result of the effects of a fusion of the initiatives of the rural and urban populations who live in it and the national policies influenced by international principles of governance and economic exchanges (figure 1.2). However, in recent years, the influence of world water policies would seem to be decisive, in a sense which is rather unfavourable for the rural farming communities. There appears to be both the risk of hydraulic precariousness for the weakest producers in irrigated areas, and the redistribution of the resource where the State, far from being disinterested, expropriates the ancient water rights and acts in favour of companies and markets or, under the influence of those with power, allocates excessive resources to those who really do over-consume water. Two centuries after the start of a hydraulic and industrial revolution driven by the idea of progress and social transformation, we discover the disastrous impact of the environment and rural society of excessive numbers of individual drillings. This whole history should be dealt with in an in-depth way, around the archives of the different countries (examples given in the series of figures 1.3), by taking account of the geographical, social, political contexts, for as Jaubert de Passa announced, no universal solution may be imposed on the irrigating civilisations nor on local societies.

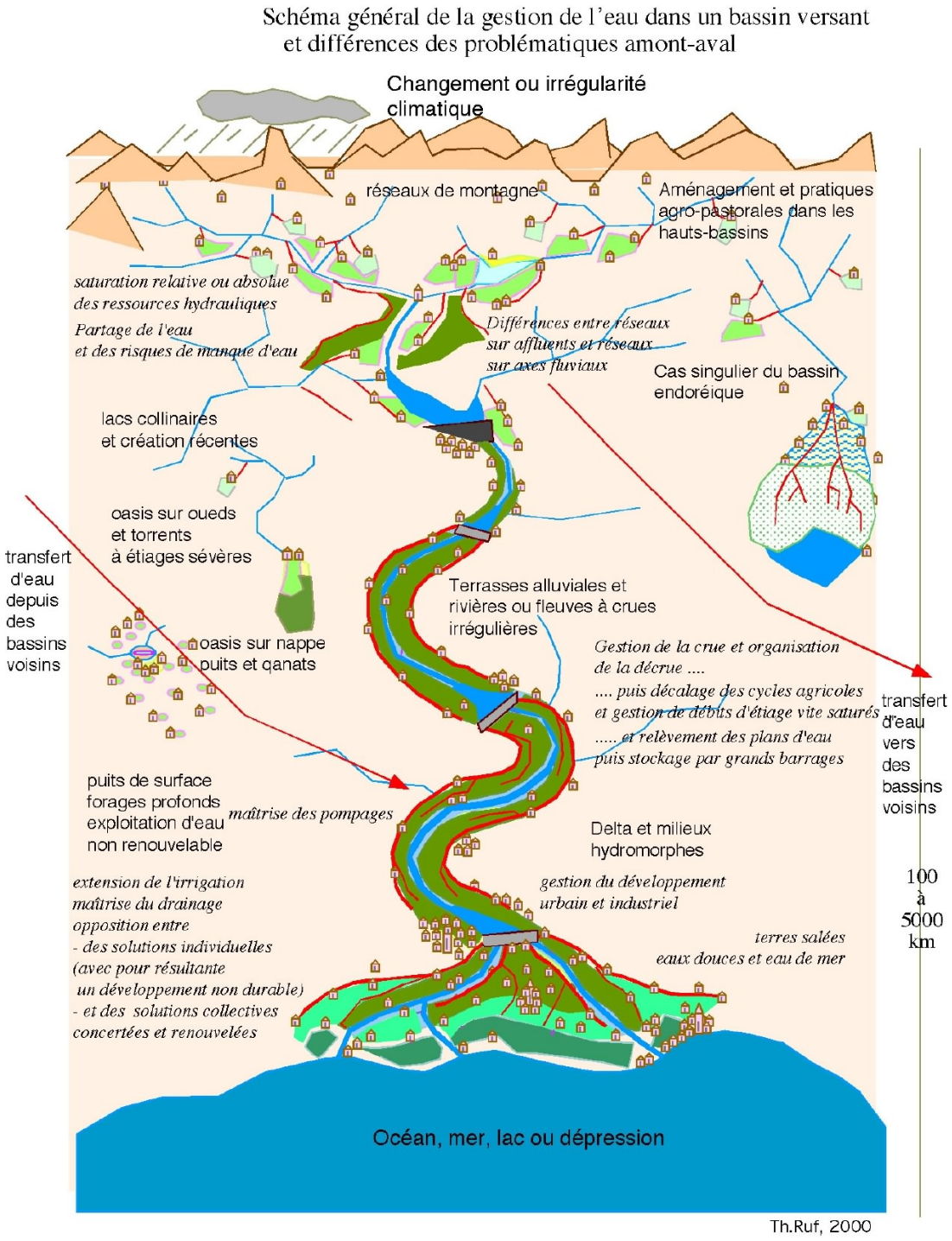
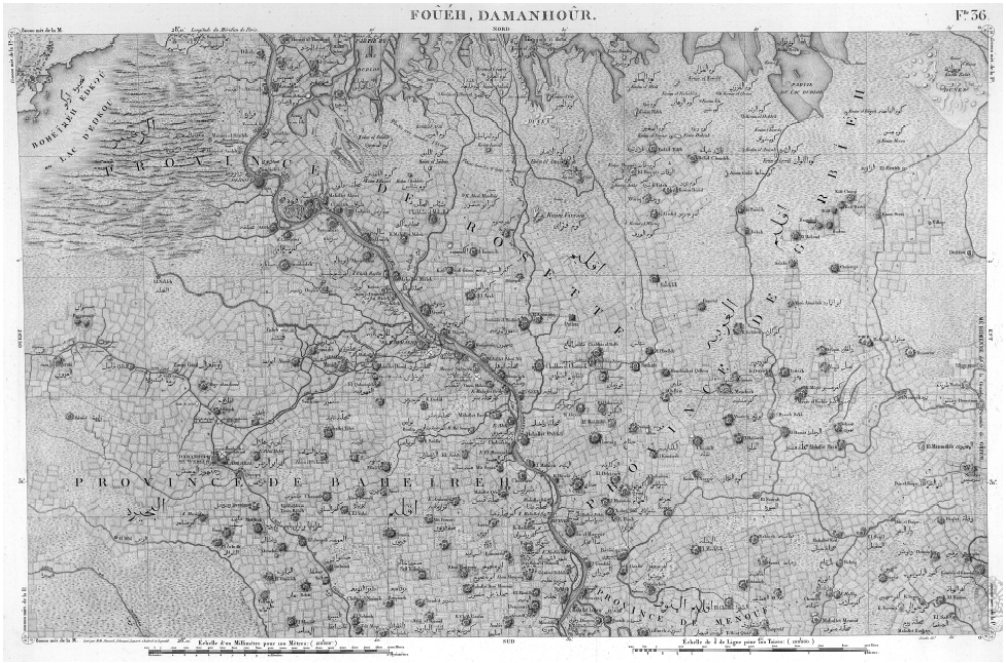


Figure 1.2. General diagram and types of historical development hydraulics in agriculture

Figure 1.3. 1 Examples of documents on the history of irrigation in the ISIIMM countries: EGYPT

At the beginning of the 19th Century, the description of Egypt comprised a series of hydrographic and hydraulic maps showing how the country was structured in a coordinated series of basins to receive the flood waters of the Nile and evacuate it. Modern Egypt converted to sustainable irrigation at the initiative of Mehemmet-Ali with the support of the Saint-Simonians to whom he entrusted the construction of the first dam at the head of the Delta (Sources: Edition impériale Paris 1809,1828)



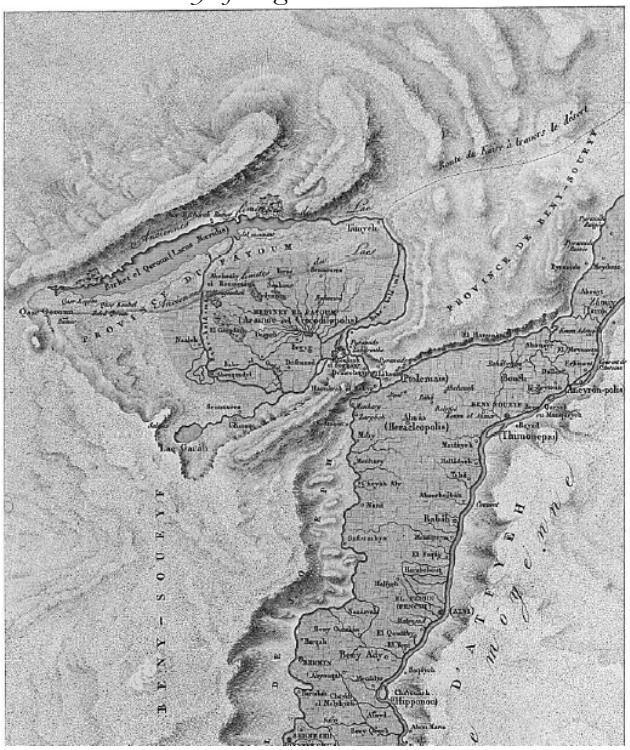
Details of the Province of Beheira at the beginning of the 20th Century, considered as one of the poorest and abandoned with flood water management infrastructures in a very bad state of repair.

Figure 1.3.1 (contd) Examples of documents on the history of irrigation in the ISIIMM countries: EGYPT

EGYPT – Fayoum

Extract of a map of the Nile valley

Sources: Description of Egypt, Edition impériale Paris 1809,1828



First historical mention of the notion of overflow catchment

Extract of chapter

Hydrographic description of the provinces of Neny-Soueyf and the Fayoum

By P.D. Martin Ingénieur au corps royal des Ponts et chaussées.

Sources: Description of Egypt, Edition impériale Paris 1809,1828

Il existe parmi les habitans du Fayoum une opinion vulgaire sur l'ancien état de cette province, et je crois qu'il n'est pas hors de propos de la rapporter; elle m'a été communiquée par deux hommes en qui j'ai trouvé une intelligence supérieure à celle de leurs compatriotes : l'un est Se'yd-Ahmed, cheykh principal de Médine, capitale du Fayoum; et l'autre, le Mamlouk kâchef Solymân, dont j'ai déjà parlé, qui habitoit depuis long-temps le Fayoum. Ils m'ont assuré que, d'après la tradition transmise d'âge en âge, la province du Fayoum n'étoit, avant l'époque de Joseph fils de Jacob, qu'ils font remonter à une très-haute antiquité, qu'une vaste mer, dont les eaux étoient fournies par le Nil ; que Joseph fit construire une digue à el-Lâhoun pour empêcher les eaux de se jeter davantage dans ce golfe ; que celles qui y étoient restées s'écoulèrent à la mer, ce qui opéra un prompt desséchement d'une grande partie des terres. Lorsque le dessus des eaux fut parvenu par ce desséchement jusqu'au niveau du lit par lequel elles s'écouloient, le surplus resta dans les parties basses, et forma le *Birket-Qeroun* et le *Birket-Garah*, qui devinrent l'égout des eaux de la province, et ne diminuèrent de hauteur que par l'évaporation.

Cette opinion, trop au-dessus de la portée des Égyptiens actuels, n'est point, évidemment, un résultat de leur imagination ; elle porte avec elle le caractère d'une ancienne tradition ; et peut-être, en l'examinant de près, y trouveroit-on l'explication de ce grand périmètre que les anciens ont donné au lac de Mœris, et sur-tout des avantages qu'ils disent que les Égyptiens en retiroient, en le faisant servir tour-à-tour de récipient et de bassin déversant. Cette tradition s'accorde avec ce que j'ai vu autour du Birket-Qeroun; et les conséquences que je tirerai de mes observations, lui donneront ou en recevront peut-être plus de force.

Figure 1.3.2 Examples of documents on the history of irrigation in the ISIIMM countries: FRANCE

France – Pyrénées-Orientales

At the end of the 20th Century, the hydraulic services of the State inventoried the hundreds of canals of the Pyrénées-Orientales and faced a multitude of conflicts between syndicated associations, factory owners and towns, between the Roussillon plain and the mountains of the confluence. The engineer, Tastu envisaged the construction of dams.

Sources : ISIIMM report France, Pyrénées-Orientales

CHRONICLE

The management of water is a compromise between the local institutions and the Departmental and national authorities

Sources : J. Feraud, Chambre d'agriculture des Pyrénées-Orientales

Tableau N°5 **Contexte historique de l'irrigation en Roussillon**

Géopolitique	Economie	Climat	Date	Aménagements	Réglementation	Agriculture
Homme de Tautavel			-450000			
Tribus gauloises	Ruscino		-600			
Occupation Romaine, Province Narbonnaise	Développement de la sidérurgie, voie domitienne, thermes, christianisme, viaduc d'Ansignan		-100		droit romain	vigne, céréales, olivier
Royaume Wisigoth de Tolède, Septimanie			400		loi wisigothe : "liber judiciorum"	
Invasion berbère						
Reconquête carolingienne Abbayes et seigneuries	Développement des Moulins	Aygats 779 878 1264 1421 1522 1632	800	Aqueduc d'Ansignan		
Intégration du Roussillon au royaume d'Aragon	Pont de pierre			Première phase de développement des canaux (moulins, forges, AEP, places fortes) Travaux d'assainissement des Templiers	Loi stratae	
Croisade des Albigeois Traité de Corbeil						
Royaume de Majorque			1300		Concessions royales Procureur royal maitre des eaux de Roussillon et Cerdagne	Mutage
Royaume d'Aragon	Mouline hydraulique					
Rois catholiques			1600			Triptique méditerranéen : vigne, céréales et olivier + prairies (fourrage) Aspre/Regatiu
Traité des Pyrénées Royaume de France	Forges catalanes					
Révolution	Industrialisation	Crues 1726 1732 1737 1740 1763 1772 1814 1833 1842 1876 1888 1890 1891 Sécheresses 1828 1864 1866 1868 1876 1878 1881 1882 1894 1896	1750	Deuxième phase de développement des canaux (industrie, AEP, irrigation)	Code civil	
	Forage de Toulouges		1850		Jaubert de Passa Loi de 1865 sur les ASA	
Traité de Bayonne	Arrivée du chemin de fer			Projets de Tastu		
	Pic de population en montagne					Phyloxéra
	Disparition des forges et moulins					Développement des fruits et légumes, Création des coopératives
Guerre de 1914-1918		Crues 1907 1915 1921 1932 1934 1942 Sécheresses 1926 1927 1928 1945 Aygat de 1940	1900		loi sur l'eau 1898	
				Barrage des Bouillouses		Développement des
				Barrages de Matemale, Puyvalador	décret-loi 1935	V.D.N. Recul de l'olivier
Guerre de 1939-1945	Disparition des mines		1950	Barrage du Lanoux		
Décolonisation		Gel de 1956			Convention du Lanoux	Mécanisation Recul de l'élevage
Marché commun		Crues 1959 1961 1965 1968 1971 Sécheresses 1958 1967 1973 1974		Schéma départemental de maîtrise des eaux	Loi sur l'eau 1964	Loi d'orientation 1962
	Aménagement du littoral Disparition des pêches maritimes			Calibrage des rivières		Reconversion de la Salanque Développement du pêcher, des serres et
	Développement urbain Tourisme		1980	Barrage de Vinça, Retenue de Villeneuve de		Réformes de la PAC
Elargissement de l'U.E.		Crues 1986 1989 1982 1995 1999 Sécheresses 1989 1990 1994 1995 1997 1998 2003		Réseaux sous pression	Loi pêche 1984	Arrachage primé
				Barrage de Caramany	Loi sur l'eau 1992	Relance de l'élevage Agri-Environnement
O.M.C.	Natura 2000		2000		Directive eau 2000 Zone de répartition des eaux	C.T.E.
Euro-Méditerranée ?	Arrivée 50 000 habitants ?	Changements climatiques		Transfert du Rhône ? Utilisation du Karst ?	Nouvelle loi sur l'eau ? Réforme des A.S.A. ?	Agriculture raisonnée ? CAD ?

Figure 1.3.3 Examples of documents on the history of irrigation in the ISIIMM countries - ITALY

In the 15th Century, two large networks took the waters of the Piave to irrigate, on its right bank, the inter-river area between the Piave and the Sile, as well as the city of Treviso. This overspill of the catchment area of the Piave was at the origin of the original territorial management units founded upon the historical organisation of the networks.

Figure 1.3.4 Examples of documents on the history of irrigation in the ISIIMM countries - LEBANON

Map of S. Munster, 1545. ***Tabula Asiae IIII [Cyprus, Holy Land, Syria& Middle East]***
sources : http://www.raremaps.com/cgi-bin/gallery.pl/archivedetail/15154

Map by S. Munster, Venice, 1545, showing the different water courses of the countries of the Eastern Mediterranean.

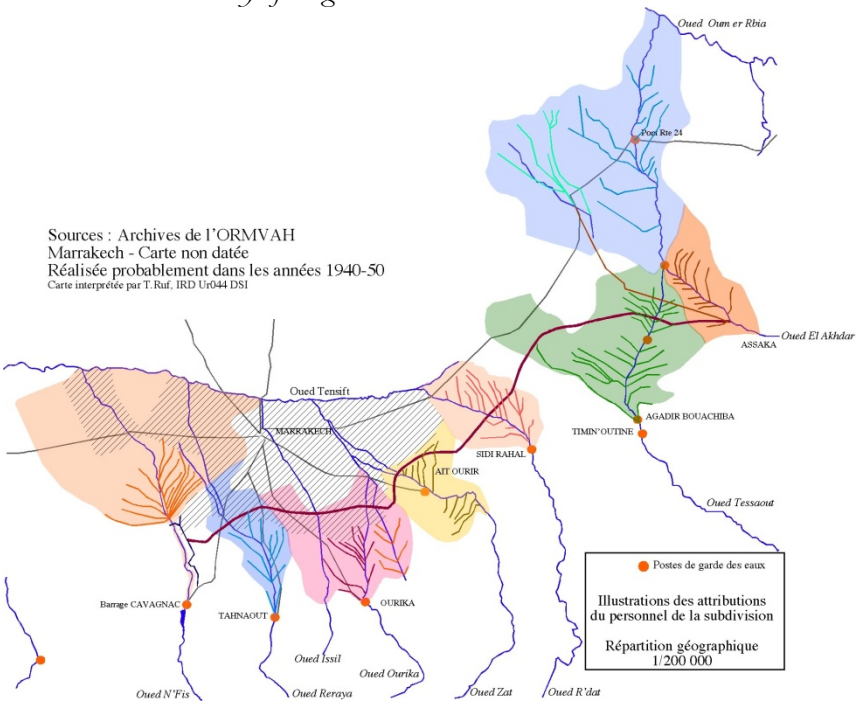
Figure 1.3.5 Examples of documents on the history of irrigation in the ISIIMM countries: MOROCCO

MOROCCO – Haouz de Marrakech

Map of the canals (seguias) and administrative zones of the hydraulic services towards 1940.

The historical, detailed study of the canals has not yet been carried out in detail.

Sources: archives of the ORMVAH Identification ISIIMM Morocco – UCAM – IRD (interpretation T.Ruf, 2005)



Map of the draining galleries (Khettaras) on the peripheral of the town of Marrakesh

Sources : archives of the ORMVAH Identification ISIIMM Morocco – UCAM - IRD

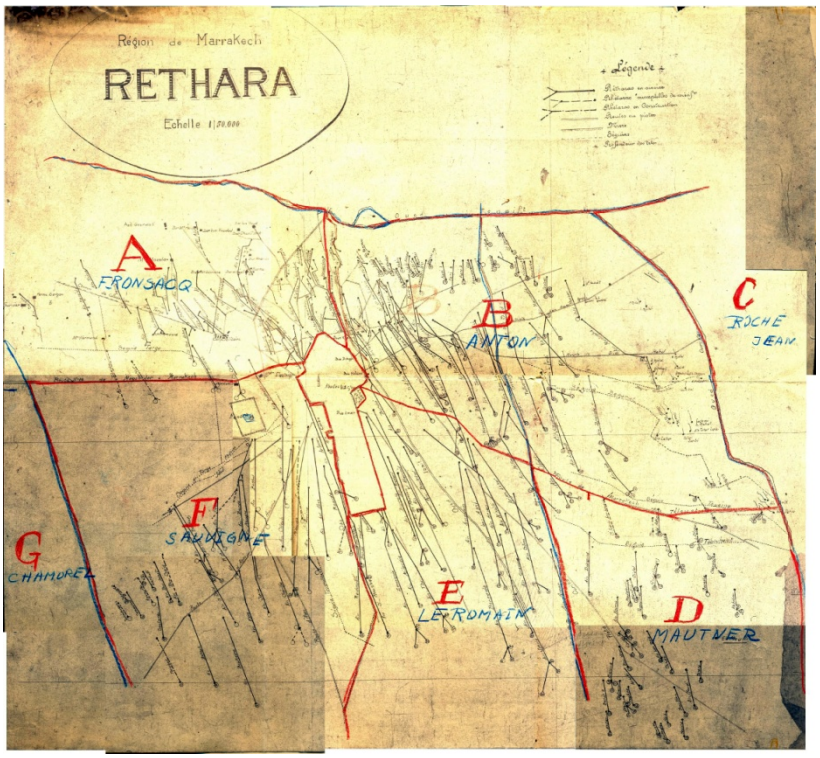


Figure 1.3.6 Examples of documents on the history of irrigation in the ISIIMM countries: SPAIN

SPAIN – Valencia

Map of irrigation in the Jucar valley

Sources : Acequia Real del Jucar, Casa de la acequia de Antella,.

Canals created in the Middle Ages and extended up to the 18th Century.

Photo T.Ruf, 2002.

2. THE TERRITORIAL COMPLEXITY OF IRRIGATION IN THE MEDITERRANEAN BASIN AND IN THE ISIIMM PARTNER REGIONS.

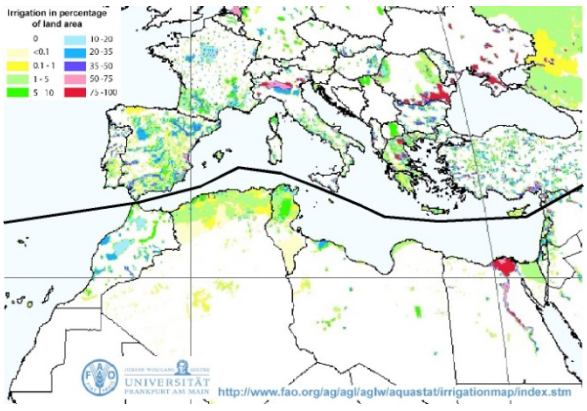
2.1. THE DIMENSIONS OF TODAY'S IRRIGATED AGRICULTURE IN THE MEDITERRANEAN BASIN

Today, the irrigated agriculture in all the Mediterranean countries covers over 20 million hectares[3]. Often, a distinction is made between the North shore that enjoys more rain, close to high mountain ranges likened to water towers for the coastal plains, and the South shore, more arid, close to the Sahara desert region (fig. 2-1). In fact, both shores of the Mediterranean exhibit rather heterogeneous conditions. In numerous valleys the hydrological regime is marked by the seasonal drying up of the streams, whereas in other valleys there are abundant and regulated flows. In the South, the oriental and western regions have considerable amount of water. In Egypt, with a mean annual regulated contribution of 55 billion m^3, the Nile river provides abundant water resources to a well delimited fertile territory. The Moroccan mountain ranges provide most of the 19 billion m^3 of water to the scattered territories of the high valleys, and Saharan, Mediterranean and Atlantic plains. In Lebanon, the mountain plays a similar role and contributes to 2 billion m^3 per year used in a conflictual geopolitical context. Other Southern countries do not have such water towers in their territory or next to it, and the recent hydraulic development is based on the extraction of non-renewable water resources (Libya, Tunisia, Algeria). In the North, not all the countries enjoy abundant water. Although some rivers such as the Rhone provide huge masses of water that flow into the sea and in fact provide little for irrigation, other less generous streams – albeit at times uncontrollable – have been developed for irrigation to the extent that they now experience recurrent hydric stress.

Figure 2.1. The importance of irrigation around the Mediterranean basin

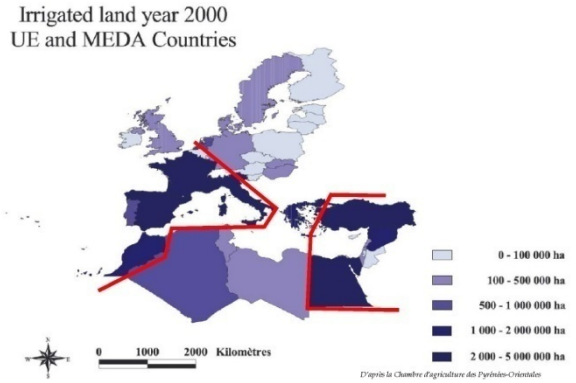
Satellite image of the Mediterranean basin

Abstract from the digital map of irrigated zones, FAO, 2005[4]



Distinction between the North and South shores

The importance of irrigation around the Mediterranean basin



Distinction between the oriental and occidental arc

[3] National or international categories for irrigated, irrigable, potentially irrigable or partly irrigated have not been studied. Incertitude on regional and local data indicate that the data are uncertain and often over-evaluated.

[4] Siebert, Stefan - Doll, Petra - Feick, Sebastian (Institute of Physical Geography, University of Frankfurt/M., Germany) and Hoogeveen, Jippe (Land and Water Development Division, Food and Agricultura Organization of the United Nations, Rome. Italy) – The digital global map of irrigated areas, version 3, April 2005

Other geographical breakdowns are possible such as a distinction between the Mediterranean oriental arc stretching from Egypt to Turkey, and the Mediterranean occidental arc stretching from the Maghreb to Italy. In both cases, the irrigated territories are the result of ancient history and massive yet unequal development. The South and the North of the arc are water-rich whereas the centre suffers from water scarcity. In the East, Turkey and Egypt control huge quantities of water. Syria, Lebanon, Jordan, Israel and Palestine suffer from specific hydric stress which – according to their advocates – justifies international water transfer projects from the Nile and from the North of Turkey to the South (the so-called "Peace canals"). For the occidental arc, in the North, the Alps provide the Provence and Lombardia plains with abundant water resources that already enable massive water transfers outside of the natural watersheds, but still within each region (the Durance canal or the Piave canal). Likewise, the flows from the Moroccan Atlas mountain range have been harnessed into 9 large watershed transfer canals from the North to the South (such as the Rocade canal in Marrakech). At the centre of this occidental arc, Spain is characterized by one of the largest irrigation developments in the Mediterranean basin (almost 4 million hectares in 2000), whereas its resources are limited. In this country, the hydrological planning of North-South inter-basin transfers fuels fierce regional and national political debates.

2.2. LOCALIZATION OF IRRIGATED TERRITORIES IN THE SIX ISIIMM PARTNER COUNTRIES.

Consequent hydro-agricultural developments have taken place in the six partner countries (figure 2-2). They amount to two thirds of the Mediterranean irrigated land. In each country, there is a strong territorial polarization between the irrigated and dry land. Thus, as an example, the Catalans often oppose the *regatiu* and the *aspre*, the Spanish the *regadio* and the *secano*, whereas the mountain populations of the High Atlas make a difference between the irrigated lands – the *igran daou targa* – and the dry lands – *bour*; as for the Egyptians, they differentiate the black soil irrigated by the Nile from the dry desert land that surrounds them.

The national geographic distribution of the irrigated land includes variants that must be accounted for. Egypt can be singled out by the dimension of the main irrigated system – 4 million hectares – organized on the basis of the Nile river, the unique large water resource of the country. The supply of the resource comes from several thousands kilometers away, in the East-African mountains, as per a pattern which is rather exceptional for the Mediterranean basin: the Nile supplies a maximum amount of water in Egypt during in the summer. From Assuan to Cairo, there is a long continuous irrigated territory that follows the river. A specific zone south west of Cairo is not included in this axis as it receives its water from the Nile river via the *Bahr El Youssef* effluent - the Fayoum oasian depression. Yet this territory is linked to the Nile valley by means of an agricultural strip[5]. North of Cairo, the Nile splits into two branches – Damiette and Rosette. Each part of the Nile delta – east, central west – receives the same amount of water. In the old farming system, irrigation is used by 4 million farming families which have less than one hectare of land from which to make a living but water to farm their plot of land. The Egyptian agriculture is one of the most intensive in the world, with permanent usage of the land and water: the winter farming (Chetoui) is followed by the summer farming (Sefi). In the modern extensions, water is attributed rather to large farming enterprises that exploit several hundreds or even thousands of hectares, or to small plots of a few hectares exploited by university graduates who do not have access to positions in the public administration.

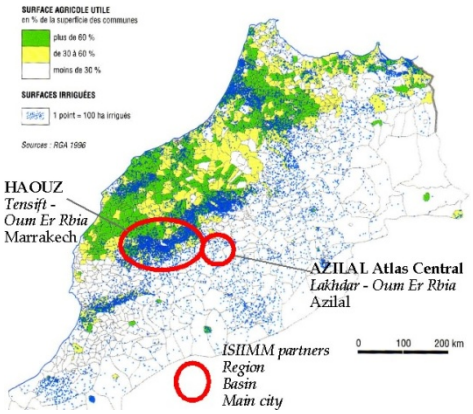
[5] New special territories are coming out since year 2000. In the Lybian desert, there is a new irrigation programme in the western part of Assouan (Toshka project). In this case, there is no continuity with the current irrigated areas and the main framework is constituted by big private farms along a concrete canal. Such territorial discontinuities exist in the North Sinaï through the water of the Nil coming in the Suez Canal Siphon.

No other country exhibits similar characteristics even if some regions come close to it such as in Italy in the Pô plain or in Spain in the region of Valencia, or even in some smaller sites around the Mediterranean basin. In the five other ISIIMM partner countries, irrigation schemes are scattered over the national territory with inter-regional disparities even within regions. This scattering is specific to large hydrographic basins that are usually independent from one another, at the foot of mountain ranges. It also exists in each region where water is accessible in a differentiated manner and as per specific schemes. Thus, in Morocco, if one follows the flow of the water that falls on the top of the Atlas mountain, there is the high valley and low land irrigation systems, which seem minor when considered separately, but when taken as a whole play a key role in the mountain and pastoral economy, in settlements and land development. This phenomenon also exists in the Pyrenees, in the Alps, in Lebanon, in the South of Italy and inland Spain. These high basins feed major rivers which facilitate the development of irrigation on the high continental plains and along the rivers. Such is the case in central Morocco in the Haouz plains of Marrakech and Tadla, or in the Guadalquivir and Ebra water systems in Spain, middle Durance in France and Bekaa plain in Lebanon. Finally, near the sea, the plains open up and form deltas and wetlands which give rise to large hydraulic developments, such as in the coastal regions of Gharb, Doukkala or Souss in Morocco, the low Jucar valley south of Valencia in Spain, or the Piave valley in Italy. In all cases, water distribution comes out of the physical boundaries of the regional watershed as a consequence of the historical development and political assignment of resources.

At the national level therefore, several types of irrigated farming territories are developed that share water on a competitive manner. These lands are often associated with regional capital cities which have a determining influence on these regions. The distribution of irrigated zones corresponds partly to the localization of large regional Mediterranean cities which benefit from the economic spin-offs of irrigated agriculture on the one hand, but which sometimes challenge the share of agricultural water and spread their urban growth onto more fertile land. The coastal cities and the hinterland cities defend interests which may be diverging, and these confrontations involve all the interdependent irrigated territories. In some cases, the rivers never reach the sea. There are endoreic territories in southern shore countries, such as the Fayoum in Egypt and the Tafilalet in Morocco. They lead to distribution between upstream and downstream zones that are unstable since the resources are rarer and more localized than elsewhere. Finally, the irrigation is disseminated in the periphery of the large irrigated zones, but also in isolated sites, a situation that reflects the exploitation of the renewable and non-renewable underground water tables. This means that irrigation is now applied in dry zones, due to the use of new pumping and distribution technologies, a phenomenon encouraged by the liberalization of economic trade but poorly regulated by the local and public authorities.

Figure 2-2 Comparison of the geographic distribution of irrigated zones in the six ISIIMM partner countries and situation of the 1 region concerned

South shore countries

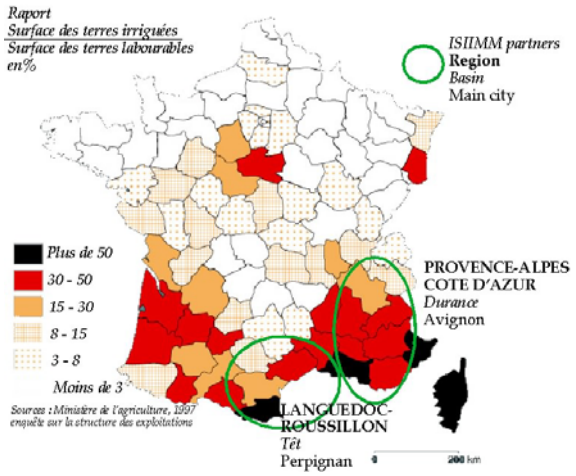


Sources : Ragala Rachid, Refass Mohammed (eds scient.) 2002. Maroc - Atlas de L'Afrique – Editions J.A., 88p

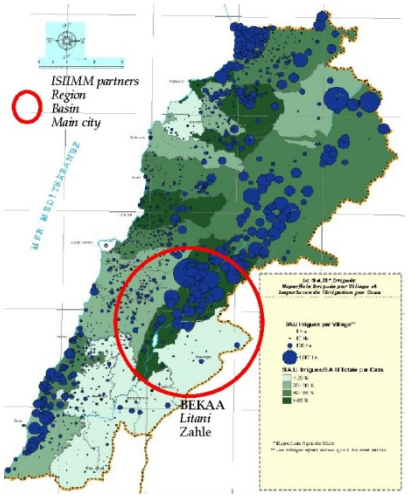
North shore countries

Sources : MAPA, 1998

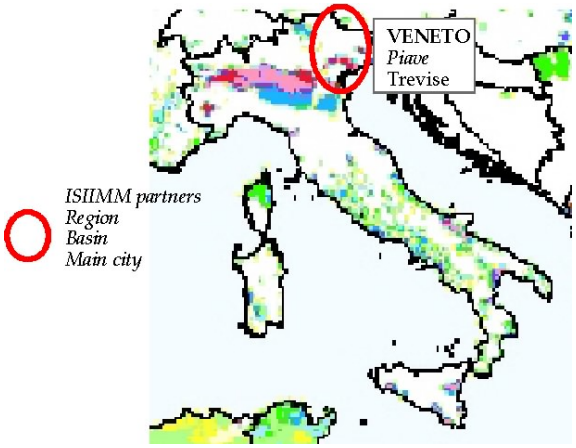
Sources : CRDP Alsace http://www.crdp-strasbourg.fr/imageEcole/egypte07/index.php?contexte=album



Sources : Agrandissement carte 2-1 - FAO, 2005



Sources : Isiimm - Lebanon



Sources : Agrandissement carte 2-1 - FAO, 2005

2.3. ORGANIZATION OF IRRIGATED TERRITORIES AND WATERSHEDS FOR THE 11 ISIIMM REGIONS.

Eleven regions (or part thereof) and watersheds (or part thereof) of the six partner countries took part in the study, exchange and social and innovation research programmes (figures 2.3). In the eleven cases, there were difficulties in describing and comparing the territorial organization, since at the regional scale the relevance of the zonings that support the political action and water management is questionable. Indeed, the administrative and political spatial units seldom correspond to those of the watersheds and of the water user basins. These comparisons lead to several observations. **The watershed is a rational hydrographic unit used to assess primary water, but it proves insufficient to express the complexity of water demands in a territorial system that is difficult to represent and understand.** We shall look at the different situations.

- **The hydrographic basin embodies whole political regions** in which water sharing is strongly regulated. Thus, Egypt is downstream from the Nile basin, and except for the Libyan and Sinaï oasis, the Egyptian irrigated zones depend entirely on the Nile, as is the case in the regions of the ISIIMM project: *Minya* and *Fayoum* in the middle valley, *Beheira* in the Delta (Fig 2.3.6.). Although all the regions depend on ministerial decisions for the distribution of the Assouan dam water, the Egyptian hydraulic system is composed of regional sub-assemblies that control intermediate regulating dams and systems of canals within a precise territorial zone, which use and return water to the river and to the following systems of canals. Except for the Fayoum where the perimeters of the Governorate and of the hydraulic zone correspond, each province is traversed by several inter-provincial series.
    - This is the case in *Minya* where the hydraulic scheme comprises three longitudinal strips between the Nile in the East and the desert in the West. The first oriental strip of the alluvial plain is comprised between the Nile and the large *Mouhit* dyke. It is permanently irrigated by the large *Ibrahimieh* canal since the end of the 19th century. The second central strip, between the dyke, the *Mouhit* drainage canal and the *Bahr El Youssef* effluent, uses permanent irrigation since the beginning of the 20th century. The *Mantout* workshop site is located within this territory. Finally, the last strip between the *Bahr El Youssef* and the desert used the Nile floods until the sixties, via the *Bahr el Youssef*, which served as a vector to spread the water and collect upstream the unused water then transferred downstream, especially to the Fayoum. There is therefore, no provincial watershed *per se* but rather three territories with distinct organizations, and interconnected upstream and downstream by lateral links (canals, outfalls and drains). Water demand and water offer overlap territories in Egypt.
    - Further North, in the Nile delta, west of the *Rosette* branch, the *Beheira* province also comprises three different hydraulic systems which are different but interdependent. The *Mahmoudia* canal system corresponds to the reorganization of the Alexandria canal-channel in the 19th century, and the site of the *El Resqa* canal is at the interface between this system and the system upstream.
    - The *Fayoum*, which at first could seem to be just a simple overflow zone within a defined administrative area, is in fact an assembly of mosaics offset between spreading areas and collection areas. This is why the Seila workshop site was selected in order to use a spatial coincidence between the watering units and the drainage units, a rather exceptional situation.

- **The main watershed does not include the political regions,** the boundaries of which embody part of the main watershed and different juxtaposed basins which are generally independent. Such is the case of the two French regions separated by the Rhone: the PACA region (*Provence Alpes Côte d'Azur*) south-east of the river, and the Languedoc-Roussillon Region which is south-west of the river (fig.2.3.5).
    - The *Durance* river basin is in fact the main area of the PACA region. It comprises several hydraulic territories based on the development of gravity irrigation for the last 800 years. From upstream to downstream, there are the mountain systems above the *Serre-Ponçon* dam, and in the high basins tributaries still bear witness of the rich medieval hydraulic past (*Queyras*, *Briançonnais*, *Champsaur*, *Gap* canals). Numerous canals have been constructed along the bed of the *Durance* river, among which the *Manosque* canal which was selected as an ISIIMM workshop site due to the recurrent social and institutional crises it has been experiencing since its forced creation in 1898. In the low valley, water is diverted to the plains located outside of the watershed north and south of Avignon. Two workshop sites were selected, the *Carpentras* canal and the *Craponne* canal, because of their syndicate organizations.
    - On the Catalan Pyrenean side, we can observe that this part of the *Languedoc-Roussillon* region comprises four distinct watersheds including that of the *Têt* valley which, as for the *Durance* river, includes one altitude basin hydraulic system, one river bed hydraulic system with rather autonomous lateral systems (*Vinça* workshop site) and one low valley hydraulic system specific to the Roussillon (*Vernet and Pia* workshop site). It should be noted that during the ISIIMM discussions, syndicates from the alpine system (*Gap* canal) and Pyrenean system (*Dorres* canal) took part in the discussions with their counterparts from Morocco and Lebanon.
- **The main watershed supplies most of the water resource of an irrigated region, yet it is common to several other regions.** This is the case of the *Jucar* basin in Spain (fig.2.3.3) where the coastal zone holds ancient rights on the water from the river and even owns the most important regulation dam. The *Litani* basin also falls into this category with its reversed hydro-political organization. The *Bekaa* upstream region concentrates the rights and usages above the *Karoun* dam (Fig. 2.4.2), whereas South Lebanon is extremely dry.

- **The main watershed supplies most of the water resources to an irrigated region located partly outside of the basin, yet industrial users divert the water and increase the conflicts between the high, middle and low regions of the basin and its dependents.** This is the case of the *Piave* river in Italy, where the river is the source of a water war between private electrical power supply operators and agricultural water managers who organize the distribution in the plain (Fig. 2.3.4).

- **The limits of the main watershed and of the political region largely coincide,** yet within this large hydro-political entity there are specificities and autonomies. This is the case in Andalusia where the Genil altitude basin is different from the system of the *Guadalquivir*, and is structured around the city of *Granada* (fig. 2.3.3).

- **Several watersheds supply water to a given political region the boundaries of which include parts of large basins.** This is the case in Morocco with the *Marrakech Haouz* which receives its water from the *Tensift* basin and from the *Oum Er Rbia* basin which also supply water to the downstream regions, in limited quantities for the *Tensift* but in large quantities for the *Oum Er Rbia* (Fig 2.3.1).

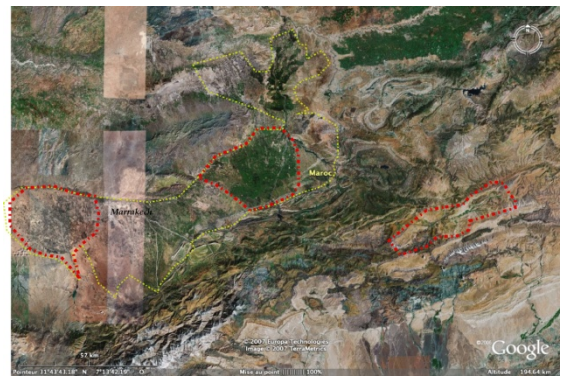
- The *Haouz* is a large continental area irrigated by a public hydraulic system, at the foot of the High Atlas mountain range. Yet, the resources do not come from one or two hydrographic basins, but from a dozen of mountain basins. Four of these basins have a dam: the *N'fis, Tessaout, Lakhdar ett oued El Abid* rivers have been regulated and the others are free: *oued Baja, Issil, Ourika, Zat, Touana, Rdat* which take the water from ancient canals from the central Haouz, recharge the table, and supply water to the *Tensift* oued which is dry most of the time. Two workshop zones have been selected, first the *N'fis* zone west of Marrakech where there are 6 different generations of irrigation networks that are supplied with distinct resources, the*Tessaout-amont* zone, which has been significantly redeveloped and where the ancient canals have been abandoned.
- The *Lakhdar* basin, a tributary of the *Oum Er Rbia* is one of the water suppliers to the Marrakech plain, via the *Rocade* canal. The *Lakhdar* high basin is the perfect ISIIMM mountain site, more precisely the *Ait Bougmez* valleys, which is covered by a canal modernization and irrigation participative management plan.

Depending on the configuration between the hydrographic basins and the political regions, and on the influence of the State and the level of decentralization and regional political organization, either water governs politics, or politics govern water. This impacts the articulations of the institutions (basin, region, local water access systems) and the local management which is often highly specific and linked to the history of the sites. In fact, the categories-types of organization and the mismatch between the water supply areas and the water demand areas are found in almost all the 11 cases, since it depends entirely on the scale selected for the basin or for the region. Obviously, a large region comprises several independent basins, with different contrasted dynamics between water-rich and water-poor zones. Conversely, a large hydrographic basin often comprises distinct political regions due to cultural, historic, social, ethnic or religious reasons. Regardless of the situation, it seems important not to take the watershed as the sole and unique management integration entity. Each situation deserves a practical analysis of water territories: what are the limits proposed by the players in the national, regional and local management? What are the encroachments on the resources and which arguments could be used to renew the current or ancient management practices within existing or new institutions.

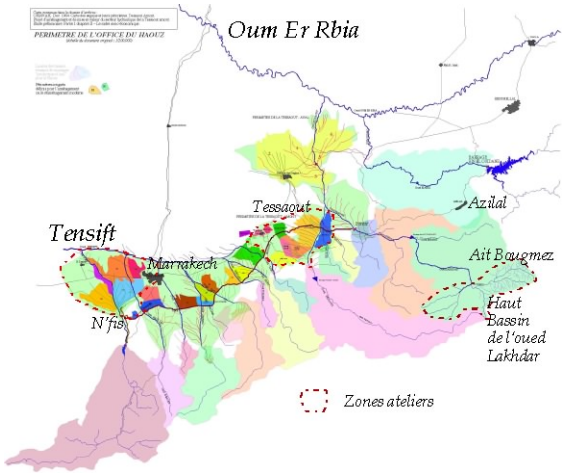
One important comparison point consists in **re-introducing the territorial notion of hydrographic basin** proposed by Martin concerning the Fayoum (1799 – see Chap.1) and which the French ISIIMM group rediscovered in Provence and Catalonia. This defines the **area of hydraulic and hydrological influence which depends on the works and networks that use its water.** Thus, this definition can be applied to deltas such as that of the Nile river, but in fact there are many "inner deltas" and even more complex systems, especially in the developed interfluves or in the areas as complicated as those mentioned for Egypt or Morocco.

Figure 2-3 – Presentation of the regions, hydrographic basins and local ISIIMM case studies

2-3-1 MOROCCO – High Atlas – Marrakech Haouz – Tenssift and Oum Er Rbia basins
Haouz workshop sites: N'fis and Tessaout
High Atlas workshop site: Ait Bougmez

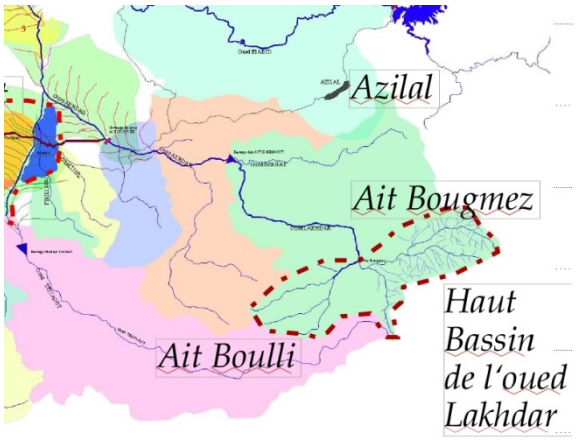


The Marrakech Haouz is a large irrigated plain at the foot of the central High Atlas, which drains water from about ten rivers (coloured in pastel) which flow towards two hydrographic basins, the Tensift westward, and the Oum-er-rbia north-west. Four dams regulate part of the water and two inter-basin transfers have been constructed, via the Rocade canal and the T2 canal. Two site-workshops were selected in the territory managed by the Haouz office, the N'fis and the Tessaout.



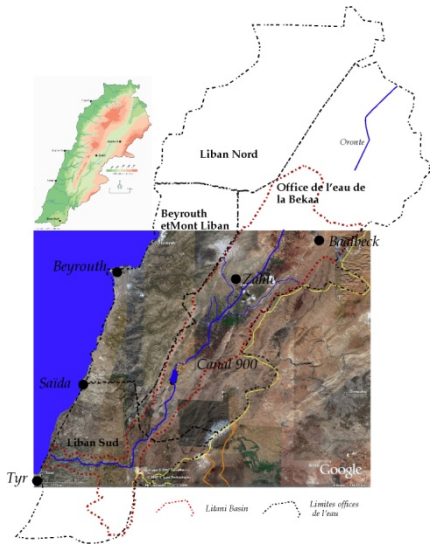
The High Lakhdar site belongs to another region and basin, but the Haouz is linked to the Lakhdar oued by the Rocade canal. Medieval and modern networks are superimposed. Most of the population in the plain speaks Arabic.

The Atlas high valleys have been developed by the Berber-speaking mountain populations. Irrigated agriculture is combined with pasture and tourism around the different mountains and dozens of small basins.

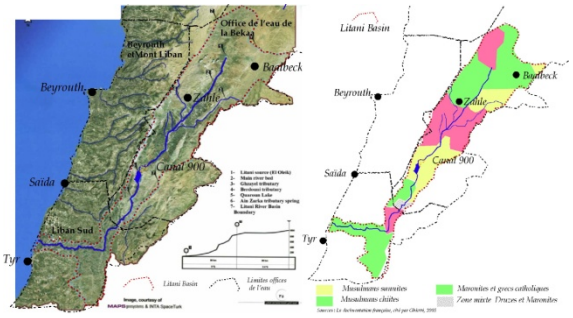


The bottom of the valleys and some of the sides are irrigated from upstream sources and drainage from torrents downstream. The hydraulic systems are ancient (undated).

2-3-2 LEBANON – Bekaa Region – Litani Basin
Litani workshop site: High basin and canal 900



Location of the Litani basin and water offices



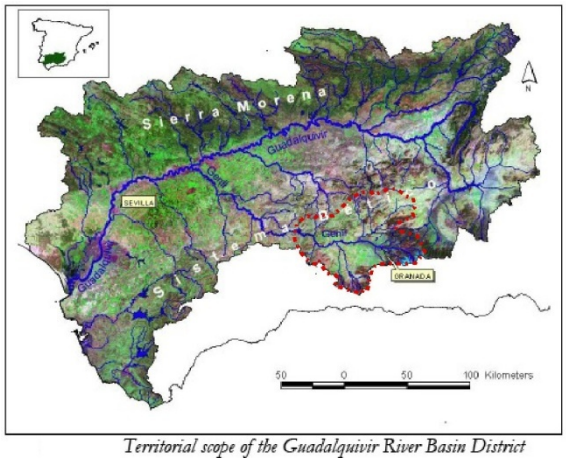
The Bekaa is an altitude plain irrigated by the Litani river (south) and the Oronte river (north). The Litani, which receives several tributaries and sources, flows into the Qaroun lake, a regulation dam located downstream from the main irrigated zone. Part of the water is pumped up to 900 meters and counterflows to the Bekaa using the canal 900. The population of the Litani basin comprises all the components of the Lebanese society.

2.3.3. SPAIN – Andalusia Region and Valencia Region – Genil (tributary to the Guadalquivir) and Jucar basin

Genil workshop sites: High Genil - Cacin and Santa Fe Canal (Granada)

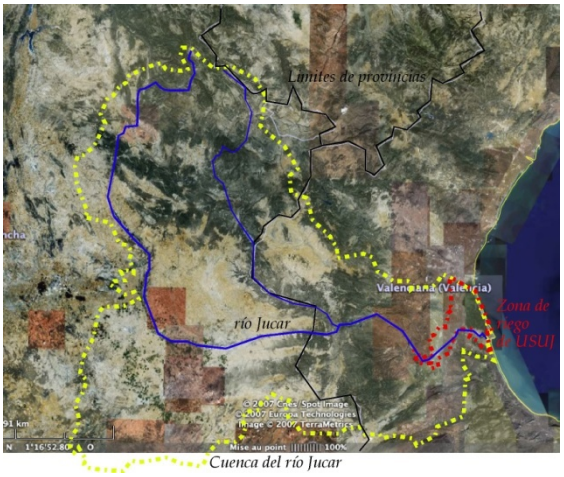
Jucar workshop site: USUJ irrigated zone

The rio Genil basin and the city of Granada form part of the Guadalquivir large basin, in the province of Andalusia. This region shares a common history with that of Marrakech. The functioning of the Genil high basin is autonomous from the Guadalquivir axis.



Territorial scope of the Guadalquivir River Basin District

The region of Granada forms a specific Huerta upstream from the regulating dams of the Guadalquivir basin. It comprises medieval and recent development systems.



The Jucar basin is developped in several Provinces. The river is managed by the Alarcon Dam which distributes water resources to several irrigation areas managed by USUJ in the downstream Jucar valley. The "Huerta", in the South of Valencia, is irrigated by the "Acequia Real del Jucar".

The Júcar River. Tributaries and basin

2.3.4. Italy – Veneto Region – Piave Basins
Piave workshop site: consorcio du Destra Piave, Paese zone

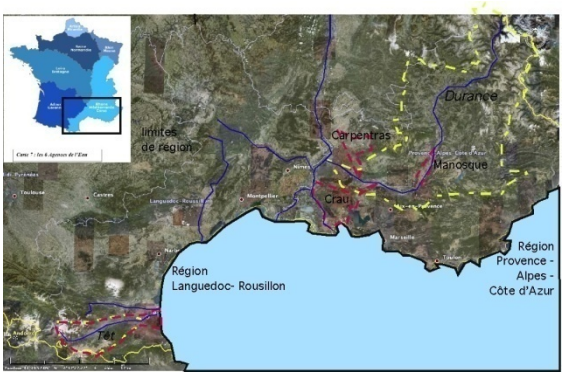
The Piave valley is part of the Veneto region, north of Venice. At the foot of the Alps, the Piave feeds a network of canals constructed on the alluvial cone.

There is no agreement between the hydro-electrical systems and the hydro-agricultural systems.

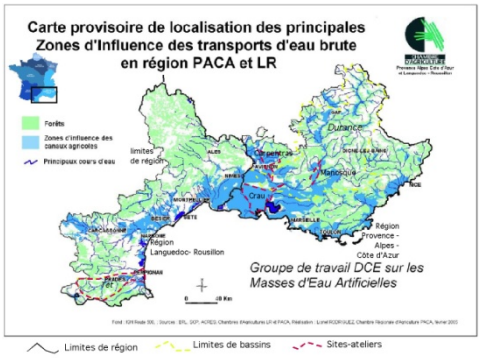
On the right bank the zone irrigated by the branches of the Piave is managed by a collective organization for the improvement of the land, the consorcio Destra Piave whose head office is in Trevise. Downstream from the interfluve between the Piave and the Sile, the plain is irrigated by the outflow of the underground water table into hundreds of sources partly supplied by gravity watering systems of the consortio Destra Piave. Upstream, the redevelopment of the basin for electrical production leads to systematic conflicts in summer.

2.3.5 *FRANCE – Provence-Alpes-Côte d'Azur and Languedoc-Roussillon regions – Durance and Têt basins*

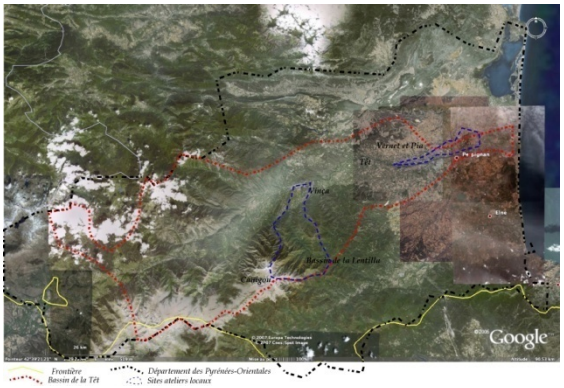
Durance workshop sites: Manosque and Carpentras canals, Craponne Canal (Crau)
Têt workshop sites: Vinça plain and Vernet and Pia canal



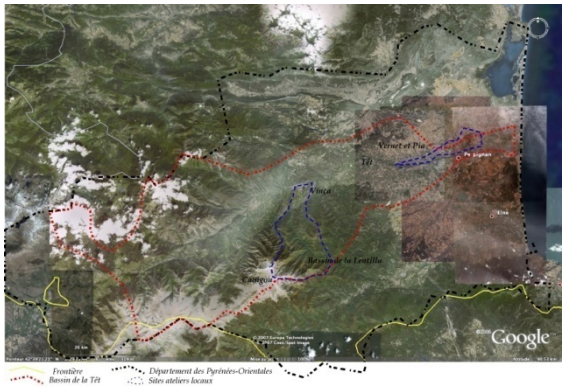
The two French partner regions - Provence-Alpes-Côte d'Azur and Languedoc-Roussillon – belong to the same basin agency (Rhône) which has a low contribution to irrigation (except in the Camargue and in the south of the Gard departement).



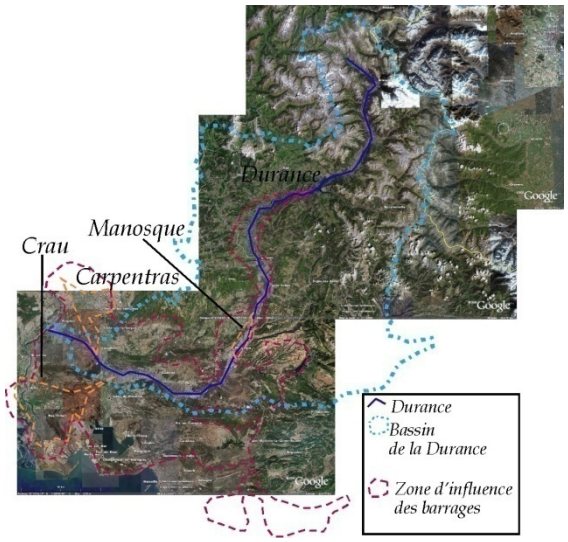
The scattered irrigation in the two regions is fed by numerous rivers and various inter-basin transfers. The culture of water is different in the mountains and in the plains, just as it is different between Provencal and Catalan populaitons.



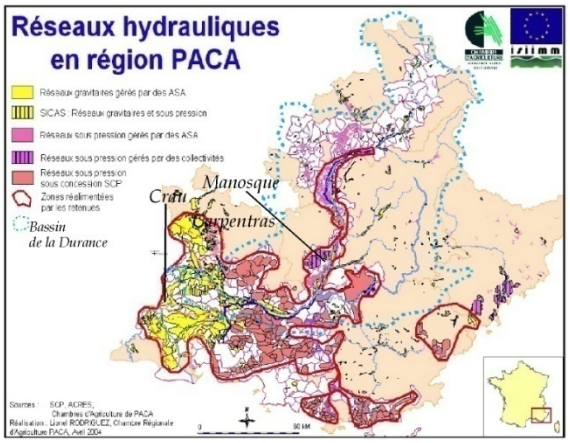
In the Pyrénées-Orientales departement, there are three rivers with medieval systems. The Têt is central and comprises about 200 hydraulic works for the irrigation of mountain, alluvial and coastal plain areas.



In 1874, the engineer Tastu established a map which is the first systematic surveys of canals. It illustrates the hydraulic interdependence of the rural communities. Vinça is on the side of the Canigou and depends on the Lentilla tributary. Vernet and Pia is the oldest canal of the Roussillon plain, in the low valley of the Têt.

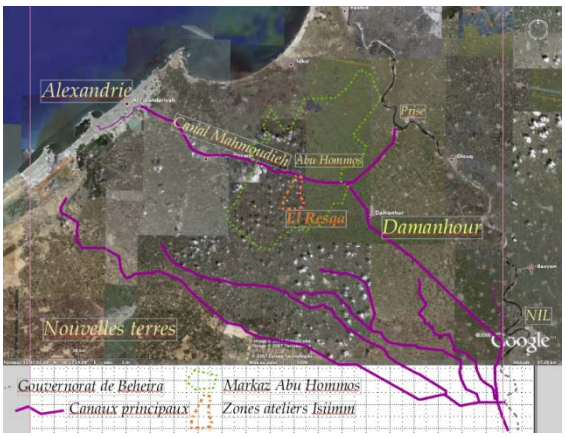


The Durance is a major resource for the Alps and Provence, with multiple canals in the mountain and in the low valley. Since the Middle Ages, water is diverted from either banks of the river well beyond its watershed boundaries. New extensions in the 19th century led the canal authorities to create, at the beginning of the 20th century, an arbitration committee for water sharing during the periods of water scarcity.

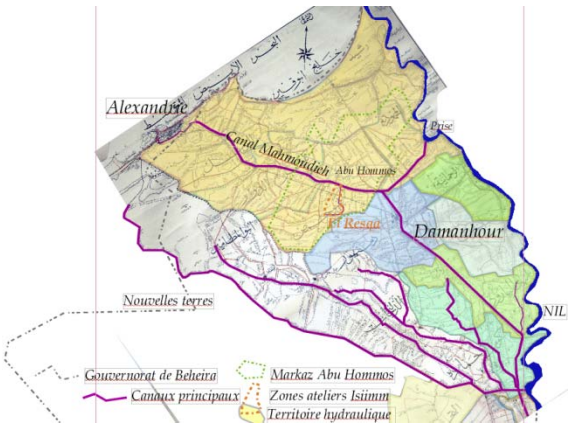


The Serre-Ponçon dam, the restauration of the pressure-irrigation extensions by the Canal de Provence Company and the hydro- electrical development on the Durance have led to the restructuration of the territory between 1960 and 1990. Three workshop sites have been selected in the zones managed by syndicates: the Manosque and Carpentras canals take their water on the right bank of the middle and low Durance, the Craponne canal supplies water to the Crau plain taking water from the left bank of the low Durance.

2.3.6. EGYPT – Nile delat, Fayoum and Middle Egypt region – Nile basin
Delta workshop sites: Beheira, El Resqa Province and Fayoum workshop site: Seila
Middle Egypt workshop site: Al Minya

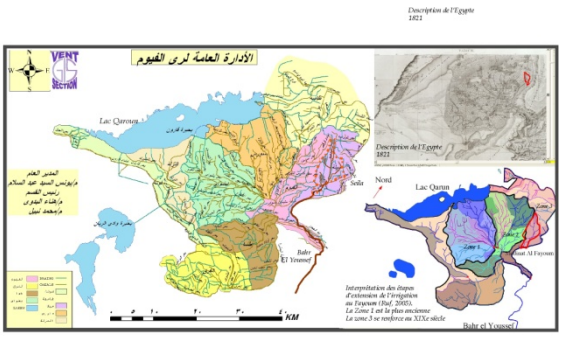


The Beheira province comprises three distinct hydraulic systems. In the South-East, the network is connected directly to the delta dam. In the North, the Mahmoudieh canal takes water from the Nile to Alexandria. In the West, there are extensions to desert areas. The El Resqa workshop site is a distribution branch of the Mahmoudieh canal, a key work of the conversion to lasting irrigation in the middle of the 19th century.

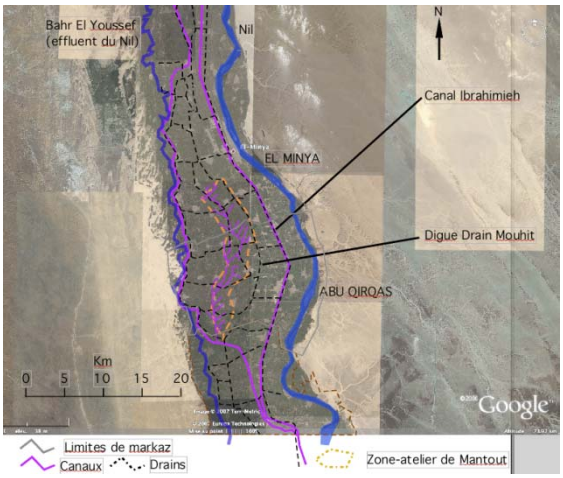


Originally, the El Resqa canal served a few large pioneer farms. There has been no local structure for collective water management. In 2005, the State-managed canal makes it possible for thousands of farming families to earn a living on plots of land smaller than one hectare. Since 2003, this canal belongs to the Improvement Irrigation Pilot Project that includes the creation of dozens of water user associations.

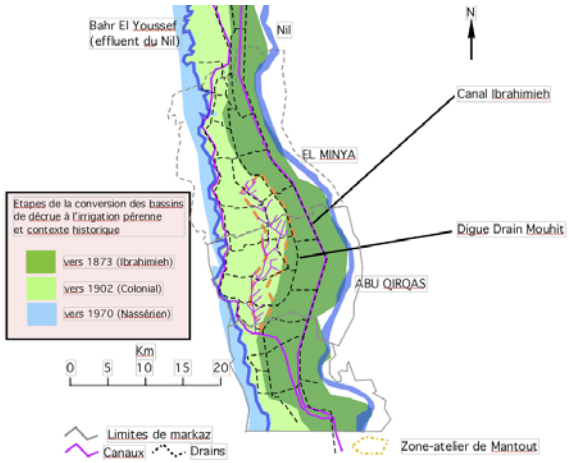
The Fayoum depression is one of the most ancient irrigated sites of the Mediterranean basin. For the last 2000 years, the Bahr El Youssef has been supplying water to a set of canals at the central distribution point of the Fayoum in the city. Traditional institutions and water rights for the distribution of water are governed by customs.



The Seila workshop site is located in the North-East periphery of the depression, on lands where at the beginning of the 19th century irrigation was still limited.



The Minya region, in Middle Egypt, experienced a form of progressive conversion from flood management to permanent irrigation. The Ibrahimieh canal is the main axis of this evolution, whereas today the Bahr El Youssef is the water header for the Fayoum and downstream



The Mantout workshop site is part of the second conversion phase that took place at the beginning of the 20th century. It receives water from the Nile river by means of a transversal canal linked to the Ibrahimieh canal that crosses the ancient Mouhit dyke at the centre of the valley.

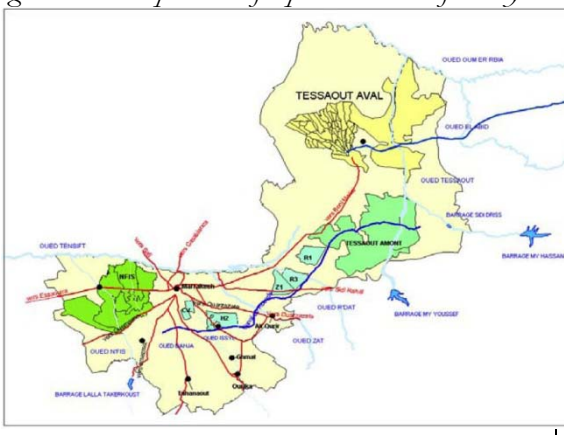
2.4. DIFFICULTY FOR DIFFERENT INSTITUTIONS TO UNDERSTAND THE REGIONAL HYDRAULIC TERRITORY: EXAMPLE OF THE MARRAKECH HAOUZ.

The ISIIMM sites of Morocco make it possible to illustrate the problems faced when trying to understand the hydraulic territories. Different institutions work on offset action zones (maps on figure 2.4). The Haouz Agricultural Development Regional Office – which in 1970 launched a large programme of redevelopment of ancient perimeters – covers a field of action which corresponds globally to the zone of influence of the ancient canals of the Tessaout in the East and the N'fis in the West (map a). The mountain regions (map b) are considered as water suppliers for the dams managed by the Hydraulic Direction, and for the transfer canals managed by the Office. Broadly speaking, the mountain zones are considered as detrimental since the oueds transfer sediments which disturb the whole hydraulic functioning (silting of 4 dams, poor operation of the canals, works, and ducts). The scope of action of the Basin Agency created in 2005 has shifted towards the Atlantic (map c), and the issues linked to the irrigated zones of the Tessaout are not in its authority. It is however in charge of the underground table areas the delimitation of which extends beyond the boundaries of the watershed (map d). The academic and scientific vision tries to deal with the global geographic assembly of mountains and plains and the composition of ancient areas and areas recently irrigated (map e), and introduces the notion of areas linked to different networks (map f).

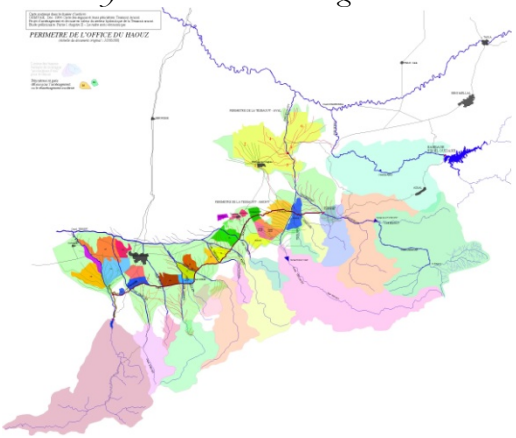
In fact, each institution designs its own intervention spatial units within its zone of action. All these elements raise the issue of compatibility of zonings and distributions, but also of the ability to collect information and link it between units at a given scale; whenever the scale is changed, it must be globalized at the scale of the region or focused on a more local framework, where networks are intertwined and where information is less precise and less frequent. In terms of hydrography and politics on the regional scale, it is extremely difficult to regulate the water sector when offer is unstable and demand poorly known. The global messages on water integration and saving cannot solve the problems overnight. There is an obvious need for coordination in a complex world, composed of multiple players, starting with the rural communities often poorly understood, represented, or considered in central policies. In the last part of this chapter, the authors explain why it is also difficult to define the local space.

Figure 2.4 Comparison of representations of the hydraulic territory in the Marrakech region

Vision of the Haourz gricultural develop-ment regional office (ORMVAH,

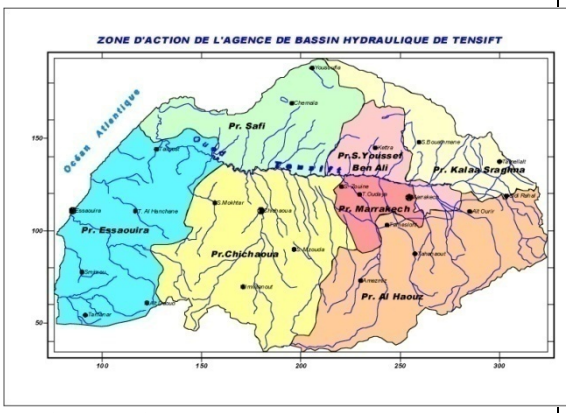


a) Between 1960 and 2000, the hydraulic territory is composed of an administrative area and of perimeters that receive water from the dams, with inter-basin transfers (Rocade canal and T2 canal), and large hydraulic development zones.

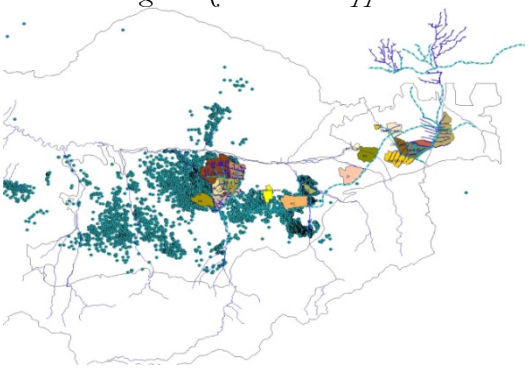


b) Previous studies (1964) specify that the mountain hinterlands comprise 14 water producing catchment basins for the Marrakech and Tessaout plain (outside of the Tensift basin). The attention is focused on large hydraulic works. The other irrigated zones do not appear.

Vision Of the Tensift hydraulic basin (ABHT) created in 2005

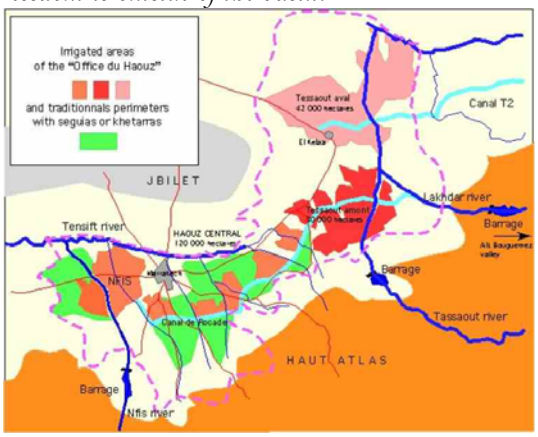


c) The ABHT crosses the basin boundaries with the boundaries of the provinces that do not cross the boundaries of the basins of the tributaries. The Tessaout is outside of the basin.

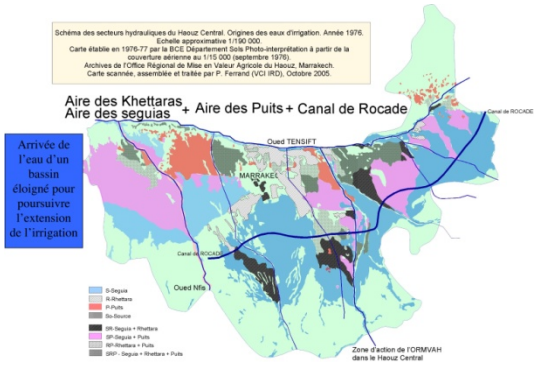


d) The agency tries to understand the overexploitation of the underground tables through the zoning of declared wells, in the zones of large hydraulic works and elsewhere.

Vision of the research and higher education (UCAM-FSJES, IRD coopera-tion)



e) Research introduces the mountain space and the juxtaposition of the areas with traditional irrigation and the areas with Office-managed irrigations, within the space of large hydraulic works.



f) The study of the ORMVAH archives enables understanding the mosaic of areas connected to the various surface and underground networks.

2.5. APPROACHES OF LOCAL TERRITORIES IN THE WORKSHOP SITES – COMPARISON OF THE SPATIAL SYSTEMS AND OPENING TO SOCIAL AND INSTITUTIONAL QUESTIONS.

For the six countries and eleven regions partners of ISIIMM, 18 workshop sites have been used for studies, analyzed by national and local teams, covered by complementary expert studies. Furthermore, they have evolved over the four years of work and have been used for inter-country discussions, in order to enrich the social and institutional innovative approaches. To these sites – described in the series of figures 2.5, must be added a few other local systems studied during the discussions, especially for the Mediterranean mountain sites: the Haute Durance canals (Gap), Cerdagne (Dorres) for the Alpin and Pyrenean mountains; Khirbet Qanafar system in Lebanon, the Ait Boulli valley close to the Ait Boulli in the High Atlas were additional points of reference.

Spatial organization: local perimeter, canal organization, distribution branches and drainage system

The workshop sites are defined as **small hydrographic/hydraulogic basins**, connected upstream to the resources of a basin by one or several points of access to superficial resources, but also connected downstream by one or several points of collected flows. Consequently, they represent, for the hydraulic and hydrological units downstream from the site, a quantitative resource and possibly a crossing point of qualitatively degraded resources. The three Egyptian sites of Mantout at Minya, Seila at the Fayoum and El Resqa at Beheira are typical of this spatial model (fig.2.5.1). They are connected to the Nile hydrographic/hydraulogic basins (the Ibrahimiacanal, the Bahr El Youssef and the Mahmoudia canal), and supported by collecting drains, the first outfall for the water used (returning either to the Nile or the Bahr el Youssef). Moreover, the local canals have direct outfalls to the next hydraulic system.

This linkage between areas and networks is also found in Provence and in the Roussillon (figure 2.5.2) with a few differences concerning the routing of the lost surface water. Whereas the issue of water access and distribution management is well understood, the issue of « superfluous » water (a Catalan expression) is often poorly understood. In fact, each local hydraulic system functions in a cooperation-opposition mode with the neighbouring systems. This mode often means that there is solidarity since either the unused water is directed to the neighbouring systems or, on the contrary, it is diverted away from these systems using the river or the drainage system. In fact these notions are specified in some ancient texts on water rights (ex: Prades/Têt, acte de1305).

In some cases, the workshop site selected comprises an irrigation area organized and delimited, as well as a rain water flow and collection area often larger but remote. Therefore the site must be considered as a complex assembly of watersheds, hydrologic/hydraulogic basins and catchment basins with no corresponding boundaries. The situation of the Vernet and Pia canal in the Roussillon appears even more difficult. Some of the areas irrigated by this canal are indeed connected to runoff areas on the north side of the Têt river, with a large central drainage canal – the Grand Vivier. However, part of the Agly basin transfers rain water to other areas irrigated by the canal which they transfer via the Llabanère channel, which leads to a new canal, the Toreilles canal. If all these elements are not taken into account in the local management and more specifically by the institutions and their rule of action, the system is simplified and its local coherence is lost. But at the same time, the denser the system and the higher the number of separation and collection points in the hydraulic network, the more difficult it becomes to collect the quantitative and qualitative information necessary for daily basis management.

The Piave workshop site, and the Paese region (fig. 2.5.3) exemplifies the territorial complexity we have just mentioned since the used water returns to the Sile river and feeds the table of the Venice plain.

We shall come back later to the impact of pumping practices of underground water on the local territorial organization. For now we will look at the site of canal 900 in the Bekaa plain, in Lebanon (fig. 2.5.4). The name of the site illustrates a recent creation typical of designations by hydraulic engineers. "900" means the level at which water rises in the Qaroun dam. In this case, the hydraulic space is a total reconstruction. It is almost a reversed canal, water climbing up in the space of the catchment basin, in a counter-slope flow pattern. We therefore propose a new definition to designate a hydraulic reorganization whenever human intervention consists of raising water and reshaping the area that receives it: a reversing basin (bassin reversant). This notion makes it possible to provide a better description of the reality of the development and it can be used even on very local scales when a person or group of persons have access to water by pumping into superficial resources. Thus, each of the three Egyptian workshop sites form a mosaic of reversing basins whose entry point is the location of the original sakkia, the spine is the mesqa fed by individual or collective pumps and the area all the plots water by the mesqa and in most cases delimited by other reversing basins separated by drainage trenches.

We are now coming to the issue of the wells and drillings developed in the 20th century in all the sites, with a dramatic increase in number in the last 15 years, both in the North and in the South. At the very local level, it is easy to understand that each point of underground water rising defines an area of reversing basin as such. The problem lies in the discontinuity of such basins, and even in the fact that they are covered at the surface, and most probably as well in their interdependence that leads to a competition for resources that are non- or poorly renewable.

Among all the workshop sites, those of the Marrakech Haouz (figure 2.5.5) are some of the most difficult to describe in terms of hydraulic territories, in as much as several generations of networks are intertwined, superimposed and recomposed. As such, the Nfis deversing basin has been studied on the Seguia Tamesgleft site (left bank) and of the seguia Jbelia (right bank). These canals transport permanent source water to deversing sub-basins. They also transport flood water as a function of specific spatial and social systems. They also comprise water supply from pressure networks that transport water from the two watersheds, that of the Nfis itself (water from the Lalla takerkoust dam) and water from the very remote watershed of Oued Lakhdar transported by the Rocade canal (new networks put into service in the 1990 for the right bank, and in 2000 for the left bank of the Nfis). These waters of different qualities are channelled to water stations that supply a delimited area – a station deversing basin – which often covers part of the deversing basin of the ancient gravity basin which is still in use to use water from local sources or flood water. Complexity does not stop here. Hundreds of wells and drillings are present in the area, often in large numbers in the interstitial zones of the former hydraulic system, where only recession grain farming was practised. These zones are currently under the control of developers who have been able to group large surfaces, drill deep wells and gain access to the various surface networks, in addition to their own system.

Compared with the Nfis, the Tessaout-Amont workshop site is singled out by a specific spatial and social organization as relatively simpler. In the 1970's this region experienced the first modernization of irrigation in the Haouz, as the ancient seguias were replaced by semi-supported concrete canals, and an agrarian reform was launched with redistribution of land in plots of 5 hectares located in fields planned by the *Office de mise en valeur agricole* (system B). Yet, the ORMVA, the ISIIMM partner, wanted this region to be studied, since almost half of the surfaces

watered do not fall within the planning of system B, and are referred to by the inhabitants as *Douar Haouz* (literally suburbs of villages, and visually zones of ancient olive groves managed as per the local norms and under the responsibility of the users and not of the Office). The zone watered by the residual seguias of Jdida and Lakhzainia and by the modern canals of the Office show a juxtaposition of the deversing basins in which each area seems isolated from the other areas by the technical system but also by the identity references of the villages.

The community dimension is in fact present in all the deversing basins but it is always difficult to understand the adequacy between the deversing basins and their sub-basins, the different water distribution and collection technical neworks, and the social formal and informal groups. As such, the Ait Bougmez valley is a logical challenge due to its social and identity fragmentations around the common resources in which water is only one of the assets available to the 29 villages of the valley. The intervention of the World Bank in this area was based on the idea of participative management of irrigation following the example of the interventions carried out on the Marrakech Haouz concerning large hydraulic systems. Yet the definition of action areas for new groups of water users is being challenged by different groups in the valley, which function on the basis of specific solidarities on local sources and more than 60 inter-village canals that supply the resource as per precise modalities in case of water shortage, despite being challenged by some groups.

To bring an end to this survey of local hydraulic territories, the Jucar site (Acequia Real del Jucar and Acequia Real of Carcaixent) in Spain constitutes a rather coherent set of juxtaposed hydraulic units based on main collections (Fesa) that supply precise quantities of water to inter-village deversing basins. The daily distribution is organized by the local Juntes coordinated within a federal organization which, opting for a new modernization and enjoying subsidies that cover the investments, propose a major recomposition of the initial system. The old watersheds are abandoned to the benefit of a more rational pattern of homogeneous areas of 200 ha connected to a central system that controls the watering of thousands of plots. The Carcaixent canal follows a similar technical approach that mirrors the ancient area of daily distribution.

The Cacin workshop site, near Granada, is another example of local territorial complexity, since this zone is composed of two deversing basins: the first one is a conventional basin fed by the Rio Genil downstream from the city of Granada, with gravity water transfer, and irrigating the Santa Fe territory; the second one, fed by a dam on the Cacin tributary, is similar to canal 900 since the water is diverted from its original valley and transferred into the left bank of the Genil near Santa Fe. Thus, the reversing basin completes the deversing basin and affects its operation.

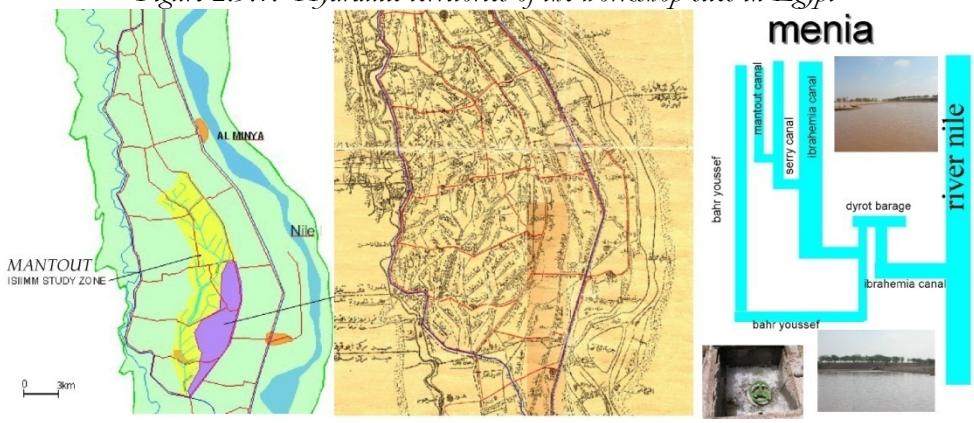
These mechanisms of spatial recomposition exist on even more local scales, especially between the hydraulic sectors of a network that receive water shares from another. The very local dimension of distribution has not been systematically treated by the ISIIMM teams in all the countries, but we refer the reader to specific works by the partners and also to the scientific support from IRD for further information, especially concerning the local, very specific rules that govern the gravity water towers, one of the most remarkable elements of the Mediterranean heritage.

CONCLUSION

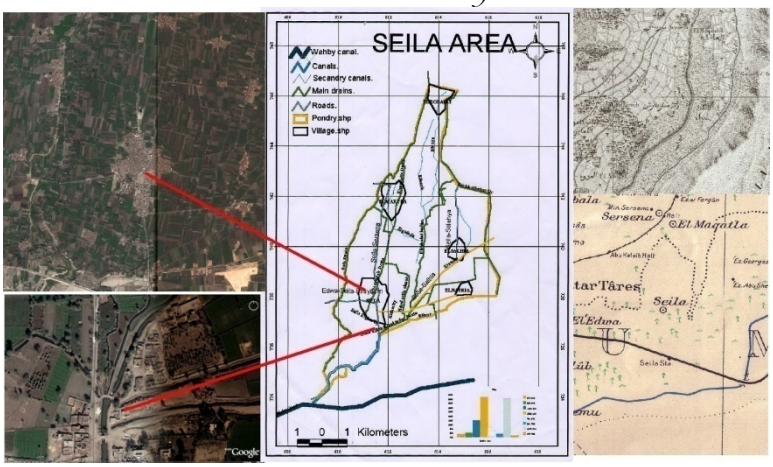
In order to understand how a society uses irrigation over a rather large territory that involves a great number of land and water users, there must be a multiple and critical territorial vision: irrigation takes place within a complex chain of mobilization, transfer, and local use within the networks of artificial water supply, often doubled by a drainage network of superfluous waters which could possibly be re-used by the same human society and by other societies located downstream.

The territorial systems, the areas of influence of the different interlocked and interdependent systems lend themselves to different interpretations depending on the position of the socio-economic groups involved in the management of the whole resource. The notion of basins centred on the water offer must be completed by new notions of basins focusing on water demands and on the organization of sustainable development policies leading to spatial interpretation that enables managing the economic system and building up institutions and conventions for environmental protection and the promotion of social fairness. The construction of innovative policies should be based on the representation of the hydrological and hydraulic complexity: deversing basins, drainage basins, reversing basins are common spaces that must be taken into account together with the watersheds.

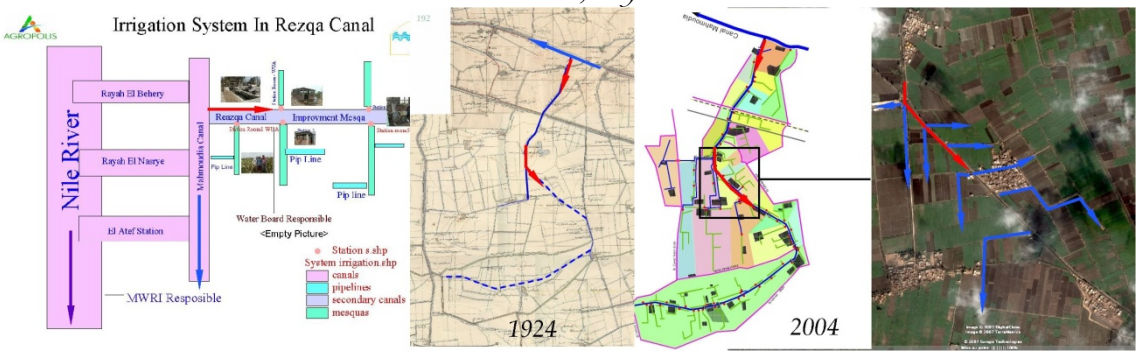
Figure 2.5.1. Hydraulic territories of the workshop sites in Egypt



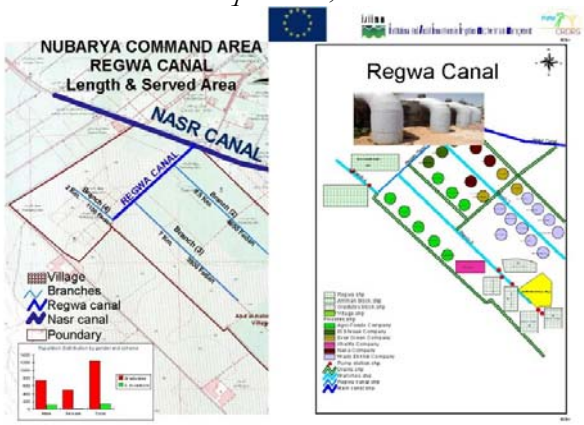
Mantout canal Minya



Seila Canal, Fayum

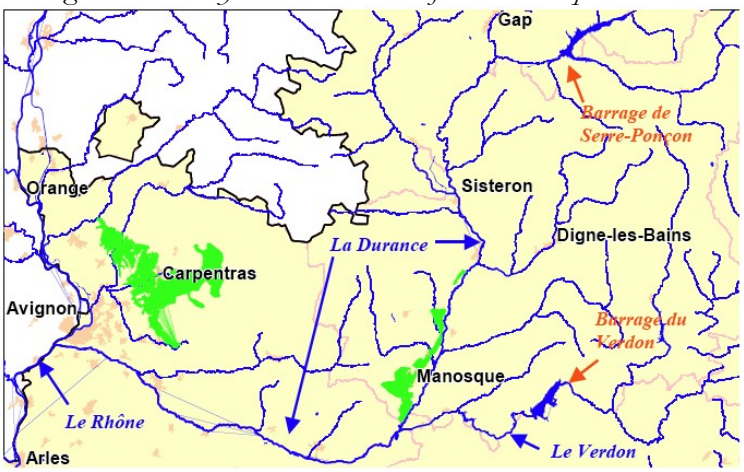


El Resqa Canal, Beheira



Regwa Canal, Beheira, New lands

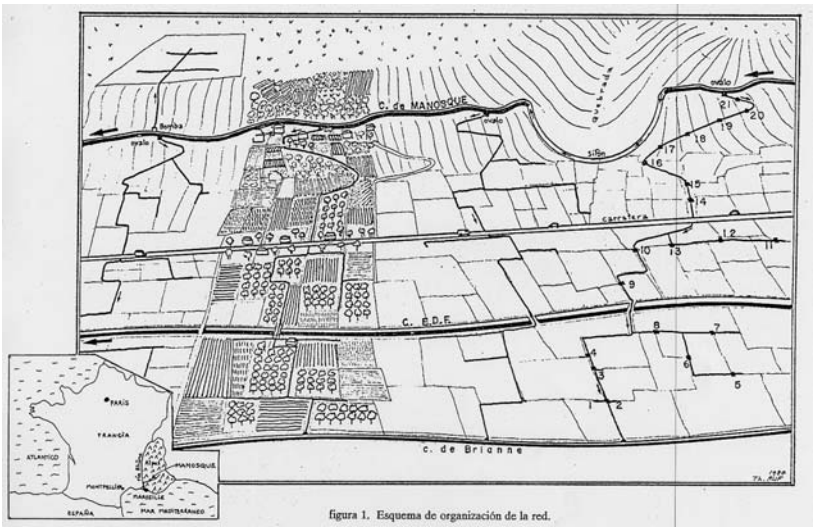
Figure 2.5.2. Hydraulic territories of the workshop sites in France



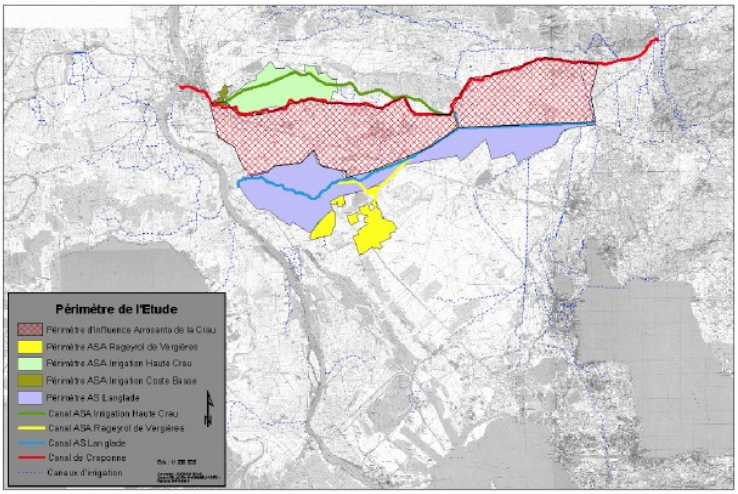
Localisation géographique des périmètres irrigués de Carpentras (84) et de Manosque (04)

(Source : N.Piton, Chambre d'Agriculture 04)

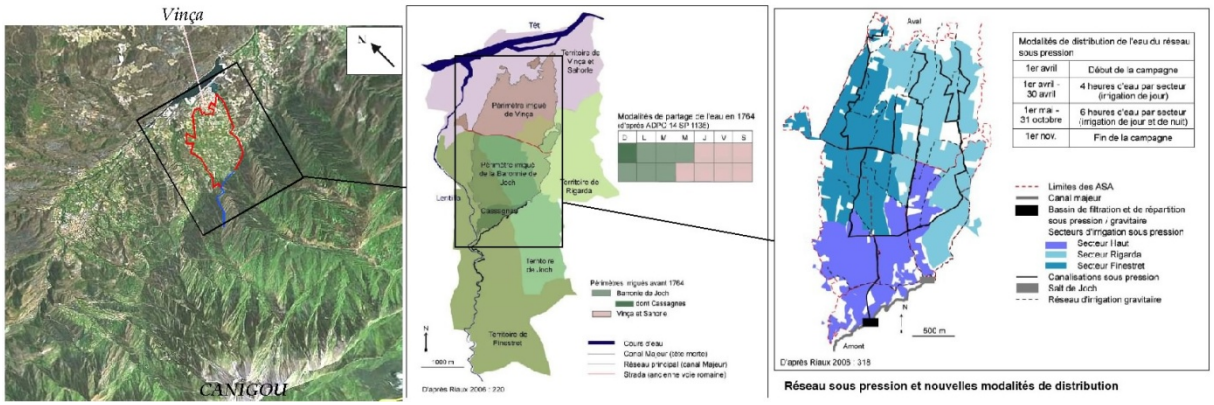
Canal de Carpentras



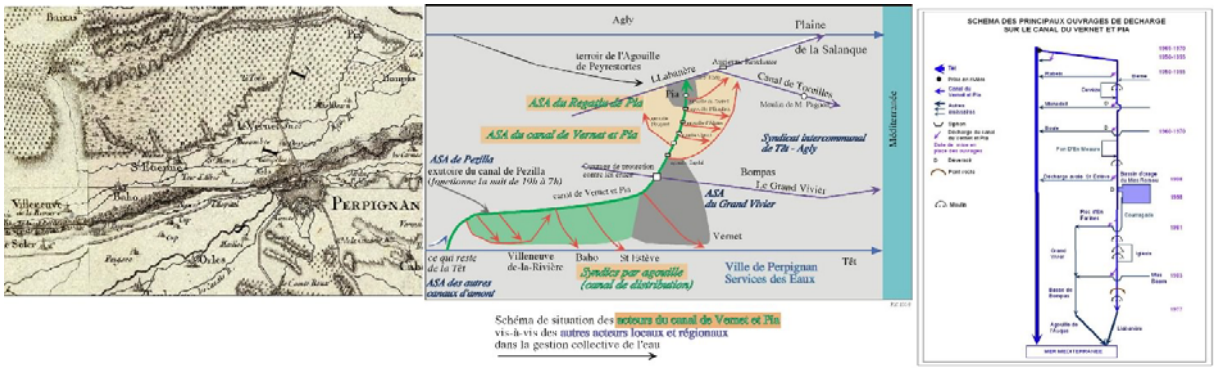
Canal de Manosque



Crau

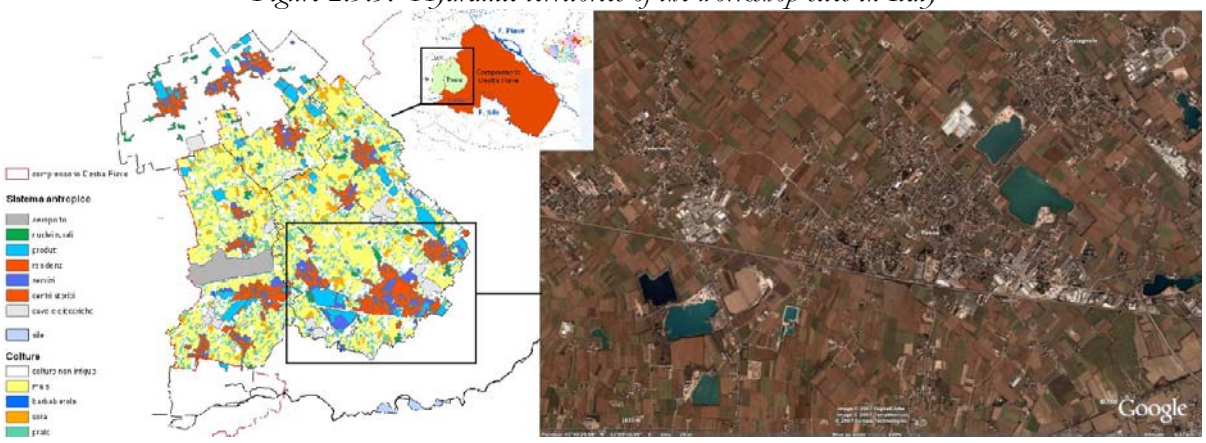


Vinça



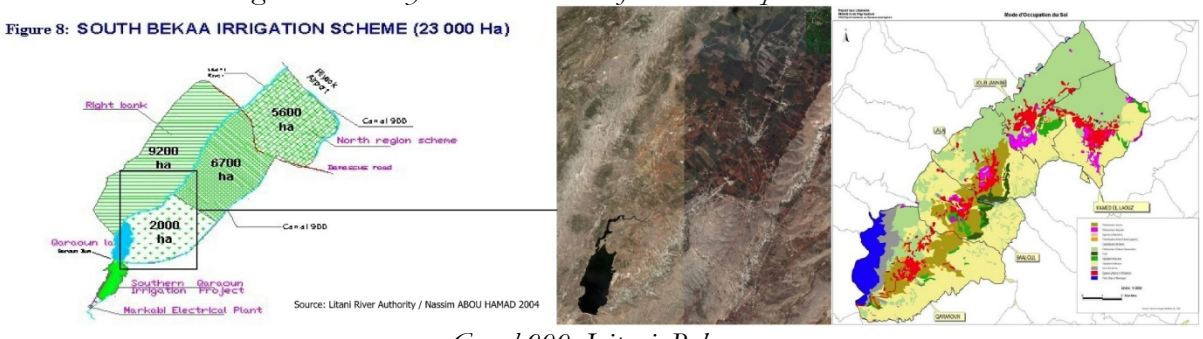
Canal de Vernet et Pia

Figure 2.5.3. Hydraulic territories of the workshop sites in Italy



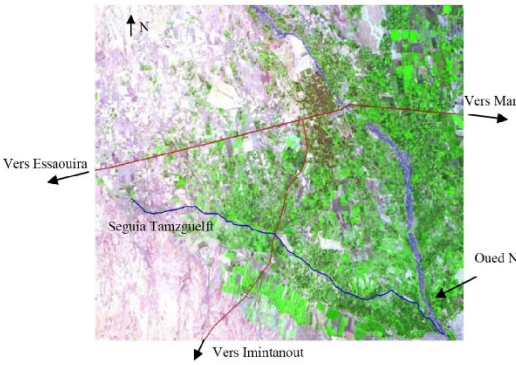
Paese

Figure 2.5.4. Hydraulic territories of the workshop sites in Lebanon

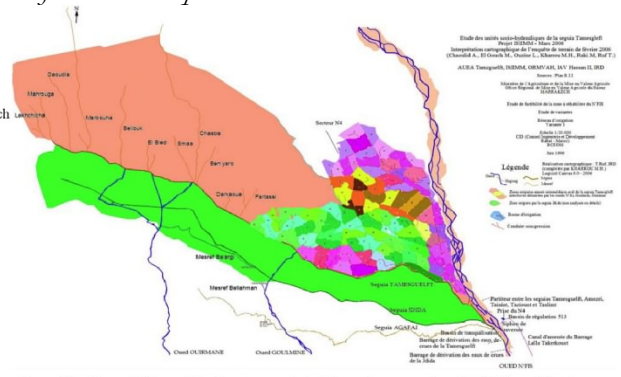


Canal 900, Litani, Bekaa

Figure 2.5.5. Hydraulic territories of the workshop sites in Morocco

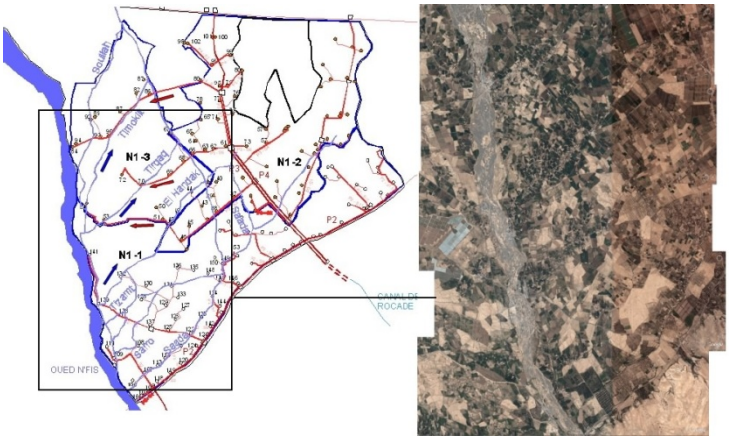


***Carte n° 7** : Image satellite du secteur N'Fis rive gauche (image SPOT Février 2001). (Source : CESBIO-projet SUDMED)*

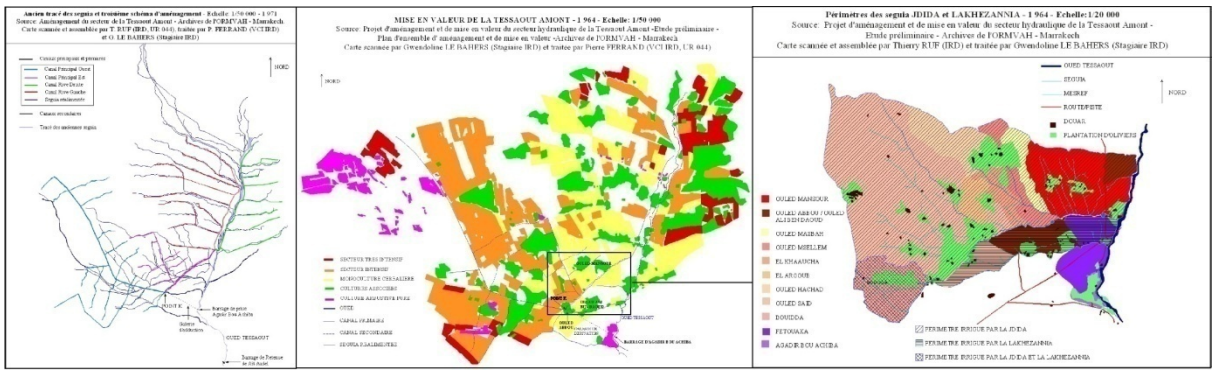


***Carte n° 5** : Secteur de Tamzguilt incluant une partie dominée par le secteur moderne du N4 (Carte élaborée sur Canvas par T.Ruf et H.Kharron)*

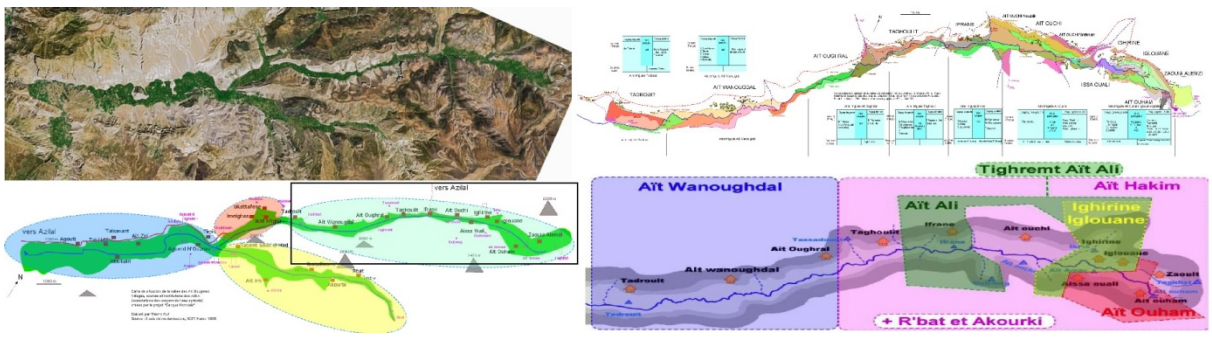
Seguia Tamesgleft, Nfis, Haouz de Marrakech



Seguia Jbelia, Nfis, Haouz de Marrakech

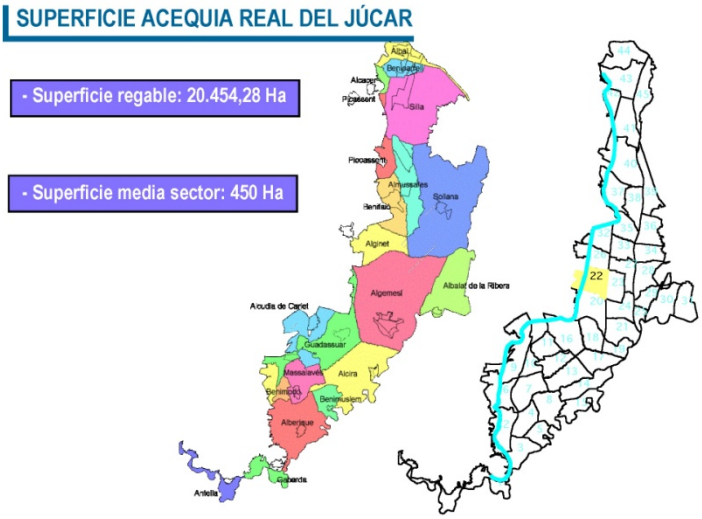


Seguia Jdida et Lakhzainia, Tessaout Amont, Haouz de Marrakech



Vallée des Ait Bougmez, Azilal

Figure 2.5.6. Hydraulic territories of the workshop sites in Spain



Acequia real del Jucar, rio Jucar, Valencia

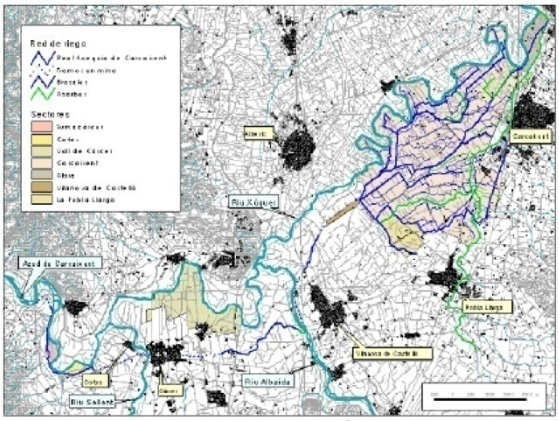
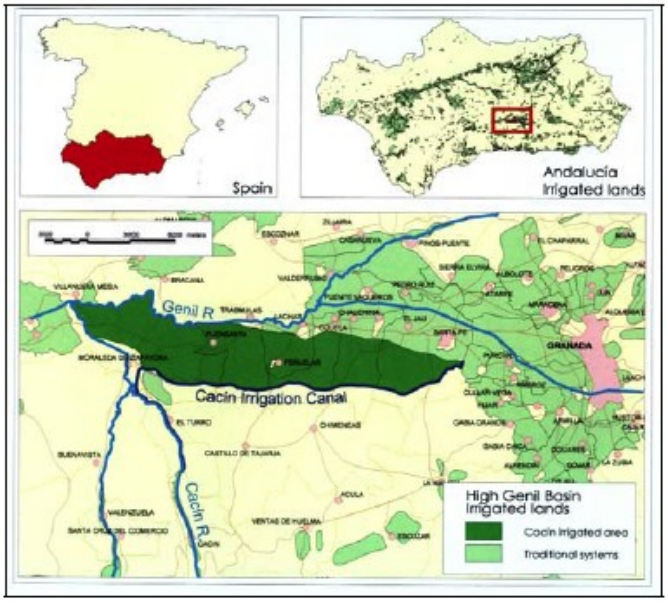


Figura 5.6. Real Acequia de Carcaixent

Acequia real de Carcaixent, rio Jucar, Valencia



Rio Cacin y Santa Fe, Granada

3. RURAL SOCIETIES AND THEIR CONTRIBUTIONS TO IRRIGATION WITHIN THE MEDITERRANEAN BASIN

The Mediterranean world is often perceived as exhibiting a certain unity. From a societal viewpoint, the history of the activities of pastoral and agricultural production – and cojointly the history of land resource management – blends the Mediterranean basin countries into a collective *likeness* (Albera *et al.* 2001). Yet, this region hosts a wide variety of people, cultures and histories. Each country has its own specificities and even within the countries themselves, there are "ethnic", cultural, religious and social features that shape identities. The North-South differentiation is the most obvious aspect, especially in the domains of the economic and industrial development, of demography and of natural and institutional conditions of access to resources. Thus, the issue of access to water appears to be more acute in the southern Mediterranean countries than in the northern ones, taking into account the past and present dynamics of development. The cultural and social differentiations within the countries studied must be taken into account, i.e. the historical differentiations between the mountain, the plain and the delta areas, between the urban and rural populations, between vertical and horizontal societies. Finally, social differentiations are also observed within rural communities, as a function of the social and land ownership status of the heads of families in the agriculture (owners/farmers), of their economic power (large / small farmers), of the type of productive activities they carry out (sedentary farmers / nomadic breeders, sedentary / migrant farmers, farmers / poly-activities).

This social, cultural and religious diversity fits within the history of the peoples, and more specifically translates into unequal historical developments between different categories of population. Yet, even if we observe these specificities and differentiation mechanisms on which they are based, there are nevertheless common points which appear to be specific to the common Mediterranean organization of irrigation. Through the observation of the characteristics common to the ISIIMM programme countries, it is possible to identify a mix of regularities and particularities in rural societies.

3.1. STRUCTURATION OF MEDITERRANEAN SOCIETIES: THE ROLE OF IRRIGATION AND OF THE PRODUCTION OF RULES

The Mediterranean climate is characterized by the violence of rain events. The critical drought and flood periods alternate as per cycles that can be both regular and unpredictable. These climatic conditions lead to the need for collective water use solidarity, be it to "share the water shortage" or to organize the reconstruction of works destroyed by floods. This collective organization is especially necessary since the Mediterranean regions are also characterized by the spatio-temporal uneveness of the precipitations. In most cases, natural water inputs are insufficient to meet the agricultural needs in a regular (seasonal) and irregular (annual and inter-annual) manner. Irrigation is made necessary to ensure that production will meet the requirements of food safety for the populations, to increase the productivity of crops vis-à-vis domestic and international markets and to meet urban demands.

Within the eleven ISIIMM partner regions, these characteristics of access to water translate into the existence of collective irrigation organizations. The hydraulic networks serve groups of stakeholders of different sizes, ranging from a few tens of irrigators to several thousands of users in the larger groups. The collective organization that underlies water usage within these eleven situations is dynamic, alive, even if almost everywhere there is a trend towards the development of individual irrigation practices through the pumping of underground water. The communities

of irrigators studied share a common culture of sociotechnical heritage that is composed of the irrigation networks, water rights, knowledge and know-how in collective and agricultural water usage (in that respect, the Lebanese example of canal 900 is different from the other cases studied).

The history of the relations between the communities and the States - and even in some cases the private sector - form another heritage of the Mediterranean societies, since the collective water regulation implies in all cases a strong involvement of authorities outside of the communities of irrigators. Indeed, beyond the regional, territorial and sectorial differentiations that may exist within the Mediterranean countries, the national or international policies have a strong influence on the water regulation modes. Thus, radical political reforms enabled some inequalities to be corrected very early, such as for example the first land reform implemented by Mohammed Ali in 1811-1820 in Egypt, followed by other reforms for the protection of small landowners at the beginning of the XXth century, and eventually the land reform launched after the struggles for independence. More permanent public policies have led to the progressive modifications of the economic, legal and institutional conditions in order to favor one or the other model of rural society, as illustrated by the water ownership processes or the formalization of irrigator communities in the XIXth century in northern Europe, and by the large development policies launched at different times in the Mediterranean countries. The present-day introduction of water user syndicates is also part of this recomposition movement, although it bears on different bases depending on the country, and corresponds to political periods of heterogenous nature.
Although the States-irrigator communities relation seems to be structuring in the six countries under study, there are differentiations induced by the State as a function of the position it occupies within the irrigation system management, by the policies it adopts, by the differentiation that such policies introduce within the countries themselves, such as the difference between "large irrigation" and "small and medium irrigation", and between the "community", "public" and "private" irrigation systems.

3.2. WATER UNITES AS MUCH AS IT DIVIDES – CULTURES OF ALLIANCES AND CONFLICTS

The appropriation and usage of water are carried out by groups socially defined by the history of an irrigation network. These groups are identified and delimited by water rights, and they are referred to as groups of stakeholders of an irrigation system, or as a community of irrigators.
A community of irrigators can comprise members of several socio-political groups (village, region), and a socio-political group can be divided into several communities of irrigators. Thus, water usage appears as an expression of a social link between several irrigators over a territory historically delimited. In that respect, water is both a major factor of social and territorial cohesion, and the cause of multiple conflicts. At times, water unites populations around an irrigation network, at times it divides them. This is the idea developed by Bromberger & Pelen (1985 : 7-15): "*water unites when it is necessary to "fight for it" or to "fight against it", and it can also divide when its usage has to be sparingly distributed*". The hydraulic works, the construction and maintenance of infrastructures provide opportunities to assert the solidarity of a group and the feeling of community around a collective hydraulic works. In some cases, rights concretize this social cohesion by reinforcing the alliance between the right holders of an irrigation network and the relations of exclusion between communities of right holders and individuals outside of this group. Thus, the community practice of irrigation appears to be mainly the result of a complex collective organization, determined by the history of the relations between a group of individuals and its territory, between the members of that group and between the community of irrigators and the outside world. In this domain, it is worth noting the importance of the role played by the parenthood, although there is little indication of these dimensions within the ISIIMM workshop

zones. In numerous cases, access to the "resources" linked to water usage - be it environmental (water and land), sociopolitical (participation to collective decision making), or financial – is strongly structured and controlled, even determined by this type of alliance.

From this observations, it appears that the definition of a group of water right holders, or that of a group of individuals associated with the decision making process concerning the collective organization, is based both on the inclusion and exclusion, the rights held by some being defined by the "lack of rights" of others. The notion of belonging is at the core of any collective appropriation of a resource, and the feeling of belonging, which can be associated with the notion of identity leads to, sometimes reinforces and even exacerbates, the opposition or alliance relations on which the legitimacy of each member of the group is based. Oppositions which are often linked to diverging interests or to different visions of the resource can lead to conflicts that stem from social or cultural oppositions. On the contrary, water management may give birth to historical oppositions between populations of different social, ethnic or political segments. Finally, water conflicts may stem from the management of other resources (forest, pasture), and vice-versa. Likewise, diverging economic strategies can also be the source of antagonistic visions on water usage modalities and lead to conflicts. Thus, the origin and cause of a conflict are often difficult to identify, and this affects the solving process.

Water therefore becomes the source of oppositions, antagonisms, challenges, open or latent conflicts which take their expression through social, ethnic or religious differentiations as mentioned earlier. Each site studied is a specific illustration.

Religious differentiations
In France, in the Durance valley, as early as the XIIth century, conflicts erupted between catholics and vaudois, then after the XVIth century between protestants and catholics. Little is known about the direct impacts of oppositions on the management of canals that were built as early as in the Middle Age.

"Sociopolitical" differentiations
Other forms of rivalry occur such as the conflictual relations between the Occitans and the Catalans in the Agly valley in the Pyrénées Orientales. These oppositions still exist in the domain of water. In Spain, there are characteristic opposition between the different provinces of the North and Center and the the Catalan and Andalusan Mediterranean provinces.

In Morocco, there rare complicated, historical and political relations between the Arab speaking populations and the Berber speaking populations, and even within the Berber speaking groups (Aït Bou Guemez valley) and within the Arab speaking groups (Marrakech Haouz).

Social differentiations
In Egypt, it is worth noting the ancient opposition between the land owners and the tenant farmers. In El Resqa, these conflicts led recently to expropriations.

Territorial differenciations
In Italy, in the Piave region, there are oppositions between the pre-alpine populations and the inhabitants of the Plain, to such an extent that it is referred to as a local water war.
There can also be antagonisms between the various administrations in charge of water management, especially when several ministries are rivals for the control over the populations and when the engineering bodies attempt to achieve a leadership on water issues (usually, the Mining Services, the Civil Engineering Services, and the Rural Engineering).

These multiple forms of antagonism take different forms of expression, ranging from simple verbal opposition to "barney", even violent or symbolically violent reactions, from the blockage of collective organization to law suit, from the circumventing of collective rules to the destruction of hydraulic works. In some cases, the confrontations that stem from these oppositions generate symmetrical positions within the network so as to balance the powers. This is the case of Vinça in the French Pyrénées and of the Tessaout in Morocco, where dozens of villages shared resources as per a repetitive pattern from upstream to downstream, and from upstream of the river to the downstream of the branching canal, and from the upstream to the downstream of the distribution branches in villages. In other situations, dominating positions are being constituted around large private domains, as in the Marrakech Haouz, in Lebanon in the Litani region, and in the Basso Piave area in Italy.

Yet, the existence and expression – or lack thereof – of these oppositions may also lead to alliances either to regroup or to combat. This refers to the ethnological theories of ethnicity and segmentarity: the limits of groups are dynamic, alliances are done and undone as a function of the contextual games and stakes. Thus, there is solidarity when dealing with natural events, especially flood and drought (in most cases, scarcity is usually shared in a fair manner between the members of a group of right holders and sometimes even beyond that). Likewise, in some cases, users with different interests can ally themselves to obtain subsidies as was the case in Vinça (Pyrénées Orientales, France) or around the Jucar with the creation of the USUJ (Spain, Valencia). Groups can also be formed in a given political situation, to fight for the rights and interests of irrigators, as illustrated by the creation in 2003 of the association of irrigators of the French mediterranean regions (Association des Irrigants des Régions Méditerranéennes Françaises - AIRMF), which wold like to be integrated at a transnational level into the EIC (Euro-Mediterranean Irrigators Community) initiated in Spain. These associations are created to support the interests of Mediterranean irrigators before the national and international decision making bodies.

Depending on the cases, either the whole group concerned by the usage of an identified water resource (the socio-hydraulic group - Riaux 2006) shares common principles and values that make it possible to achieve compromises in the case of conflicts, or the group of right holders does not have common values and this generates conflicts. Finally, on some of the sites, it can be noted that these conflicts are at the origin of the creation of institutions-organisms whose role becomes essential in history (ex. the Durance executive commission in France, cf. partie II), and that the water management social organization is structured as a function of these antagonisms for their mitigation, invalidation, control or arbitration.

L'eau rassemble autant qu'elle divise

L'expression "L'eau, l'art et la violence" (Ruf, 2002) rassemble à la fois les éléments naturels parfois dévastateurs mais aussi les contradictions sociales excessives avec la concentration des pouvoirs, des terres et des accès à l'eau d'un côté, mais aussi à d'autres moments ou en parallèle la fragmentation d'autres pouvoirs, terres et droits d'eau inhérents aux dynamiques démographiques, foncières et sociales et aux jeux d'alliance ou de sujétions. Ces violences sont contrebalancées par l'art de maîtriser certains éléments d'hydrauliqueS pour conduire, relever ou retirer les eaux, et pour établir un minimum de consensus dans la conservation des ressources et leur distribution la plus juste.

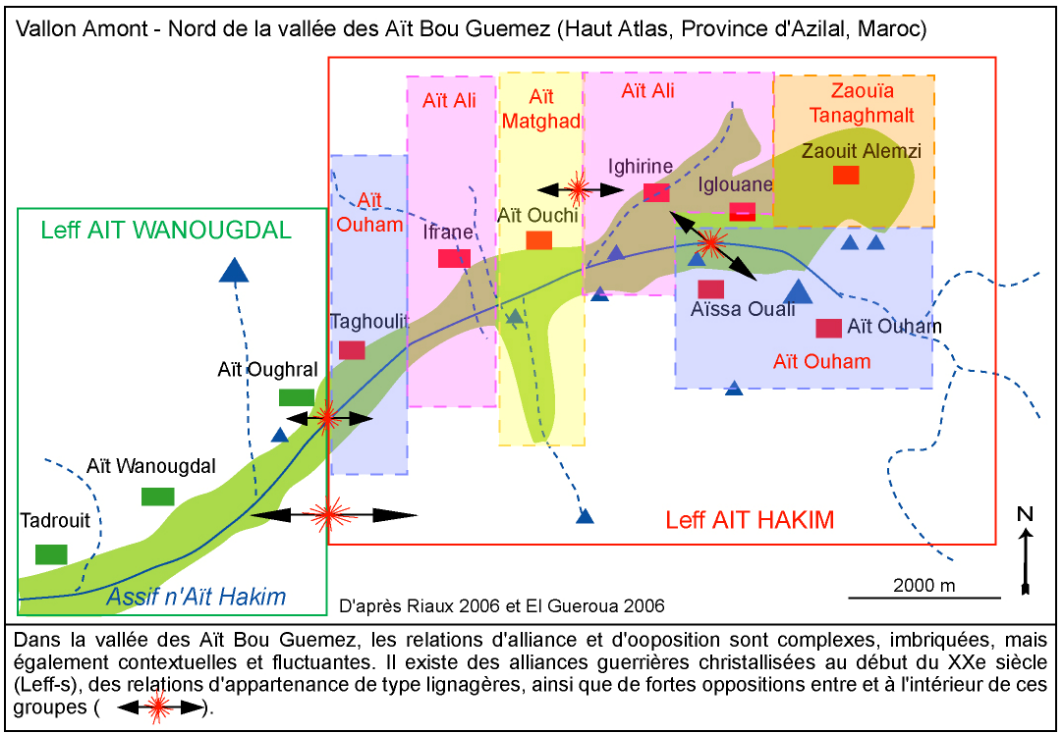


Figure 3.1. Example of union and division of social groups around the water of the High Atlas in Morocco

3.3. "RURAL SOCIETIES – CITIES" INTERACTIONS: THE MEDITERRANEAN HUERTAS.

The study of the various sites has revealed another feature of Mediterranean rural societies: societies that make a living from irrigation have been for a long time able to deal with urbanization.

As the seat of the political, religious, executive, trading and judiciary power, the City exerts a constant influence on the fate of irrigated rural zones. Moreover, the City is a large market for food and more specialized products for which irrigation is often used, and finally the City nearby makes it possible to be connected to other regional, national and international cities. But in its periphery the city grows and absorbs land that is more appropriate for irrigated culture, and which often has been fertlized using the most varied forms of urban waste. It should also be noted that rural societies contribute to urban growth by sending part of their population to the City to carry other activities.

The Mediterranean rural world has achieved a structure of archipelagos composed of habitation, production and consumption sites (*cf.* par ex. Garrigues-Cresswell 1987. *La complémentarité verticale dans le Haut Atlas* pour l'exemple de la vallée des Aït Bou Guemez). Social and family networks are created between the rural zones and the urban zones, for all the categories of population, and not just the wealthiest as it is often thought. Conversely, Mediterranean urban societies have always been present in the country through the ownership of land, and the current evolution of

the world, of communications and organization of urban life leads to the spreading of urban fabric into the country at the periphery of large cities, especially in the irrigated territories often considered as pleasant residential areas.

In that respect, the examples studied destroy several conventional preconceived ideas about Mediterranean societies. On the one hand, rural zones are not isolated from urban zones, in fact they are articulated, integrated into broad social, economic and political spaces. This observation is valid for mountain zones, often perceived as isolated, disconnected from the rest of the national territory. Rural Mediterranean societies are integrated within the regional, national and international socio-political spaces. Moreover, the opposition usually accepted between rural zones and urban zones, urban populations and rural populations must be revised in the light of the interaction and interpenetration dynamics.

3.4. TRENDS COMMON TO THE EVOLUTION OF MEDITERRANEAN SOCIETIES.

For each of the study sites, the socio-historical approach makes it possible to detect a trend towards agro-economic, technical, political and social change. This movement is amplified by the influence of the national and international public policies, but also by the irrigators themselves.

- **Evolution of agricultures**. As a function of their territorial, historical and social context, rural societies have evolved throughout the XXth century from agro-sylvo-pastural systems to more specialized systems usually more intensive and productive, in as much as the hydraulic missions of the States provided a more regular and permanent access to irrigation water and local communities were innovative and modern. This translates differently in the different "workshop sites".

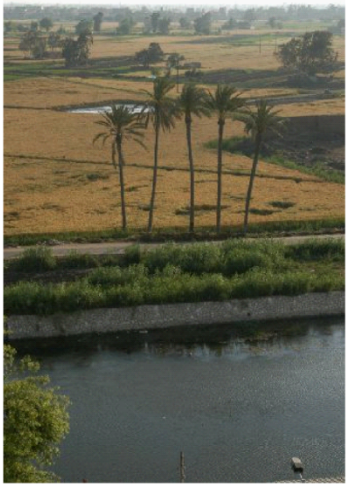
Throughout history, some societies have built huge Huertas around large regional urban centers, with priority given to family labor and able to federate producers on the basis of a fruit and vegetable farming model. This is the case of the Fayoum (Seila) in Egypt, of the Roussillon plain around Perpignan in the Pyrénées Orientales, of the Marrakech Haouz in Morocco, of the Valencia and Granada huertas.

Other societies opted for large intensive grain farming, and in the deltas, societies of specialized rice farmers appeared on the north and south Mediterranean shores – the Albufera in Spain, Camargue in France, Beheira in the Nile delta in Egypt.

Other societies have continued polyculture-breeding models by using the complementary functions of family breeding farms (saving, traction force, organic manure, family food). Currently, these are mainly in mountain zones (Aït Bou Guemez in Morocco, Catalan Hautes Pyrénées, and Crau zone for the Alpine system, High genil in Spain), or in the high plains of Lebanon (Khraïzat region). Yet the association of different irrigated cultures, even of the different economic activities on the same zone characterizes the history and for some irrigators the actual situation of most of the sites studied.

There is in fact the historical construction of oppositions between the irrigators who maintain the food crop polycultivation model and those who specialize in cash crops. Although they have different objectives (preserving the family farm/optimizing on capital, labor and water value), these modes of farming coexist on most of the zones observed. Nevertheless, the current trend is to privilege the entrepreneurial form which attempts to extend its rights by coopting those from users deemed as less efficient.

Egypte, site de Behera (Ruf 2004. Osiris ISIIMM)



Plaine de Vinça, France (Osiris ISIIMM)

haouz de Marrakech

Destra Piave, Italie

Huerta de Valencia (Osiris, ISIIMM)

Liban (Osiris

Figure.3.2. Examples of landscapes irrigated by farming societies on the ISIIMM workshop sites

During the ISIIMM programme, the difficulties experienced by the communities of irrigators to tackle these evolutions of context have favored the dialogue between the various players of the different "workshop zones" (Morocco-Egypt, Aït Bou Guemez-Pyrénées Orientales upstream-Provence Alpes Côte d'Azur upstream Lebanon high plains).

- **Evolution of rural-urban relations**

The social, political and economic relation tht develops between the irrigated rural zones evolves with water legislations which tend to favor "urban" funtionalities (drinking water, sanitation, dilution of sanitation effluents), and the "recreational" ones (tourism, golf course and garden watering, aquatic parks) of water to the detriment of farming usages. Non-agricultural "usages" tend to become organized groups that become integral part of water management and of an international debate on joint policies. Issues such as land and aquatic environment protection are now occupying a key position in the northern Mediterranean countries (European Framework Directive) and in the southern countries as well. In the south of the Mediterranean basin, poverty mitigation objectives seem to have priority over water management environmental issues, although the two concerns are closely linked. In this context characterized by social and environmental concerns of "sustainable development" and "good governance", the water policies established at the international level tend to impose themselves as a uniformized model.

The general trend in water policies is the creation of "integrated" and/or "participative" water management bodies – similar to basin agencies – which represent the multifunctional usages of water, hence the different categories of users. The communities of irrigators are de facto associated with such bodies, and they must jointly defend their interest and become acquainted with the "concerted management" of the resource, as it is imposed to them.

This new social, political and institutional panorama corresponds to a period of transformation of the rural populations and has an impact on the social organization of the communities of irrigators. Depending on the case, this leads to either the individualization of the irrigators, with a rupture of the social links established around collective management, or on the contrary to the establishment of new relations either informal but often more contractual and formal (associations) between irrigators, intended to give them enough weight in the concertation/negociation arenas.

CONCLUSION : HISTOIRE SOCIALE, HISTOIRE POLITIQUE

Mediterranean rural societies share long histories of social links between the users of rare resources and of strong solidarities to overcome the most violent events thrown at them by nature or society. For a long time, the issue of coherence between social groups and categories has led to difficult arbitrations: economic development, preservation of justice and fairness, collective preservation of environmental resources in irrigated zones.

This quest for common living rules has given birth to numerous different institutions which take their principles from political models that combine local demoncratie and centralized power. This diversity must be emphasized on within a context of uniformization of the political solutions brought to water management issues.

4. THE MULTIPLICITY OF REGULATORY AND MANAGEMENT INSTITUTIONS GOVERNING WATER AND OTHER RESOURCES NEEDED FOR AGRICULTURE

Irrigation can be described as a twofold system: i) the individual usage that results from the choice of farmers as a function of their environment and of the techniques available to them; ii) the result of hydro-agricultural development which pertains to collective organization and in some cases to public will or private initiatives. In any irrigation system, the existing link between the technical infrastructure and the social organization appears mainly through Law, rules of water usage and appropriation, and the irrigation network, together with the social organizations or bodies in charge of elaborating and supervising these rules. All these elements form what is called a water management "institution" (Ostrom 1992). The content of the institution concept: "institution-rule", "institution-organization" and "institution-organism", generates a polysemic term as observed in the various case studies of the ISIIMM programme. This implied diverging practices.

4.1. FUNCTIONING RULES AND REGULATION AUTHORITY: THE INSTITUTIONS

Institutions may stem from water user communities ("bottom-up" institutions), from authorities outside of the communities ("top-down" institutions, private institutions), or they can be coproduced. Therefore, there are institutional configurations specific to each ISIIMM study field, providing an original articulation of the three poles that are formed by the rural communities, the private sector and the State services (cf. figure 4.1).

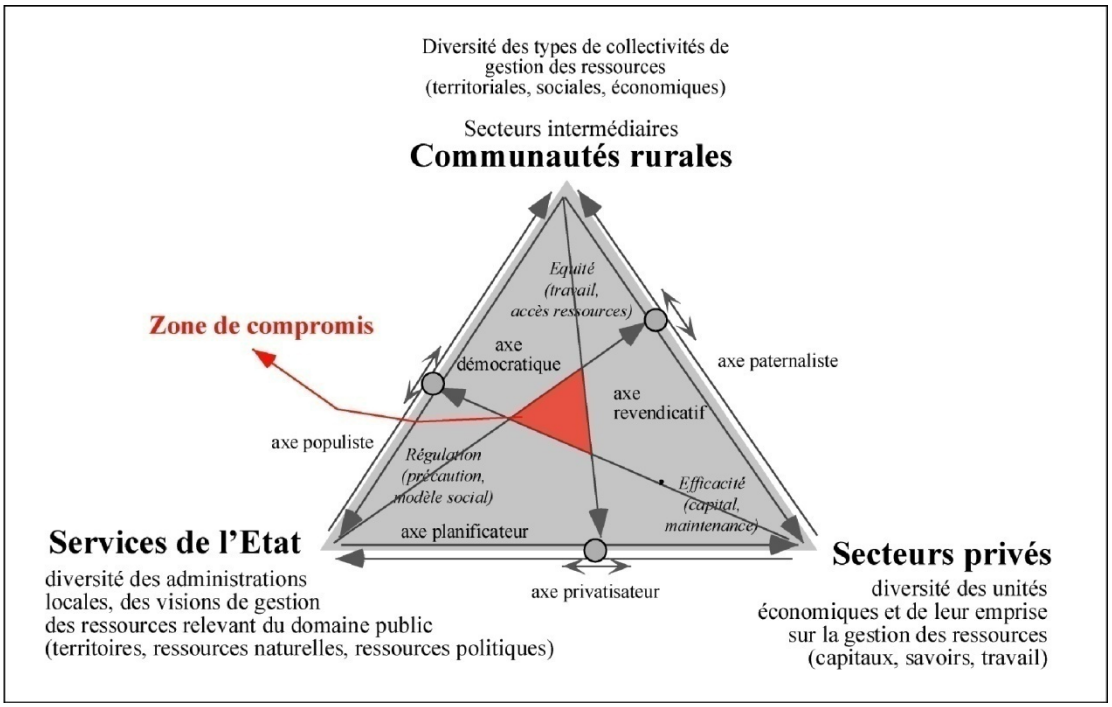


Figure 4.1. SOCIAL COMPROMISE between the "public", "private", "community" players. (in Annex A. ISIIMM Project).

In order to achieve a social compromise between the different categories of players involved in water management at the local level, there must be a form of articulation between the institutions that represent each of these sectors.

Although they are in inter-relation, these institutions play different roles in water management, and they express different conception of the resource and of the regulation. We shall make a distinction between the institutions whose actions have a direct impact on irrigation at the local level, and the institutions whose actions have an indirect impact on irrigation through the creation of operation standards and the supervision of these rules at the national and regional levels. This distinction could be likened to the one applied by the politicians between "governance" and "government". The notion of governance implies a "shared power", without excluding forms of authority, or possibly regulation bodies. The notion of government refers to a hierarchical idea of power. This debate applies to water management where the theme of "water governance" is becoming a prerequisite to any reform of public policies.

4.2. THE "GOVERNANCE" INSITUTION.

The observation of irrigation systems leads to a first remark: *in order for an irrigation system to function, the activities of the individuals must be integrated into regular and foreseeable modalities* (Ostrom 1992: 27, translation: Lavigne-Delville 1996: 10). This implies that any irrigation system is necessarily organized in a formal or informal manner, around a set of rules. These rules can be grouped into two categories: rules that aim at organizing water usage and collective practice of irrigation, and rules that enable the collective organization to be maintained. In most cases, the rules implemented by the communities of irrigators stem from a complicated imbrication of several categories or rights (common law, national law, religious law, customs). In other cases, the operation rules of the irrigation systems do not come from communities of water users, but from public organisms such as the *Office Régionaux de Mise en Valeur* in Morocco and the Regional Development Societies in France – in their original conception. Within the ISIIMM sites, there is no irrigation system managed by a private company, even if some French RDS tend to function as private companies (*cf.* more specifically the Compagnie Nationale Bas-Rhône Languedoc now designated Bas-Rhône Languedoc S.A.).

A system of positive and negative – but always constructive – sanctions together with a control exerted by a legitimate authority must ensure that the rules are respected. *''Water is managed by a "socially recognized hydraulic authority" which ensures the essential functions of water right registration of the users and vesting of rights. It is responsible for water policing and for the organization of the hydraulic maintenance. Finally, it ensures the distribution of charges (labor and financial). The hydraulic authority implements the principles of "hydraulic democracy" through the collective application of the contractual regulation* (Ruf & Sabatier 1995: 10-11). The rules are produced, renewed and legitimized by a group of individuals who represents that "hydraulic authority".

Depending on the societies, the hydraulic authority may stem from the whole community (cf.ex. the village communities of the Aït Bou Guemez valley, the *universitats catalanes* created before the Revolution in the Pyrénées Orientales), from a group of people appointed by the community or by external bodies (case of associations of irrigators: *syndicate associations authorized in* France, *comunidades de regantes* in Spain, *consorzii de Bonifica* in Italy), or even from a group of individuals which imposes itself or is being imposed from outside the community. In some cases, management is ensured by public administrations which are given the role of hydraulic authority. Nevertheless, today policies of management transfer to groups of users (*Participatory Irrigation Management*) imply the generalization of "users association" type of institutions, as seen in Morocco and Egypt.

Water management insitutions – be they "endogenous", "co-produced" or imposed from the outside – fulfill three main functions: the organization, the control and the mediation of the collective action. These three functions may correspond to several roles played by different individuals. These roles correspond to exercising a power over irrigators, by example the power to impose or not sanctions to irrigators should they break the local rule in force. On the ISIIMM sites, these roles are generally shared by representatives from the irrigators and representatives from the public authority (sometimes member of the hydraulic services), but the configurations of the State-rural communities associations differ from one country to another (cf. fig 4.2.)

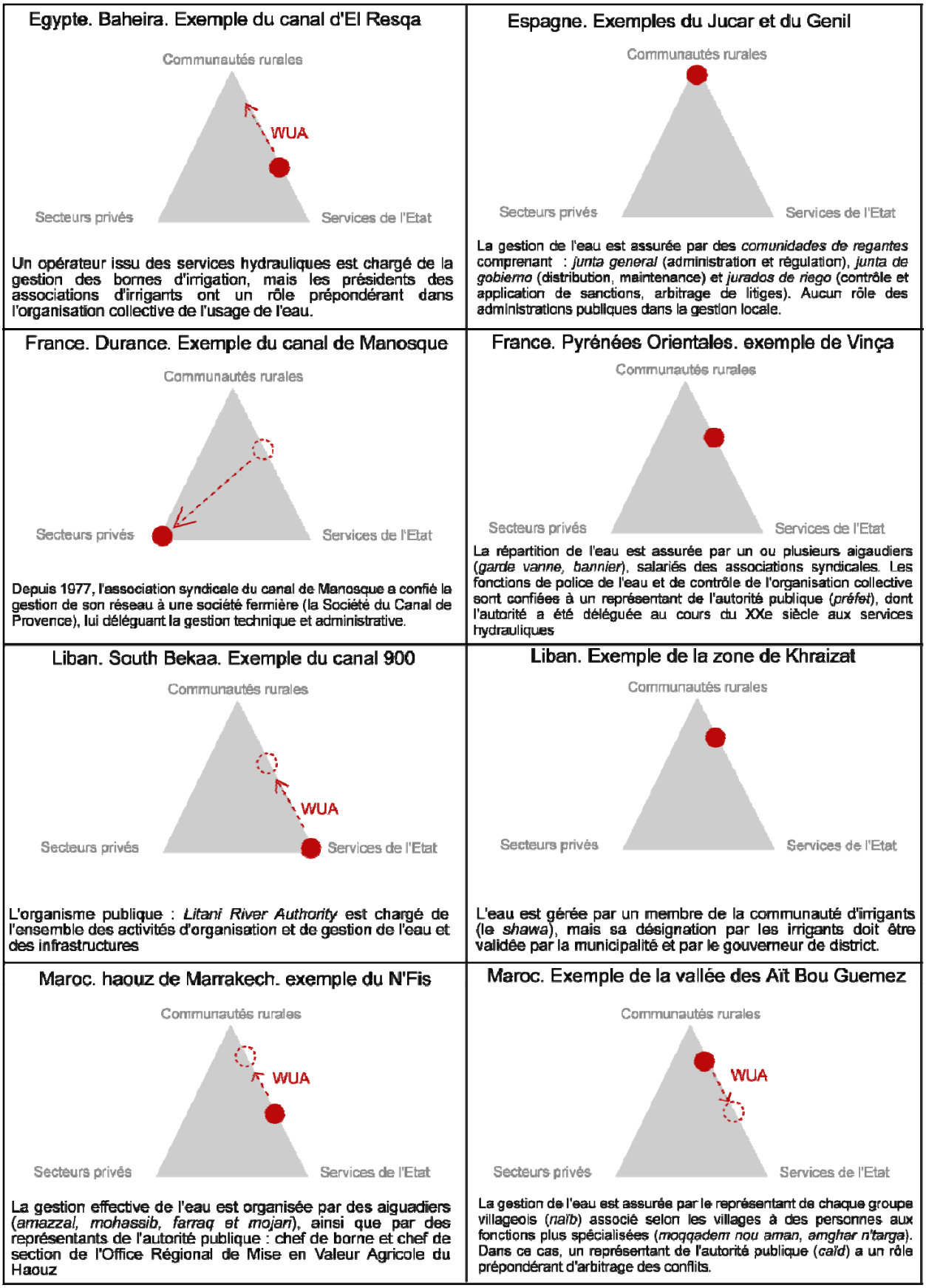


Fig 4. 2. Situations and trends of water local management in ISIIMM countries.

The articulation between the different poles observed on each site does not provide a finite situation. On the contrary, throughout history, there is an evolution of the compromises between the different poles. In fact, institutional cycles of water management can be observed in the history of each site, together with the short term trend (fig.4.2).

Moreover, in certain cases, there is an ascending organization of the local institutions, from local to national, and sometimes supra-national. As an example, for the French case study, the syndicates are relayed by departemental federations of managers and then progressively at the regional level by the *Association des Irrigants des Régions Méditerranéennes Françaises*, and the *Euro-Mediterranean Irrigators Community* is currently being set up at the supranational scale.

Finally, depending on the countries, parapublic organisms, elected or not by irrigators or more generally by farmers, are in charge of representing and protecting their interests versus "government institutions" (chamber of agriculture, commerce or industry, federations and other professional associations).

4.3. "GOVERNMENT" INSTITUTIONS.

In each of the countries of the ISIIMM programme, water usage regulation is governed by political, administrative and legal devices established by the States. The regulation, control and planning tasks are ensured by public bodies. The structure, role and functions of these "institutions-organisms" are defined by national law codes. Curently, in all the countries of the ISIIMM programme, there are changes in the setting up of these organisms and in the tasks they ensure. These changes must be considered in view of the evolution of water policies elaborated at the transational level by institutions which have more and more influence in the definition of national water laws (European Union, international financial organisms whose financial aid is submited to conditions).
The "government" institutions are articulated as a function of a vertical axis which corresponds to the pyramidal organization of State services, and as a function of a horizontal axis related to the sectorial character of this organization. The synthesis of these axes will reflect the complexity of the public institutional landscapes.

Vertical / hierarchical axis: administrative and hydro-administrative breakdowns.

The countries part of the ISIIMM programme are organized in a pyramidal manner, from the national level to "local" levels; "intermediate" State levels correspond to the administrative breakdowns of the territory (tableau 5).

Table 5. Administrative breakdowns of the countries of the ISIIMM programme.

Egypt	Spain	France	Italy	Lebanon	Morocco
	Autonomous province	Region	Region		Region
Governorats	Region	Département / district	Province	Mohafaza	Province
Markaz		Canton		caza	Caïdat
Zimam	ciudad	commune	municipality	municipality	Rural commune

In some of the countries there are less administrative breakdowns, but in all cases the decentralization and/or deconcentration processes of public administrations can be observed, albeit at different steps.
In all cases, nevertheless, the transmission of functions, of responsibilities from the central State to the different administrative levels implies:

- The existence of imbricated administrations linked to ministries (in France, the Ministry of Agriculture and Fishery, the Regional Direction of Agriculture and Forestry, the Departemental irection of Agriculture and Forestry), with different scopes of responsibilities, freedom of action, decision making and the enacting of rules.
- The existence of territorial collectivities with varying scopes of responsibilities, within the framework of decentralization (example in France: Regional Council, General Council, Community of Communes, Communes). These levels are involved in water management, since very often water management responsibilities are entrusted to local authorities; the issues related to "urban waters" (AEP, sanitation, flood management) are often entrusted to communes, whereas the "intermediate" level authorities are usually in charge of part of the financing and planning of hydraulic works, together with the water usage control.

The organization of these administrative territories corresponds to prerogatives set by Law, and to zones of State or individual power. In that respect, a distinction must be made between the States with centralized tradition – France, Morocco, Egypt, Lebanon – and the regionalized federal States such as Italy and Spain.

Horizontal and regulation sectorization axis.

Public regulation of water usages is also organized as a function of the different sectors of action and responsibilities. Because of these multifunctional dimensions, water management is under the authority of several ministries and directions. Generally, the ministries in charge of agriculture, hydraulic developments and public health play a central role, whereas ministries in charge of the environment progressively gain increasingly important roles in the domain of water, through coordination institutions.

The organization chart of the ministries in charge of water may be different from one country to another. Depending on the water functionalities favored by the States, there are two main modes of organization of ministry:

- Either a ministry is exclusively in charge of water, such as the Egyptian *Ministry of Water Resources and Irrigation* or the *Water and Energy Ministry* in Lebanon. I such a case, the various domains of activity are shared by directions or departments: developments, irrigation, underground water tables, etc.
- Or water management is under the authority of several ministries: agriculture, public works, environment, etc. as this is the case in Morocco, Spain, France and Italy.

The functions of each of the ministries are complementary in the domain of water, but in most of the ISIIMM countries there are some contradictions or difficulties in the distribution of tasks, roles, and responsibilities attributed to each institution. These difficulties can be observed at different levels of the organization of States: national, regional and local.

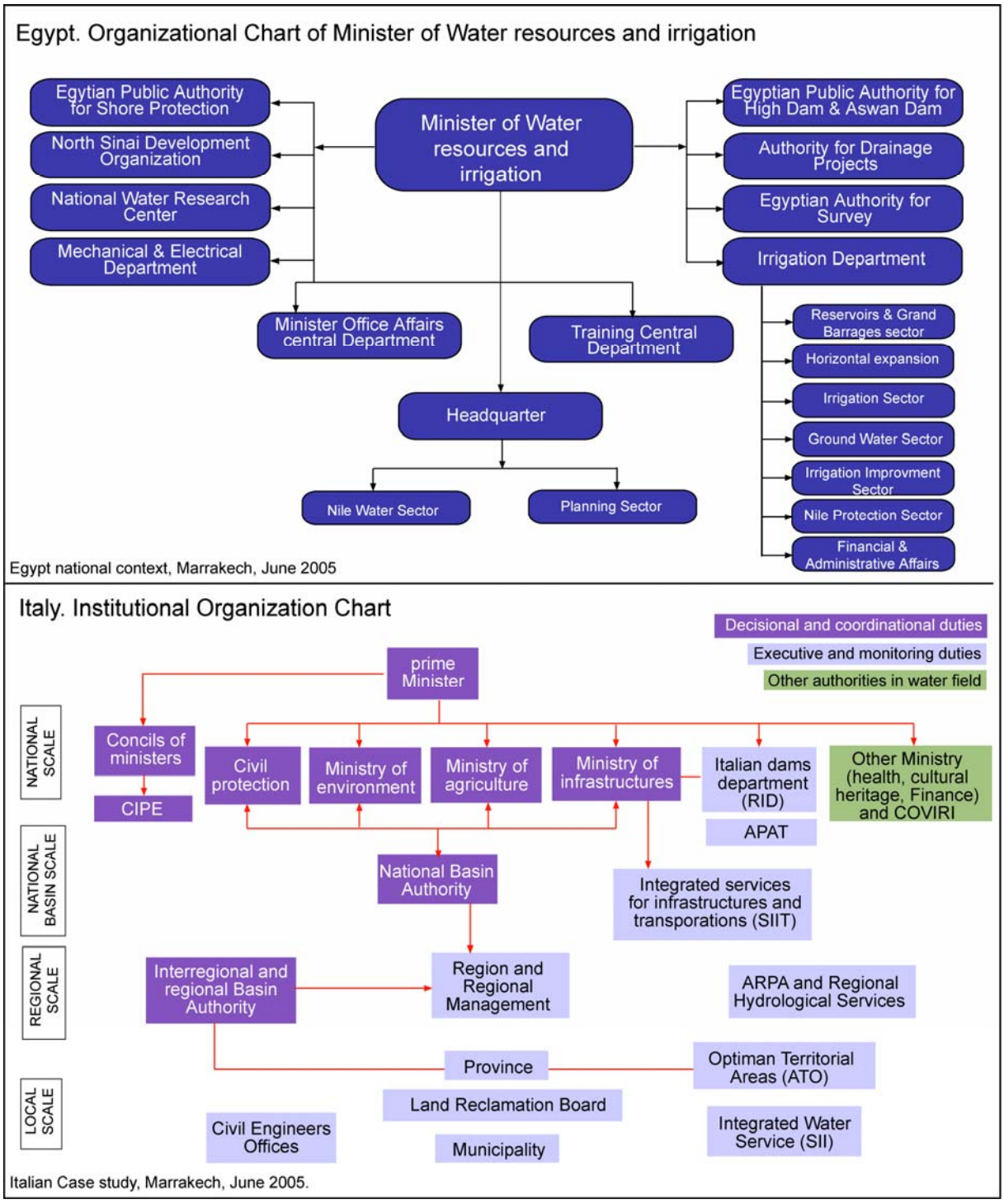


Fig. 4.3. Examples of organization of ministries in charge of water management: Egypt / Italy

4.4 BASIN ORGANISMS: HYDRO-ADMINISTRATIVE BREAKDOWNS

In some countries, in parallel with these administrative breakdowns there are "hydro-administrative" breakdowns, as territories and organisms which are in charge of water management only. In the ISIIMM countries, there are basin organisms (France, Morocco, Lebanon, Spain) or basin organisms being renegociated (Italy). The situation is different in Egypt, since the Nile basin stretches over ten countries; district-based regulation devices are being elaborated (*District Irrigation Management project* 2004). There is apparent unity between the countries studied in these institutions promoted within the framework of Integrated Water Resource Management (IWRM) and imposed by the international stakeholders. In reality, basin

organisms exhibit heterogenous operations, responsibilities and prerogatives as illustrated by the following table for Francen Spain and Morocco.

		France	*Spain*	*Morocco*
		Water Agencies	***Hydrographic confederations***	***Basin Agencies***
Planning		yes	yes	yes
Aids		yes	yes	yes
Pumping fees / disposal to the environment		yes	no *(à l'étude)*	yes
Depreciation fees / works operations		no	yes	no
Water Police		no (MISE)	yes	yes
Autorizations		no (MISE)	yes	yes
Drought Plans		no (MISE)	yes	yes
Ownership		no	yes	no *(sauf exception)*
Works management		no	yes	*yes (barrages)*
Environment Surveillance		yes	yes	yes
Composition of BoD	**Users**	33%	32%	32%
	Collectivities	33%	29%	12%
	State & Public Authorities	33%	39%	56%
President of Board		Appointed by the State	Appointed by the State	Minister of the Environment

MISE: Water Inert-Service Mission

Fig. 4.4. Comparison of basin devices (Féraud 2006).

Moreover, these basin organisms – relatively recent in view of the administrative breakdowns of States – are often in competition with the other decentralized institutions in terms of competence. Since it refers to a geomorphologic unit, basin management often appears mismatched vis-à-vis the other political and administrative entities, especially as politico-administrative imperatives often interfere with the definition of territorial definition of "basins" (*cf.* ex. basin agencies in France and in Lebanon) and in the definition of their competences. Depending on the cases, basin organisms embody several regions or provinces, thus forming units that do not match administrative or political zones, and therefore creating contradiction in the definition of the attributions of each administration and not taking into account the existence of pre-existing socio-political groups. Moreover, the "basin"-based management rarely correspond to the reality of water usages; as an example, interbasin water transfers are rarely taken into account. The issue of underground water tables still raises numerous problems.

4.5. COMPLEX INSTITUTIONAL LANDSCAPES: COOPERATIONS AND CONTRADICTIONS

The various types of institutions observed within the ISIIMM countries - "governance institutions", "government institutions", "*bottom-up* institution", "*top-down* institutions", community, private or co-management institutions – are present or represented at the local level. This structure of institutions coming from different sources of authority leads to a high complexity of the institutional water management landscapes. It is also necessary to take into account the history of this landscape, as a function of the laws and orientations of public policies in water management, as illustrated by the example of Vinça, in the Pyrenees (fig. 4.5).

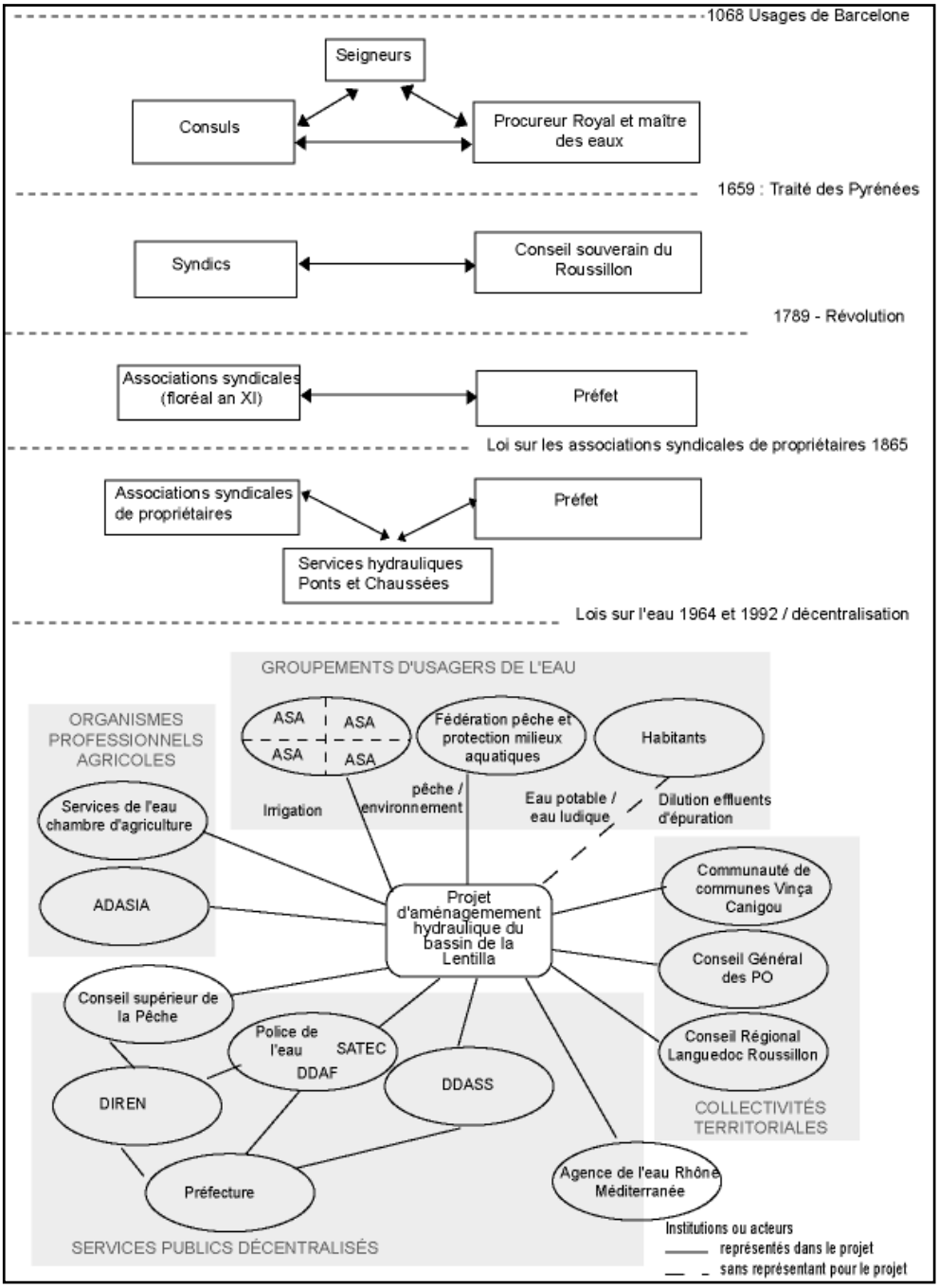


Fig. 4.5.:History of the institutional water landscape in the Vinça Plain (as per ISIIMM France)

From the example of the management of the Lentilla in the Pyrénées Orientales, there is currently a major complexification of the institutional landscape. On the one hand, an increasing number of water user categories are represented in the discussion arena concerning the hydraulic development project. On the other hand, an increasing number of decentralized or deconcentrated administrations play a role in local water management. This process can be observed on the various study sites of the ISIIMM programme at various degrees.

The coexistence of institutions coming from different sources generates contradictions at the different levels of organization, as illustrated in water local management.

Vertical contradictions. The modes of water regulation in the Mediterranean region are designed at different scales - not always in agreement – as illustrated by the imbricated territories and conflicts of usage. The national and very local scales are often documented, but the intermediate scales are far more difficult to identify and understand. Yet, these are institutions that "carry" contemporary innovations in water policies, whether this concerns the continuation of an ancient decentralization, catchment basin delimitation or regionalization process (*cf.* Ghiotti 2006) ou the implementation of a new mode of operation promoted by current water policies such as Integrated Water Resource Management (IWRM).

Transversal contradictions. The coexistence of different institutions poses also the problem of the definition of their attributions, which may collide in some cases, as is the case in Spain, with the *confederaciones hidrograficas*, and the government of the autonomous provinces, or in Italy between the *consorzii de bonifica* and *AATO*. It is also difficult to distribute roles between the ministries in charge of water management, which at times may have contradictory objectives, as this remains a historical constant element.

CONCLUSION

It is necessary to clarify the modalities followed by all the institutions in the way they work, and have relations of complementarity or competition, cooperation or redundancy of functions, mutual recognition or ignorance of the others. Water governance is a social construct, never completed, always evolving. There are real difficulties of articulation and operation of the institutions, either transversal between organizations with different objectives, or vertical at different scales of action. Major discrepencies exist between the Laws and the practices.

The accumulation of problems is the last observation: environmental degradations, evolution of Mediterranean societies in general (urbanization, poverty, individualization, loss of culture), and or rural societies (losses of social capital, rural exodus, conflict of access to resources). The multiplication of "institutions" - not only the "regulation organisms" but also the "organization rules" as per uniform formats - created within an international political context of fight against these environmental and social problems, does not seem to be able to provide all the answers necessary to mitigate these trends.

GENERAL CONCLUSION OF THE FIRST SECTION

All water management players in the Mediterranean basin face difficulties that stem largely from the lack of shared experiences and from unclear actions on the part of the water management institutions. Table 6 illustrates – at each territorial scale - the main problems faced and the institutional water usage conflict resolution levels. The hydraulic territory approach has led to the definition of different water management areas, and more specifically to the introduction of the concept of deversing basins to be added to that of watersheds. The historical approach demonstrates the cultural, legal, political and symbolic roots of water management in the Mediterranean basin. In history, all the countries have taken part in the hydraulic development and have borrowed from one another elements of water culture and management. Yet the idea is not to reproduce any given technical, agricultural and institutional model. Each region has its own specificities and builds itself using a subtle mix of traditions and designs of networks and modes of access to land and water. Thus, all Mediterranean societies consider water as a form of art that consists in collecting a rare resource or fighting against floods. They also experience water as a form of violence, since its control leads to exclusion and fuels power greed. Every site develops a specific combination of techniques and institutions. Water political organization is different from one region to the next, and sometimes even from one village to another. The ISIIMM teams will learn and enrich themselves from the differences, the understanding of other realities and the formulation of suitable recommendations.

Some countries, such as Morocco and Egypt - have powerful national institutions whose water distribution decisions are enforced at all regonal and local levels. Water distribution arbitration implies that agreements be achieved at the central level between the ministries in charge of water, environment and agriculture. Yet, the administrative and decentralized administrative management of water appears to be a deficit activity on a macro-economic level (?). It also experiences local limitations, especially when users have autonomous means of access to water from public canals (or any other types of community or private works), from drains and underground tables. By reinforcing the local irrigators' organizations, the State intends to create a partnership in order to rationalize water management and reduce the number of interlocutors. In As to the rural local companies, they must achieve some form of autonomy to allocate water as per joint and decentralized rules, outside of the scope of control of the bureaucratic system.

Other countries do not have any central water administration; instead they have regional institutions which experience roughly the same problems at the lower levels, but which are compounded by rivalries between neighbouring regions which fight for the water resource from the same hydrographic basin or resources transferred from one basin to another. Italy and Lebanon are examples of this situation, as in these countries water is a major stake between antagonistic groups. The rivers of Lebabon are at the core of the region torn by geopolitical struggles with the neighbouring countries, yet the water war expression applies just as well to the Italian Piave situation where the hydro-electrical lobby is in direct confrontation with the secular irrigated agriculture. In both cases, the local associations of water users are not playing any role and the confrontation is fueled essentially by the intermediate authorities with ill-defined powers when it comes to allocating water resources to the different eeconomic sectors.

Other countries created local public institutions in the XIXth century – communities of irrigators in Spain and syndicate in France – which enjoy a broad autonomy to issue management rules and undertake actions under State legal supervision. The central political and administrative entities are powerful, but the regionalization of the political power is of course stronger in Spain, since this country federates provinces which strongly wish to preserve their prerogatives on water (hydrographic confederations). In France, the centralized jacobin State intervenes in the name of

a national policy applicable to the Republic as a whole, that controls basin agencies through the Ministry of the Environment, and the syndicate organizations under the authority of the Ministry of Agriculture and the Treasury (Ministry of economy and finance).

Table 6 – The different levels of conflict in water usages and needs in institutional adaptations

Scale	**Problems**	**Confrictual groups**	**Institutional arbitrators**
Catchement basins / deversing basins	Imbrication of catchment basins and regional (sometimes inter-national) diverging views). Discrepancies between the areas that produce water and the areas that distribute water and create new environ-ments. Upstream/downstream dependency; competition with other users.	Regions, or even countries.	Regional authorities and central governments. Ministries in charge of water, the environment, agriculture and Justice. Decentralized administrations at the regional level: Regional governments, specialized regional offices, basin agencies, community movements and NGOs.
Local unit of catchment basins /deversing basins, dependent water collection.	Upstream/downstream dependency; competition with other users, discrepancy of adminsitrative units versus the catchment and deversing basins.	Other irrigation systems; industrial and urban appro-priation	Decentralized state organiz-ations and regional autho-rities, territorial communities, associations. Local, regional and central legal institutions as a last resort.
Canals, networks	Fragility, protection of works, serial crumblings, etc.	Management groups of segments of parralel canals	
Allocations between perimeters	Inequal allocations	Villages / villages	**Intermediate institutions between central and local authorities**
Water distribution between blocks of a perimeter	Inequal allocations	Districts, large family groups	
Water distribution among users of a single block	Inequal allocations, excessive intervals between waterings, water thef, illegal water market	Farming families	Local authorities, constructors of irrigation canals (communities, villages). Modern associations of agricultural water users.
Exceptional water distribution	Inequal allocations	Farming families	

Regardless of the political and institutional configuration, the roles of the central and local authorities clearly need to be clarified, together with that of the intermediate authorities which should facilitate management compromises between the representatives from governmental and provincial pulbic authorities on the one hand, and the representatives of water users, especially the representatives of local irrigation institutions. In Egypt, it is necessary to federate very localized irrigation groups in order to create a co-management body for public canals. In Morocco, this articulation between water user associations and regional offices receives little attention. In Lebanon the local level is too weak. In Italy, the intermediate level of the *consortio de bonification* lacks organization at the local level. In Spain, on the contrary, the intermediate institutions are powerful and rely on very strong local organizations of communities of irrigators, whereas in France, there are intermediate institutions for domestic water (intercommuncal syndicates), but not for agricutural irrigation water.

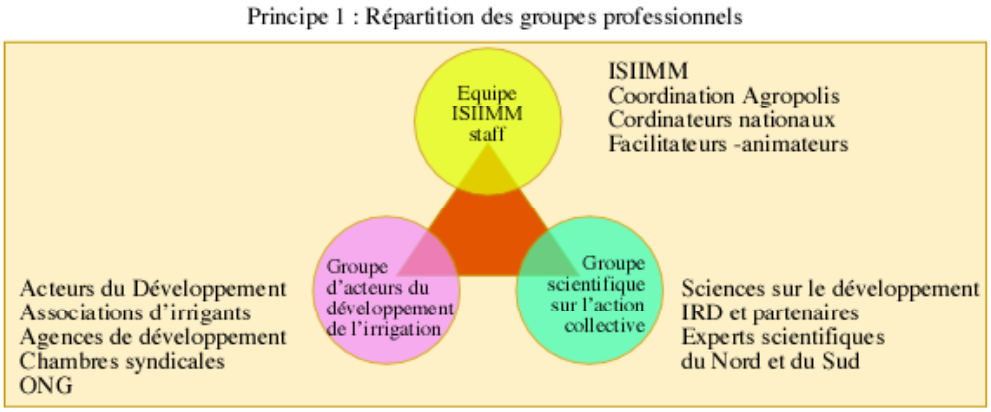
The ambition of the ISIIMM project was to make progress in all these domains of knowledge, starting not from ex-nihilo models of concerted or integrated water management, but by looking into details at the way the players on site work out solutions in different Mediterranean contexts and irrigated systems.

The second large part of the synthesis will demonstrate how the ISIIMM project has both enabled common questions to evolve in all the countries and more specifically in some of the workshop zones, and put the emphasis on the social and institutional innovations envisaged, sketched (?), and experimented during the 4 years of work and exchanges.

PART II - SYNTHETIC REPORT OF THE ACTIONS LAUNCHED BY THE ISIIMM

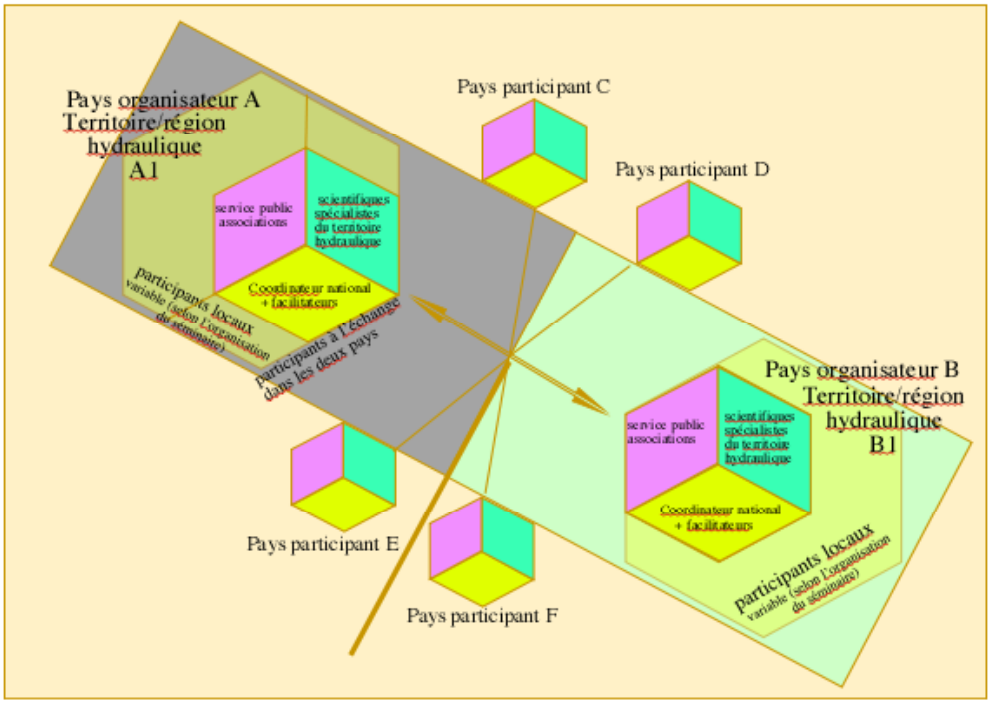
INTRODUCTION

For four years, the ISIIMM National teams have pooled their competences and coordinated joint activities between irrigation development players in their own countries and scientific and academic communities involved in collective action (1st principle of the project).



These ISIIMM teams involved in development and research works, were active at every social and institutional scales of agricultural water management. As a first step, they collected scattered knowkedge on the 20 workshop-sites selected, at the scale of perimeters and irrigation networks, local user and operators-managers associations. They broadened their working framework to regional and national scales, not only to shed a light on the local context, but also to dialog with the other teams of the project during exchange seminars. Thanks to these multi-scale, comparative approaches that fostered the circulation of information on local water management, the ISIIMM teams have contributed to the resolution of local issues of organization of irrigators and network managers. Moreover, they have established bridges between local innovative actions and renewal of regional and national political frameworks. Each country has published a specific report on the four years of activities, with the emphasis put on its own specificities, and by allowing all the players to better understand the complex realities of the complexity of irrigation issues in the Mediterranean basin, both in their own country and in the other countries.

Principe 2 : Oganisations des échanges et de la répartition des participants
selon les pays , les groupes professionnels et le croisement des expériences et regards



During a dozen of on-site seminars, the teams have been able to learn together on the action initiated to support the social and institutional changes in each region and its workshop-sites. The IRD provided the scientific supervision throughout the project, through discussions and proposals of the ISIIMM scientific council, on the basis of the analyses of the coherence committee, and through the additional works of young PhD and Post-Graduate students.

Tens of documents have been produced by ISIIMM in the most dverse forms. They are available on the web site maintained by the IRD in agreement with Agropolis International: site reports, country reports, project-related expert reports, numerous communication texts from exchange seminars, master's theses and PhD theses, cartography at different scales, free software, iconography, photography and videos[6].

The ISIIMM project is open and based on the initiatives of the partners, adpated to the different sites, rural societies and forms of conflicts of usage. In each country the ISIIMM project has produced rich specific effects difficult to share without a coherence framework. The ISIIMM coordination unit in Montpellier relied on the coherence committee and on the scientific council to manage a project that comprised: local development actions, team networking, bilateral meetings between countries (Egypt-France, Lebanon-Italy, Morocco-Spain, Morocco-Egypt, Lebanon-France, France-Spain), theme-based pluri-national meetings (seminar on the European Framework Directive, meetings of irrigator associations, meetings on integrated water management, seminar on irrigation in Mediterranean mountains, workshop on the Egyptian and Moroccan models of irrigation management). As an example, table 7 gives the coherence framework proposed to all before they launch their local actions and exchange programmes.

The bilateral exchange seminars took place in a symmetrical two-step manner (principle 2). An ISIIMM team – reinforced by its R&D partners – hosted on the local workshop sites the counterpart team of the country with which the comparison is desired. A few weeks later, the

[6] *See http://www.isiimm.agropolis.org/*

roles were reversed and the visiting team of the first exchange hosted the partner team. This led to mirror, symmetry and cross-vision effects between the North and the South. Observers from other countries were allowed to attend the meetings. By extension, theme-based seminars also functioned on the bases of balanced teams of participants, with additional contributions.

The second part of this report cannot be exhaustive in view of the numerous events and actions rich in contents and exchanges. Several hundreds of people took part in this movement of ideas and were involved in local development. Within all the items treated, it has been decided to select a series of items considered as the most symbolic, original ones with evolution potentials. The appreciation of these actions for social and institutional change does not rely on quantitative evaluations but rather on signs of shifting of questions, the search for shared solutions, and the implementation of new rules and organizations. In the regional and national spheres, the social and institutional dimensions of water management at different geographic scales have been taken into account.

The summary of the collective actions is structured in several chapters. Chapter 5 is dedicated to the striking facts of innovative actions at the local scale and reports on some remarkable actions. Chapter 6 deals with the actions that influence the regional and national organization of irrigation in each country. Chapter 7 deals with the marking events of exchange seminars. The general conclusion refers to different post-ISIIMM projects and networked collaboration perspectives.

Table 7 – Coherence framework of the ISIIMM works by scale and themes.

SCALE	ECONOMY	HYDROLOGY	LAND USE	HISTORY	SOCIETIES	INSTITUTIONS	INTEGRATION
INTERNATIONAL	➢ The situation of agriculture in the international market (is the agriculture production recognized in the international market, impact of globalization, etc.) ➢ International water treaties in the case of transboundary rivers/aquifers and their impacts on water availability ➢ Impacts of climate change on the availability of water						
NATIONAL	1. Importance of agriculture in the country's economy. 2. Subsidies/ tariffs of water services.	Water resources assessment	National policy for land use, including agriculture, domestic, industrial, etc.	Present versus historical land use, societies, institutions, legislation, etc. on the national level	Existence and situation (political acceptance, power, etc.) of water management societies (agriculture and others)	Types of water management institutions, roles, power, etc. (past and present) Legislative status (past and present).	Integration with clear identification of legislation, status of participation of users on the national level, water allocation, land use, etc on the national level.
REGIONAL/ BASIN	1. Importance of agriculture in the basin economy (if different from national). 2. Subsidies/ tariffs of water services (if different from national).	Water resources assessment	Basin policy for land use, including agriculture, domestic, industrial, etc (if different from national).	Present versus historical land use, societies, institutions, legislation, etc. on the regional/basin level.	Existence and situation (political acceptance, power, etc.) of water management societies (agriculture and others) on the basin level	Types of water management institutions, roles, power, etc. (past and present) Legislative status (past and present).	Integration with clear identification of legislation, status of participation of users on the national level, water allocation, land use, etc on the regional/basin level.
HYDRAULIC UNIT		Water allocation (allocation) to the hydraulic unit.	Land use policy within the hydraulic unit (administrative unit), including agriculture, domestic, industrial, etc.	Present versus historical land use, societies, institutions, legislation, etc. on the level of the hydraulic unit.	Existence and situation (political acceptance, power, etc.) of water management societies (agriculture and others) on the level of the hydraulic unit	Types of water management institutions, roles, power, etc. (past and present) Legislative status (past and present).	Analysis including possible interventions for innovations in water management and actions for cases of crises, conflicts, etc.
LOCAL		Water allocation to the command within the hydraulic unit.	Land use based on allocated water (taking into consideration the case of abundance and case of crises (drought)	Present versus historical land use, societies, institutions, legislation, etc. on the local level.	Existence and situation (political acceptance, power, etc.) of water management societies (agriculture and others) on the local level. Description of their role(s), power, sustainability, etc.	Decentralization of water management, responsibilities and status of water users and their role(s) in water allocation, pollution prevention, enforcement of laws, financing structures, etc.	Analysis including possible interventions for innovations in water management and actions for cases of crises, conflicts, etc.
VERTICAL INTEGRATION	Analysis of the relations between all scales, impact(s) of actions/land use/hydrology, etc. on one another Most important is the cases of crises and conflicts.						
CONCLUSIONS AND PERSPECTIVES	For each scale, the present status and the possibilities of interventions/changes in the future.						

- ***It is important, on the local scale to differentiate between mountain regions and valleys, peri-urban and rural to help comparing the situation in the different countries.***
- ***The land value/price is an important aspect in many countries, especially when urban areas are encroaching the agricultural land and may result in the abundance of agriculture.***
- ***Powers/authorities (government or other) in water allocation are important to mention, especially in regions/locations where old traditions in water allocation are predominant.***
- ***Role of the various entities in conflict resolution (government, basin association, farmers groups, women representatives of residential spot/villages), including source, rate and quality of water, as well as timing.***

5. LOCAL INNOVATIONS THAT REINFORCE THE WATER MUTUALIZATION CAPABILITIES OF RURAL COMMUNITIES

5.1 INTRODUCTION

The rural communities that use irrigation are able to mutualize their water access and management systems, since the usage of water is authorized by the legal and public administrative systems as well as by custom-based modalities. The objective is to combine solidarity, efficiency, and the possibility to achieve fair and decent conditions of life whilst preserving environments that are exceptional and useful for the whole society, and by taking into account other usages, especially domestic needs. The management of agricultural water as a common asset is based on ancient and modern scientific works that cross the domains of human and social sciences, agronomic and environmental sciences (see the indicative bibliography at the end of the report). Although the ISIIMM took its inspiration from water social management schools of thoughts (all the nationl teams maintain a scientific partnership in this domain), the local action project fits within a framework of participative observation and of action specific to each site. By comparing the twenty workshop sites it has been possible to evidence contrasted forms of local water management powers. The South ISIIMM teams have made significant efforts to reinforce the agricultural institutions and to shift from a virtual form of participation to the effective involvement of responsible rural communities in charge of managing a common resource. The North teams helped the associations or communities of irrigators to reorganize their force and legitimacy versus other water management players who tend to underestimate the agricultural issue and the positive role of local organizations.

Five innovative elements representative of the ISIIMM approach in the workshop sites have been selected:

- The definition of water management mutualization territories, taking into account the concept of deversing basin.
- The notion of public purpose and charge distribution syndicate perimeter.
- The elaboration of original internal rules - with rights and duties - in the organizations of irrigators.
- The implementation of local conflict arbitration structures.
- The acceptance of a time period necessary to implement new institutions.

First, each element is defined. Then, the present document gives the on-site team observations, the general innovative lead – as a recommendation to support the institutional reinforcement – and the innovative actions of the ISIIMM projects by means of concrete examples coming from the ISIIMM teams.

5.2. FIRST INNOVATING ELEMENT

Definition of well defined territories of water management mutualization, including the concept of deversing basin.

-> Definition

Several different cases reflect the combination of hydraulic and rural spaces that embody identifiable management entities: blocks of plots managed as per local rules, groups of blocks co-managed within a perimeter, groups of perimeters within a single system or local network, which constitute de facto a specific deversing basin. Each level may include a relay institution that reflects the local interests and practices. The general difficulty that several ISIIMM teams ran into

stems from the fact that in certain parts of the irrigated territory deversing basins are super-imposed, i.e. the presence of several collective or private networks.

-> Observations from the ISIIMM teams

On the workshop-site of the Oudayas in the N'fis of the Marrakech Haouz (Morocco), the territories of the agricultural water user associations have been defined by the administration of the *Office de mise en valeur agricole*. This makes it difficult to identify the coherent territorial unit that grants a real authority to the AUEA (*Association des Usagers de l'Eau Agricole*, new institution in Morocco) since the water pressure network managed by the Office has been added to the ancient canal networks managed by traditional communities, and to the privately owned underground water pumping systems. The discussions between the ISIIMM team and the Office and local players have made it possible to raise the awareness of the problem. One solution would consist in redefining the hydraulic systems by mutualizing the different water inputs from the canals that divert flood water, the stations that supply water from dams, and from the pumps that tap water from the tables.

On the workshop-site of the Ait Bougmez, in the Morocco High Atlas, the configuration of the 4 AUEAs created by the agricultural administration was discussed again throughout the project, in as much as these delimitations met with oppositions upstream and downstream of the valley. The creation of a fifth AUEA was made possible by the "downstream dissidents", whereas on the side of the upstream sources of Ait Ouham, the delimitation of the Ait Hakim AUEA revealed a strong disagreement between the 11 villages as to the allocation rules of scarce resources, compounded by conflicts of access to pastoral and forestry resources. At the end of the project, the organization dynamics were oriented towards the implementation of development associations in each village, as a way to challenge the development associations that covered the whole valley. The difficulty lied in the gaps between hydraulic territories and village territories. The numerous canals take their source in a village, run through another one, and then possibly supply water to several districts in several other villages. The system also includes a series of deversing basins with recovery of the waste water and partial resupply of downstream deversing basins. A similar device can be found in other Mediterranean mountains such as the Pyrénées-Orientales.

In France, on the Vinça workshop-site of the Pyrénées-Orientales, the ISIIMM team found a complex village territorial breakdown in which several associations of irrigators co-manage a gravity network. But in fact the largest part has been converted into pressure irrigation with a new breakdown of the hydraulic districts. In this case, the local society advocates for several organizations specific to each network; village and hydraulic block, yet the association of the main village of Vinça acts as a coordinator and federation of associations for the four other villages. The ISIIMM team supports this plurality of organizations before the administration which would like to pool the small associations within one irrigated territory.

→ general innovative lead: an imbricated and federative territorial organization.

This is the strong point of the organization of the communities of irrigators of the Jucar, south of Valencia in Spain. It has three imbricated territorial levels. At the municipal level, the network and the irrigated lands are managed by a local association which can also ensure the coordination with the neighbouring associations that belong to the same distribution branches (fesas). They are all members of the *Acequia real del Jucar* association which coordinates all the branches on the main canal. This association includes the Union of Jucar Users Syndicates which is involved in

the river management and in the systems of reservoirs, i.e. in the offer and demand, in partnership with the hydrographic confederation and the provincial and governmental structures.

If a local organization is based on small associations, coordination between them must be promoted in order to federate them at the level of the system, albeit not necessarily within a single organization. The presence of several associations on the same network creates a dynamics of power balance and mutual control.

If a local organization is based on a large territory that corresponds to the network or to a large part of the network, it is necessary to promote the recognition of specific sub-assemblies and of socio-hydraulic units likely to enable the optimum daily management operation and to appoint active representatives of the users who otherwise are in too high a number to meet in an assembly.

→ ISIIMM project innovative actions: concrete examples from the ISIIMM teams for the transformation of imbricated and federative territorial organizations or for support issues

In Egypt, in the workshop site of the El Resqa canal in the Damanhour province in the Nile delta, the ISIIMM team has facilitated the implementation of associations of irrigators who share the same pumping station that raises the Nile water which is transferred by the Ministry of Water Resources and Irrigation. ISIIMM has acted as a mediator between groups of fellahs who were reluctent to adopt the network modernization model as defined by the Ministry and the provincial services under its authority. It must be pointed out that the reconfiguration of the water local management system in the Nile delta respects the former hydraulic territories created through the conversion of the flood basins of the perennial irrigation. The modern territory of local water management reproduces the ancient circle of sakkias, i.e. the basic hydraulic system from a few hectares to a few hundreds of hectares in the village areas (zimam of a few hundred hectares). Several dozens of micro-associations of water users have been created. They are responsible for water pumping and sharing management. Moreover, the team has facilitates the local reflection on the coordination required between the the micro-associations. This takes place at two scales. For the village Zimam, nothing is planned at this intermediate scale, whereas the Mayor (Omdah) can interfere (example: 17 of the 52 associations of the canal are under the authority of the village of Gaouad Hosni). At the scale of the territory irrigated by the El Rezqa canal, the implementation of the assembly that administers the El Rezqa canal (Jamaa Idara el Rezqa) is in progress. The principle is to apply the Water Board model proposed by the Ministry in order to have a partner in the global water allocation system. Hence, the direction is that of a two-level territorial organization to treat the deversing basin of the Nile water at El Rezqa. It should be noted that the organization of the drainage water collecting basin seems to be less decentralized.

In Morocco, in the Tamesgleft canal workshop site, on the west bank of the N'fis, west of Marrakech, the ISIIMM team worked with the Haouz Office, the Marrakech association of irrigators and with the custom management structure to untangle a conflict linked to the allocation of the water transported by the different sections of the canal and its branches. The study revealed that several waters ran in the works and led to specific allocations, under the supervision of the Amzal, the custom coordinator. When the canal receives regulated water from the N'fis dam, released by State decision, the management territorial unit is comprised of all the plots of land connected to the Tamesgleft canal, and the allocation takes place from downstream to upstream, as per hours and days defined in the 1930-1940, during a conflict with the administration of the Protectorate. When the water that enters the canal comes from uncontrolled floods, the canal is then managed by three independent management sectors, and

each sector receives water from one of the three flooding rivers, with upstream-downstream internal distribution. The Office has carried out a double modernization plan. On the one hand, the main canal has been concrete-lined over the first two sectors; on the other hand the first sector has been connected to a new pressure network, totally independent from the ancient canal. In that portion, the secondary canals (mesref) previously connected to the ancient canal, have not been reconnected during the concrete-lining work. The water right owners of these mesrefs have « cut » (?) into the concrete canal and restaured their rights of hours of water on releases and exceptional floods (?) (Les détenteurs des droits d'eau sur ces mesrefs ont cisaillé le canal en béton et rétabli la faculté de prendre leurs heures sur les lâchers et sur les crues exceptionnelles). Yet, broadly speaking, these rights are not being used on site and are negociated as part of an internal market between the upstream and downstream sectors, regulated by the amzal. ISIIMM was involved in the resolution of the multiple conflicts induced by the successive developments and by the local reactions, using concertation and recognition of the players involved, in order to work out institutional and technical solutions for the mosaic of territories and for the variable geometry of the management units.

5.3. SECOND INNOVATIVE ELEMENT

Recognition of the notion of public purpose syndical perimeter and of charge sharing

-> Definition

The recognition of water right or usage right is too often associated with the streams, the collection points and sometimes with the routes of canals and pipes. However, an irrigation system also comprises a distribution surface and communities of direct and indirect users or simply residents. There can also be, depending on the case, a drainage and sanitation system, the elements of which are remote from the irrigation system but not independent from it, with a water collection zone, a technical network of gullies and drained water ducts and outlet points. It is very important to link the syndicate or associations of irrigators to a perimeters in which all the decisions of the community apply for the common interest (which is the sum of individual interests) and for the public interest (application of the general interest and of the Law).

-> few observations from the ISIIIMM teams

In France, syndicate associations (*associations syndicales*) are authorized as per the Law of 1865 which grants them a function of public pupose, applicable to a syndical perimeter within which all land owners have to respect the management rules and must regularly provide a financial contribution to the association. The ISIIMM team identified the ancestral character of this statutory obligation. Since the Middle Age, land identified as irrigable and linked to a given canal belong to the "regatiu", an undivided set of small and large plots with a right to collective water, as opposed to the dry land which does not receive water from the canal, except for the downstream plots which can receive the superflous water, the drainage water and the lost water. The ancient acts often stipulate that the water taken to irrigate the land of a village cannot be ceased or sold to other lands. Outside of the defined perimeter, the water must be returned to the river.

The legal force of the syndical perimeter is also observed on the Provence workshop sites – such as in Carpentras or Manosque. The plots located inside the State-approved syndical perimeter must pay their hydraulic fees (the watering roll), regardless of the usage made of the land, including land where urban development takes place. The motorway companies too must pay the watering syndical fees for the agricultural land they acquired to build the motoroways. Owing to this mechanism, the associations of irrigators preserve a minimal economic base to balance their

accounts, whereas the inhabitants, the farmers, gardeners and urban dwellers contribute to the maintenance of the canal and of the green environment around towns and villages. Moreover, the extension of watering systems on dry lands not included in the syndical perimeter proves difficult, since no syndical perimeter is allowed to be modified without a public purpose enquiry and a long and stringent administrative procedure. The Manosque canal is an exception due to its status of syndical association imposed by the State and to the delegated service contract of the Société du Canal de Provence network. This institutional construct leaves a broader margin of maneuver to the water managers, in view of a composite assembly of urban and agricultural users scattered over roughly ten municipalities and divided into antogonistic lobbies.

The perimeter of communities of irrigators also exists in Spain, albeit in a less constraining manner. If a plot of land is turned into a construction area, or if the farmer no longer wishes to irrigate it, he does not have to pay the community fees, he simply opts out. Therefore, the economic resources of the communities of irrigators dwindle as urban growth takes place within the irrigated perimeter. Yet the communities of irrigators have been able to compensate for the losses of irrigated land by means of peripheral extensions for which they pump water from the canals and therefore include dry land in their perimeter (case of the Carcaixent canal, on the right bank of rio Jucar, south of Valencia).

In Lebanon, the canal 900 hydro-agricultural organization is scattered. Water pumped from the Qaroun Lake is distributed by the Litani Office to beneficiaries disseminated in villlages. Without a spatial continuity of the land that can be watered, the organization perimeter of water allocation is not visible. It is in fact a sociological perimeter since the beneficiaries are mainly farmers who own large plots of lands and have enough money to pay for the water services. The Lebanese ISIIMM team has found on the other bank of the Litani an ancient management system for the Khraizat sources that irrigate the Khirbet Kanafar territory, on the basis of a model similar to those observed in the Marrakech Haouz in Morocco. The areas irrigated by ancient canals are continuous and there are strict watering rules between plots within a single perimeter. The geometry of this perimeter may vary as a function of the flow of the water sources and of the irregularities of the supplies. In this case, it can be said that there is a rare water perimeter and an abundant water perimeter that are interdependent.

→ general innovative lead: statutory perimeters that guarantee public purpose.

This is the strong point of the French associations of irrigators and of the Italian Consortii. Once an irrigation system has been defined with its technical network, its area of influence and all its members (all recognized plots), the delimited perimeter is declared of public purpose. Thus, it becomes a zone of solidarity between rich and poor farmers, a zone of integration and a zone where urbanization issues can be solved whilst maintaining the principles of water-related rights and duties. The public purpose perimeter legitimates the organizations of irrigators and enables them to occupy a proper seat in the discussion and coordination groups that deal with the public authorities and other institutions involved in local water management. The point being to identify the public purpose perimeter within a local hydrosystem. Between the ancient sakkia circle of a few hectares transformed into basic hydraulic blocks in the Nile delta, and the *consorzi di bonifica* of the Piave plain which cover tens of thousands of hectares, there are intermediate levels of spatial organization and delimitation of perimeters to be adapted as a function of the sites, of their history and of the current social rivalries.

→ innovative actions of the ISIIMM Project: concrete examples from the ISIIMM teams

Let's return to the case of the forced syndical association of the Manosque Canal (ASFM), which has been functioning in permanent conflict for the last 30 years, and is experiencing the fragmentation of its network and the weakening of its institution. The ASFM is governed by specific rules, the City Mayor being director of the canal in conformity with the regulations. He works with a Bureau, half of the members of which are appointed by the State and the other half are elected by the general assembly of users. The *Société du Canal de Provence*, which manages the perimeter by delegated service contract, wanted to dismantle the ancient canal to overcome the conflicts and to pull out of the peri-urban management of the canal which it considers as too complex. Today, the downstream portion of the canal is supplied by pressure networks connected to another canal. This canal runs into zones equipped with stations that distribute water outside of the initial syndical perimeter. Because of urban growth, plots of land have been removed from the watered lands and users refuse to pay the taxes mandatory within the syndical perimeter. The thousands of peri-urban and urban users do not respect the rules of the irrigation roll and take water from the distribution branches (the *filioles*) and sometimes even from the main canal. The canal almost disappeared but it is finally protected by the environmentalists who have made it an issue of local heritage within the local political debate. The French ISIIMM team has worked within a fairly difficult context. It has been able to restore the confidence of the forced syndical association to re-establish a form of solidarity in the perimeter and to contribute to the training of new trustees which do their best to reappropriate the history of the canal and of the conflicts, to rebuild the territory of action and to renegociate the terms of the delegated service contract with the *Société du Canal de Provence*.

In Morocco, the ISIIMM team looked into the demand from the Haouz Office, in the perimeter of the upstream Tessaout, 80 km east of Marrakech. This perimeter of 55,000 hectares was the first irrigation modernization site of the office in the 1960-1970. The dirigist model comprised the disconnection of all the ancient canals, the construction of a semi-supported concrete network and the redistribution of land as per a rational logic of geometric plots, mandatory crop rotation, and the planning – by the administration – of the watering (so-called "B patterns" perimeter). Yet, this reshuffling of hydraulic and land ownership only concerned 60% of the perimeter, the rest having been left intact following the opposition of the owners or farmers. Therefore, the ISIIMM team studied the pattern of the territory and of the various networks and digged out the specific elements to support specific perimeters within the general perimeter of the Tessaout. The peripheries of the villages used to be irrigated from the summer water levels to preserve an olive tree grove. In fact these zones were called "haouz de douar" (village peripheral assets). Besides, on the upstream part of the perimeter, some villages have preserved their ancient canals and their irrigated territory is composed of different blocks, some being submitted to the programme of the Office, others enjoying customary water rights which are sometimes billed to the Office as a lump sum. There is clearly a need to secure the local practices and to single out the specificities through a better delimitation of the irrigated areas that are susceptible to go into joint management by integrating the modern and traditional networks in legally well-defined perimeters.

5.4 THIRD INNOVATIVE ELEMENT

The elaboration for the organizations of irrigators of original internal by-laws which comprise constitutional rules and operational rules

-> Definition

The hydraulic territory - that is coherent in relation to the networks - and the recognized syndical perimeter both define an exclusive contour and an area of solidarity among the co-users of the water resources within the territory. This holds true as long as there are clearly defined procedures to share the resources, the operating and maintenance costs, the collective investment charges and the defence of common interests. Although there is no norm in this domain, it does not mean that it is a *laissez faire* situation. Public Authorities must ascertain that the local institution in charge of managing the hydraulic territory within the perimeter does so in full respect of the laws and constitutional principles. Yet, the State must not prevent local initiatives nor impose a formal organization model that is allien to the local rural society. Thus, any association established without an assembly and without any procedure for the creation of specific rules is likely to collapse due to the weakness of its organization and its unability to manage a complex system of concrete water distribution. Networks are different and a standard format of internal regulations cannot be imposed from the outside. To this must be added the mistrust of the other territorial authorities close by (other associations of users better structured) and of other local bodies (municipalities, associations that focus on other centers of interests, etc.). Procedures of collective choice must be encouraged, and in case of internal litigations, there must be a mediation so that a management compromise can be achieved with clear indications of the concrete rights of the members of the association, together with the duties in keeping with the rules and the participation procedures.

-> Observations from the ISIIMM teams

In Egypt, the ISIIMM teams managed to ease out the tensions between the co-users of pumping stations who were unable to agree on the pumping schedule. As a mediator, the team proposed to El Rezqa distribution devices based on land ownership blocks (i.e. the hydraulic districts) that are supplied water alternately at night or during the day, on the basis of two hours of use at half the flow rate per feddan (0.42 hectare).

In Morocco, the ISIIMM team had to work out the subtelties of the internal rules for the distribution of scarce water in mountain zones of the Ait Bougmez valley. Some villages and village sub-groups distribute water from upstream to downstream, field by field successively over the whole territory served by the canal – the *assemdi assemdi* system (supply by supply). Other inhabitants have defined hydraulic districts that receive water one precise day of the week – the *Dart* system. Within a single hydraulic territory formed of several interdependent canals, there can be two types of internal regulation systems. The mountain hydraulic system renovation project – financed by the World Bank – faced the opposition of some of the villages which were reluctant to change the distribution modes. The application of the standard internal regulation caused de facto a loss of the rights for the upstream villages of the valley, unable to cultivate their fields in summer, through the excessive prolongation of the watering intervals.

In Italy, the absence of organizations of irrigators at the scale of local village or district implies a pattern of water gravity distribution in which the managing organization – the Consorzio – supplies water to the distribution branches on the basis of a routine model, elaborated decades ago, following the completion of large hydraulic works in the 1930-1940. The conversion into pressure networks of certain irrigated zones takes place at a slow pace, in financing steps, with

total abandonment of the gravity system. The notion of regulation takes its full meaning for the payment of pressure water in line with the billing of the service proposed.

In France, in the Pyrénées-Orientales, the conversion of the gravity networks into pressure networks is by no means obvious. The two types of networks will co-exists with specific internal regulations. The beneficiaries of the pressure networks become members only if they wish, yet they still participate in the mutual management of the gravity network. In a certain manner, they operate with two internal regulations and they contribute to the preservation of the two complementary networks.

→ general innovative lead: recognition of the plurality of rights, customs and modern law, to ensure a new social contract to govern the water allocated to the territory, system and members of associations, taking into account the other needs of society.

This is the strong point of the French Authorized Associations of Syndicates (ASA). Their ancient rights date back to the Middle Age. These rights were transformed into title rights by the Civil Code after the French Revolution, and confirmed by the Law of 1865 that sets the syndicate associations, and finally by the recent law of modernization of the the ASAs. The authorized associations of irrigators are public institutions that group the land owners involved in the joint management of canals, in charge of preserving the works and organizing the usages, as per modalities specific to their history. They regularly adapt their by-laws, especially to update the stake-holder matrix and their obligation, and they propose to adjust the ancient rights to the new technologies albeit without imposing modernization. Their limits are set by the restriction of land owners (?) (Leurs limites résident dans la restriction aux propriétaires fonciers) (prior to 1865 the bona fide local associations included the canal tenants, i.e. the water users), and by the principle of voice weighting as a function of surface areas and water rights, which can be in opposition with the democratic and mutualistic principles (one man, one voice). The Prefecture validates all statutory and regulatory water provisions. The Public Treasury (or tax administration) manages the accounts of the association. The Pay Master only applies the rules, ensures the collection of the syndical fees of the ASA and pays the charnes and costs in keeping with the mission of the ASA.

→ innovative actions of the ISIIMM project: concrete examples from ISIIMM teams

In order to be innovative in the domain of by-laws capacity building of the associations of irrigators, each ISIIMM team had to ascertain the coherence between the hydraulic territories and the action perimeters of the associations of irrigators, which generally was not the case, both in the South and in the North. It was also important to be supported by the public organizations in charge of irrigation and water management. This was not always easy especially when the organization pattern of the players at the regional and national levels is either blurry or contradictory.

In France, the updating of the ASA status takes place within a mandatory context which favors the reviewing of internal regulations in terms of structures. Two main questions are still pending. The first one concerns the renovation of water regulations which are often too old, not respected and disturbed by land ownership issues (parcellation of land, wildland process, peri-urban speculation), or by the tenant farming process (the farmers ate not members of the ASA, and if the owners allow it, they may attend the general assemblies but without voting rights).

To propose an innovative by-law would require time for concertation, studies, elaboration, modification and approval by general assemblies and by the public authorities. This could mean

several years if not decades. The ISIIMM teams have enabled a reflexion process within the local associations without having the possibility to carry through operations that long, except in Egypt where the mediation of very localized conflicts was acheived in the delta and Fayoum workshop sites, but proved harder than foreseen at Minya in the Nile valley.

5.5 FOURTH INNOVATIVE ELEMENT

The installation of local conflict arbitration structures.

-> Definition

The common management of spatio-temporally scarce water resources compounded by climatic uncertainty and social tensions implies several elements: construction of technical devices to distribute water; elaboration of common constitutional and operational rules; handling multiple operational conflicts ranging from neighbourhing issues to oppositions between diverging interests among village groups.

-> Observations from the ISIIMM teams

In the Ait Bougmez in Morocco, several conflicts oppose villages in the higher Ait Hakim valley. These conflicts arise in summer when water is scarce and the technical devices do no longer make it possible to transport water to all the territories which are irrigated during spring whan the springs are fed by the melting snow. There is a restriction regime which favors the upstream villages which are the only ones that can use water for summer farming. The organization of the association of irrigators driven by the downstream villages has been perceived as a dishonnest maneuver by the upstream villages which have decided to pull out of the institutional rule imposed by the agricultural administration and the ministry of the interior. In the middle of the valley, two small villages share the same water from local springs and from the oued, precisely where water stops running from the upstream at the beginning of summer. For more than ten years, these two small villages have been going to court to solve the issue of water sharing, and from appeal to appeal, the arbitration has gone up to the Supreme Court in Rabat, the capital of Morocco. It is most likely that the judges will face great difficulties to arbitrate this conflict. Indeed, on the one hand it appears as a very localized dispute with poor technical and legal data on ancient rights, and on the other hand because this conflict can only be understood by taking into account the positions of all the players in the Ait Hakim valley. This situation also reveals the failure of the traditional system of arbitration, of the assemblies of decision-makers in the valley who could not find any solution to the problems. The ISIIMM team has revealed that the agreements and disagreements on water distribution between villages or groups of villages were probably linked to the agreements and disagreement on access to the altitude pastoral resources.

In France, in the Pyrénées-Orientales, the irrigated system of the city of Prades is divided into two syndical associations. One for the ancient branch that owns a water right since 1305, and one for the new branch whose water supply was secured in 1840, following the reinforcement of the ancient canal. The latter branch used to receive the superfluous water from the ancient canal, that is to say the excess of water from upstream. For the last 150 years, the two associations have been battling before the hydraulic and agricultural administration and, once in a whyle, before the court, with appeals to the higher levels of the judiciary system. Professional courts do not exist in the domain of agricultural water to handle diligently the most frequent litigations on the local sharing of water resources. Moreover, ASAs are blamed by municipalities or inter-communal drinking water syndicates in order to obtain the water rights for urban and touristic development. Other ASAs are under the scrutiny of the water Police to limit or prevent water pumping from rivers in order to respect the law on water and maintain an ecological flow rate.

→ General innovative lead: an arbitration authority for local conflicts.

This is the strong point of the Spanish associations. In addition to the executive authorities, they have created an irrigation jury composed of water users elected by the assembly of users as per a modality different from that of the management bureau. This jury settles the issues of the multiple infringements to the common rules. Therefore, it prevents the parties from launching into heavy, costly judiciary procedures that often yield inappropriate practical results. The most symbolic irrigation institution of the Mediterranean Basin is the Valencia Water Court, which for a thousand years has been settling litigations within the irrigated perimeter of Valencia. This system was initiated within the arabo-andalusian political framework and has been preserved ever since, acting as a source of inspiration for all the local communities.

→ Innovative actions of the ISIIMM project:

None of the ISIIMM team was in a position to experiment a formal arbitration device within the associations of irrigators established in accordance with the domestic laws of each country. However, all the teams have proposed elements of knowledge that can be used by the managers of the associations to understand the grounds of the conflicts in progress. The maps, explanatory diagrammes, historical documents can be used by the stake holders to understand the issues in long lasting conflicts. Clearly, such documents can by no means be used as evidence or for partial purposes, to oppose another party in a frontal conflict. This material is intended to broaden the scope of the conflict, to help understand the reasonings of the various stakeholders, and to facilitate the search for a lasting solution.

In Morocco, this approach based on listening to the players in opposition has been implemented to study the conflict of the seguia Tamesgleft. It has been used by a group composed of members of the Haouz Office – an association of users – academics, researchers and students. It has proved to be an innovative approach to solve conflicts of usage.

In France, the ISIIMM team worked with the Chambers of Agriculture and the ASA departemental associations to help the ASA presidents in solving the issues they face for which they do not have all the information and means to defend themselves and propose alternatives.

5.6 FIFTH INNOVATIVE ELEMENT

Acceptance of the time required to establish local agreements in order to elaborate the constitutional and operational rules and the conflict arbitration authorities.

-> Definition

Shaping institutions takes time (Ostrom, 1992). Irrigation is a practice that can hardly be described and modelized using simple equations. A spatial vision is required. It is also necessary to understand the hydraulic networks and systems in terms of irrigation and drainage. Water supply is not an end in itself as is the case with the urbain supply of drinking water. The management of agricultural water depends on the management of agriculture and vice versa. This may seem trivial but in fact there is an immense scope of adequacies of public policies on site and of conflicts of interests of the players on site in view of the resources and of the economic and organizational opportunities. Many contradictions pile up and must be taken into account. There is no ready-made recipe to overcome the contradictions. In order to achieve a compromise for local water management, some resourcefulness is called for, whilst setting rule consolidation steps throughout the process.

On the intervention sites, a distinction was noticed between the local systems that already exist and the local systems being constructed. In the latter case, the rural usages must be integrated right from the start to configure the project, the network technical design and the organization pattern. If the technical network is too rigid and ill suited to the social and agronomic needs, it would be usueless to find common rules intended to compensate for the technical deficiencies. If the local system is ancient, its development steps must be reconstructed, the past crises and their solutions identified, and the discussions to reform the system must be started ensuring that all the stakeholders share the reconstituted trajectories of the system, with its elements verified and unverified (there is never enough information), with its interpretations and limits.

The mediation to reinforce the local capabilities implies the support of the public policies. The very evolution of these policies takes a long time for the elaboration of the laws and application decrees, and in their local implementation.

-> Observations made by the ISIIMM teams

In Lebanon, the ISIIMM team tried for a long time to establish solidarity links among the farmers – usually individualistic and suspicious towards a collective approach - who receive water thanks to the modern network of canal 900. The country's legal framework and the organizational reforms of the water sector put the players in a waiting situation.

In Spain, the modernization plan of the Jucar irrigation systems leads to institutional reconfiguration with a higher weight given to the federation of the irrigators of the Jucar than to the communities themselves. The organization of the gravity networks is being modified by the technological implementation of pressure water supply controlled by a central computer for all the operators. This redistribution of powers takes place over ten years or longer.

In France, the status of the authorized syndical associations was not adopted overnight. It took a century as of 1865 for most of the canals to be managed in that form. One of the determining factors for the adoption of the new institutional framework was the conditioned public aid subsidization from which took place mainly during the second part of the XXth century. The associations that have a long history of collective water management went through a four-step institutional cycle. The crisis phase – which may last several years - occurs when the previous agreements no longer function. It leads to the second phase, during which through internal initiative or external mediation the rights, regulations and duties of the members of the association are being reorganized. The third phase is the period during which this regulatory framework is being used. Yet, after a while, the fourth phase crops up with a discrepancy between the practices of the water users and the ancient rights, thus triggering a new collective crisis. In the past, these cycles could last a century, with a critical period of crises and reforms lasting thirty to forty years. Today, the cycle is shorter thanks to technological changes and economic incentives. However, about ten years of efforts would still be necessary today to achieve a local institutional adaptation plan elaborated from a stringent analysis of the crisis in progress, from the quest for various alternative solutions leading to a reasoned choice of organization, and then a clear implementation of the collective decisions.

→ the general innovative lead: protection of the associations in the North, construction of the associations in the South.

Unless they receive direct subsidies and a clear support from the local administrative and political authorities that relay the regional and national policies, the institutions of irrigators of the northen Mediterranean basin will face serious difficulties to be recognized as valid authorities by the local populations and even by the administrative staff of the deconcentrated services of the State and of the Regions. Today, these intermediate, community institutions that group private interests for a public purpose, are being bounced about by public reforms on water governance and the liberal economic trend that favors an increased role of the private water utilities. The major institutional innovation will consists in a long term integration within their local mission of not only the social and economic aspect of water distribution in the agriculture – which is an essential element to preserve a dense fabric of producers in the Mediterranean regions – but also the environmental aspect through the integration within the system of laws, rights and duties for the preservation of the ecosystems, considering the deversing basin of an irrigated network as a natural "man-made" environment, anthropized and co-managed by users who must follow new specifications.

The creation of associations of users of agricultural water in the South is a gigantic challenge. It will be necessary first to overcome tens of years of frozen community organizations and of excessively planned resource management, and second to retrieve cultural elements and find adaptations to the diversity of the local management systems of natural resources, without returning to the ancient social orders. Besides, the associations are being asked to integrate the environmental dimension over a short period of time and – in most cases – without real financial support from the public authorities.

CONCLUSION

The works carried out within the ISIIMM project and intended to provide support to local organizations of irrigators have shown how each local society establishes its institutions within a specific territory and a specific history, distributing the land and natural resources as per very diverse principles, but where agricultural societies are perpetuated and represent the Mediterranean cultures of irrigation in the mountains, in the alluvial plains and in the deltas of rivers. Rural societies have evolved owing to the dynamics of open economy and exchanges. Some of these societies were able to consolidate collective approaches rooted in an ancient past and to preserve the mutualized management of agricultural water. Other societies became fragile to the extent that they lost their institutions and were imposed external models associated with logics that were alien to them.

ISIIMM has attempted to gather the main principles of action: a deversing basin delimited by a public purpose perimeter, supporting an organization that could define recognized internal rules that are in conformity with the political principles of the country. The need for a local arbitration institution intended to solve most of the litigations has been added to this institutional framework. A project of local institution with broader objectives has been added to this assembly, together with the preservation of the agricultural ecosystems and of the environments transformed by centuries of use of water systems in interdependent landscapes, which here and there constitute elements of the World heritage.

Without ever thinking about a "fit all" model, the ISIIMM teams have converged towards such ideas as **Public purpose associations for the management of irrigation water and the preservation of cultivated ecosystems and of their environment.** This implies that the institutions will have to evolve and that the perceptions will need to take place at the scale of the regions, catchment basins, deversing basins as discussed in the next chapter.

6. THE REGIONAL AND NATIONAL EVOLUTIONS

6.1 INTRODUCTION

Each country of the Mediterranean basin is a mosaic of specific regions shaped by nature, the environment, the population, history, geopolitics and the economy. All the regions include numerous irrigated local systems, numerous household networks and a broad variety of industrial facilities. They organize the governance of the resources using the nationl political and legal frameworks as well as the social, cultural, technical and political features of the local communities within the regional territory. The regional institutions are entrusted with new missions through the decentralization policies. Yet, the regional delimitations and competences are usually difficult to grasp, especially as the State retains prerogatives as well. Leaving aside the Egyptian case in which the regional components overlap broadly on the hydraulic components (the Nile valley and delta can be described as a succession of deversing basins), the other countries comprise between tens and several hundreds of catchment basins of different sizes and in a much larger number than the deversing basins. Everywhere, the political regional structure is very different from the dual hydraulic structure of the catchment and deversing basins.

Because of the lack of clear representations of the regional, administrative, political, hydraulic and cultural systems, it is impossible to understand the functioning of the institutions that act within perimeters that are different yet partly interdependent. The general trend of the water sectoral policies it to add new territorial and institutional components. How can cooperation take place in a world of superimposition, juxtaposition, shift and competition? As in the previous chapters, the proposals are synthetized on the basis of the observations made by the ISIIMM teams, of innovative leads, of recommendations to accompany the institutional reinforcement, and of examples of works in those orientations proposed to the different countries.

Two significant innovative elements of the ISIIMM approach have been selected in the 11 partipating regions:

- Representation of the deversing basins on the different organizations of water management regulation.
- Facilitation in the region of inter-institutional meetings on irrigation management in order to regulate the normal situations and prevent aggravating the crises.

6.1 FIRST INNOVATIVE ELEMENT

Representation of the deversing basins in the different organizations of water management regulation

-> Definition

As a general rule, each region has decentralized ministerial administrative structures. They act as State-run entities within an action framework set by the Government. Water is the object of different sectoral policies, especially where policies of offer and environment policies are concerned, in relation with the aquatic and wetland environments. The Ministry of Agriculture proposes a policy of irrigated lands that relay incentives and subsidies.

Moreover, the region has councils of elected representatives who represent the local interests and those who carry projects designed as population-friendly development or environment projects. This includes water usage projects as per specific political orientations, sometimes oriented

towards irrigated agriculture, sometimes favoring other economic sectors such as tourism or hydro-electricity.

The basin agencies - last major institutional players created – have been designed on the basis of very variable hydrographic delimitations that group elements of political regions in most cases.

In order to interact with the national and regional political authorities and the technical agencies, the rural communities that live off irrigation could group their local associations into federations of deversing basins. This is the mode of organization of the Jucar in Spain. The union of syndicates of users is an institutional player, absent in the other regions covered by the ISIIMM project.

-> Observations from the ISIIMM teams

The Egyptian example of modernization of the irrigation of ancient land is based on the respect of the hydraulic systems elaborated 200 years ago, during the conversion of the subsidence basins into perennial irrigation. Water regional governance consists in ensuring the fairest distribution of the resources allocated by the State to the Governorate (province) to all the local socio-hydraulic systems. The pattern of institutional evolution provides for the elaboration of an interface between the provincial hydraulic services and the irrigation districts created around important canals (secondary-tertiary). The future creation of the Water Boards corresponds precisely to a deversing basin agency. In each province, several water management assemblies will co-manage the system and argue for their allocation before the provincial and national authorities.

In France, the Rhône-Méditerranée-Corse basin agency is active on numerous basins independent from the Rhône. The organization of the intermediate concertation structures in each independent basin exists with the regulatory tools of the "Water Management and Development Schemes" or "River contracts". However, it is always the angle of vision of the basin and of the river which predominates, with a vision of individual or collective users or polluters juxtaposed within the space of the catchment basin considered. The irrigated zones fed by several basins and the zones that use underground water tables fit poorly in the geographical and institutional breakdown.

→ General innovative lead: the deversing basin agency that federates the users

The definition applies to the perimeters of the deversing basins that federate the local institutions that manage canals or pumping works within a union of users within a water demand space. The process concerns the inclusion of these new institutions into regional devices of regulation and organization of water, agriculture and environment public policies.

→ Innovative actions of the ISIIMM project:

In Morocco, the ISIIMM teams has identified different management areas within the Haouz using the integration of mountain basins with or without dams and underlying the superimposition of the deversing basins (according to the origins of the surface water) and of the underground water tables. These approaches can be enriched and are likely to improve the dialogues between the institutions that manage water offer, that ensure the distribution, and those which design water demands.

6.3. SECOND INNOVATIVE ELEMENT

Promoting the inter-institutional meetings on irrigation management, to regulate the normal situations and prevent aggravating crises

-> Definition

Regional political powers, decentralized State administrations, federations of water users, and other social and environmental movements, businesses involved at the regional level should all be able to establish bridges to regulate all the questions related to the waters that circulate in the catchment basins and in the deversing basins. Although different models of water agencies and assemblies have been established in the six countries, the representation and the functions of the players are also notably different. Certain agencies give more importance to the services of the State, whereas others give more importance to the regional collectivities, and others to organizations of users. Some agencies hold broader powers – executive, regulatory and sanction – and other play a more educational and organizational roles for subsidies to local investments. Some agencies hold a large power as they can summon other partners, whereas other agencies have a more independent mode of operation. They are all based on a globalization notion of "integrated water resource management" as per a conceptual model initiated during the Dublin Conference of 1992, disseminated by various international authorities, and used also by the donors.

However, when water access and distribution crises occur, institutional responses consist in taking conjunctural administrative measures of water usage restrictions. Sometimes, the State imposes centrally water allocation as a structural measure as per criteria decided outside of the regional context. This approach is based on technological measures (ex.: pressure water for drip irrigation), in order to lower individual consumptions (however with often uncertain results). To these measures must be added those which consists in increasing the cost of access to water via different devices (taxes, prices, removal of subsidies). In other cases, they are social measures which orientate temporarily or durably the choices of allocation. The negociation of rules suited to the local and regional context is less frequent. The principle is indeed to construct some kind of common inter-institutional agreement to organize the routines and deal with the risks of excessive shortages or extreme abundance.

→ The innovative general lead: elaboration of an inter-institutional discussion forum with the support of all the stakeholders, especially for the management and anticipation of crises.

This is the strong point of water management in the Têt valley in the Pyrénées-Orientales, in France. There, whenever there is a drought, all the stake holders organize a weekly round table in order to regulate progressively the whole catchment basin, and the different catchment sub-basins. These round tables are attended by the authorized syndical associations, their departemental federation, the Chamber of Agriculture, the departemental direction of Agriculture, the Bas-Rhône Languedoc company (in charge of implementing the decision on the main Vinça dam), representatives from fishermen, and possibly other players. First the syndical association describes the respective situations of the canals and the agricultural needs, then the discussion shifts to the condition of the hydric resources and the way to limit the usages in a progressive and fair manner. The solutions concern the filling and drainage of the storage reservoirs, the flow rate tapped from the river, the restitutions to be organized, the day operation and the night adaptations, and finally the water rolls between canals and between users of a single canal when the shortage is at its peak.

→ **Innovative actions of the ISIIMM project:**

In Valencia (Spain), the co-management of the resources among the different regional organizations has been institutionalized. It establishes a difference between the routine operation and the periods of crisis which are analyzed in order to make progressive decisions. The analysis of the environmental and economic risk guides the global regional action and leads to local adaptations.

CONCLUSIONS

In the six countries of the project water is considered as a public and national common good. There are nevertheless significant differences in the recognition of usage rights. In some of the countries, such rights are integrated into the global regulation that governs water user sectors, whereas in other countries they are ignored even if on site the ancient principles of agricultural allocation and distribution are based on de facto situations, seniority and strength of usages.

The State has to arbitrate between regions, not only for the physical distribution of the resources as this is done in Egypt between all the provinces of the country, but also in terms of public funding for the investment, operation and maintenance of large hydraulic works. Hence the State must balance its political choices between the conservation of the resources and the quest for positive economic effects. This debate generally takes place within semi-professional structures such as the National Water Council, the composition and influence of which vary from one country to another.

The works of the ISIIMM teams have made it possible to understand the diversity of the local dispositions in relation to the regional institutions. Moreover, the teams which worked on two or three regions in their country have been able to identify the variety of regional dispositions in relation to the national political and legal frameworks. Water governance seems to be the result of two ascending and descending movements. The management rules do not come from the top only. They also start at the base, in the confrontation of the local interests and in the adaptation of the techniques and water sharing norms within local communities of irrigators. As expected at the beginning of the ISIIMM works, the regional intermediate scale is more complex. The regional institutions act at two levels. On the one hand, they interact with the State by claiming a certain level of autonomy in line with their history and culture. From the base, they readapt the national political and legal framework to their context, by promoting different water management modes: public, private, communautary. On the other hand, they intervene at the level of the local institutions as an authority that tries to impose its vision from the top. If all these positions can be balanced and that the different measures of regional water policy apply to the maintenance of hydraulic works, water allocation, conflict arbitration, pollution control, then it can be said that the social and institutional trade-off works. However, the evolution of water technologies (industrialization, automation, computerization), leads the regional organizations to refocus their decision processes and to impose a top-down control over access to the resources, especially stored water. This is the reason why the regional representation of the water users must be reinforced and, in order to be credible and understood, must be based on the usage territory - the deversing basin - in order to balance the regional representation of the water stock producers who think in terms of catchment basins.

The work initiated by the ISIIMM teams continues in various forms, in each country as a professional network. In order for the innovative proposals to be concretized and refined, there must be a participation to the national debates on public water, agricultural and environmental policies on the one hand, and the training of staff and political decision makers must include the socio-institutional dimensions of agricultural water management.

7. INTERNATIONAL EXCHANGES OF LOCAL AND REGIONAL EXPERIENCES

7.1 INTRODUCTION

The set of results from the ISIIMM project presented earlier as a synthesis of knowledge and actions forms a rich and evolutive human capital accessible as national and synthesis reports, but also as intermediary documentation, data, maps, expert works or PhD student reports, available on a web site. The idea is not only to superimpose and organize information in an encyclopedic way. Throughout the project, experiences have been shared through meetings between teams to achive mutual understanding on the situation of the workshop sites and partner regions.

The present chapter is a report of the strong points of these thematic exchanges, as notes and points of focus. It leads to the innovations to be implemented in professional networks of the Mediterranean basin.

7.2 OCTOBER 2003 – MARRAKECH (MOROCCO) – INITIAL WORKSHOP FOR ALL THE TEAMS

ISIIMM started with a high ambition, i.e. to pool original local-scale water management experiences and to find innovative institutional and social elements within a domain dominated by physical sciences, technologies and turn-key management models. In other words, it was State-run hydraulic model versus water market liberalism, or even communitarian organization of irrigators. Each team had to find a way to work for a common base. The approaches concern different levels: from public water policies to local farmer practices, in the mountain zones and in the river deltas, with different viewpoints on complex realities. It was essential to avoid the idea of a single model for optimized water management and to find in the diversity of the local sites all possible ways to organize irrigation. There was no ready-made recipe ! Marrakech is a good illustration of the scope of issues to be managed: an old hydraulic system with several generations of technical devices ; the severe impact of water scarcity on rural society and on the Haouz Office in charge of modern equipment. Unfortunately, the Albadan valley (Palestine) was not able to join this group.

7.3 MARCH 2004 – DAMANHOUR – EL RESQA (EGYPT) – EGYPT, MOROCCO, FRANCE TRAINING WORKSHOP

For two weeks, a team of trainers, researchers and students from the North and the South worked on the ISIIMM workshop site of the Nile Delta. They discovered the most intensive and productive irrigation system of the Mediterranean world, and a mode of centralized irrigation management implemented in the 19th century, reinforced in the 20th century by Nasser, and reorganized today on the principle of decentralization and participative irrigation management. The site of the El Resqa canal was studied precisely in several upstream and downstream villages. The installation of several small pumping stations takes into account the hydraulic meshing, but this is a slow process. Here and there, inhabitants in villages question the modernization imposed by the Ministry of Irrigation. The public feedback done in Arabic was the strong point of the exchange between development partners, agricultural leaders of local associations of water users, and the trainers-researchers.

7.4 OCTOBER 2004 – TREVISO (ITALY) – EXCEPTIONAL SCIENTIFIC COMMITTEE

After a year, teams had been moving at their own pace ; some had been able to take stock of the situation, others were engaged into more concrete actions towards the associations of irrigators or their training. The scale of the regional catchment basin is a problem in all the countries. A coherence committe prepared an exceptional scientific council. Each team received a detailed note on the progress with a 4-level, 6-theme coherence matrix. Between the national and local levels there is the regional level which corresponds to the political organization and the hydrographic basin level which is often interregional. The themes remained original and interlinked: hydraulic territorial organization, history of irrigated systems, diversity of rural societies and of the institutions in charge of water management, dynamics of production systems and identification of contradictions. The bilateral exchange seminars between two ISIIMM teams that did alternating visits to the site were delayed but kept as an essential basis for the project. New thematic seminars, in which several ISIIMM teams were involved, were proposed to enhance the impact of exchanges between people who face similar situations but had never been able to compare their views: the water legal and political framework, the crossroad of irrigator associations, integrated water resource management, meeting with poplations from the Mediterranean mountains, South-South meetings.

7.5 NOVEMBER 2004 – VALENCIA, SUECA (SPAIN) – WORKSHOP OF EXCHANGES ON THE EUROPEAN WATER FRAMEWORK DIRECTIVE AND ON WET ZONE MANAGEMENT.

The Valencia workshop – the first thematic one – was attended mainly by participants from the North, which enabled teams from Italy, France and Spain to establish closer relationships. The EWFD introduces the notion of good condition of water bodies, the preservation of wet zones, and consultation with the population. During the workshop, it was noted that the implementation is difficult since the new standards are not de facto enforceable. Thus, Spain has not yet defined the hydrographic basin districts. It is experimenting the Directive in the Jucar basin, as a model that would be used for the other basins. The population participation process is just starting with the dissemination of information within the basin. Globally, in Spain the controversies concern the National Hydrological Plan and the inter-basin transfers, and not the EWFD as such. In Italy, the legal and organizational complexity is a challenge to the integration of the EWFD. In France, the delimitation of districts is that of basin agencies, yet several points raise issues of methodology such as the definition of measurement programmes or public consultation. At a more fundamental level, several deep issues are still unsolved. How could specific references be defined for the Mediterranean rivers? How could irrigation canals be taken into consideration? How could compatible objectives be combined between the various categories of water bodies? How is it possible to combine socio-economic development with environmental concerns? It was therefore suggested that Mediterranean climatic and historical characteristics should be acknowledged, together with the multiple roles of gravity irrigated systems managed by communities of irrigators, and namely their "artificial water body" feature which also provides a positive contribution to the other water bodies.

7.6 MARCH 2005 IN ARLES (FRANCE) AND ALEXANDRIA (EGYPT) – SEMINAR ON BILATERAL EXPERIENCE SHARING FRANCE - EGYPT: COMPARATIVE MANAGEMENT IN PLAINS AND DELTAS

This experimental seminar – the first full exchange between two ISIIMM teams – took place in Provence and in the north-west part of the Nile delta, within a week. The time scale was too short to truly share a diagnostic on a local situation. Therefore the scientific group of the ISIIMM did not directly take part in this exchange. The Egyptian team came with administrative staff from the Beheira province and with farmers who are presidents of local groups of irrigators. They took advantage of a two-day trip to visit three different organizations: the Crau plain and the Craponne canal built in the XVIth century and managed today by different syndicate groupes (associations syndicales autorisées - ASA) ; the Lower Durance and the Saint-Julien canal built in the XIIth century, also managed by a syndicate yet with a specific status imposed by the State in 1818 ; the Société du Canal de Provence, created at the end of the 50es, to develop and modernize irrigation in the whole region and which today operates as a service provider and water utility. Conversely, the French ISIIMM team, together with the presidents of the Provence ASA went to the Beheira province for 3 days to look at the hydro-agricultural organization of the former lands of the delta in El Resqa and at the land development system of the desertic area of Regwa. This meeting was very positive despite the density of the presentations and the short duration of the visits on site. The teams were able to understand the fact that they face similar organization problems in the Mediterranean irrigated plains. Differences remain, namely in the sizes of the irrigator syndicates. In France, large associations have been managing different independent networks for centuries. In Egypt, the State manages a unique system shaped in the 19th century into its current configuration, and the associations of irrigators are recent creations of very small hydraulic systems.

7.7 JUNE 2005 IN MARRAKECH (MOROCCO) – METHODOLOGICAL WORKSHOP AND COMPARISON OF WORKS BETWEEN THE SIX COUNTRIES

Having taken into account the detailed remarks of the coherence framework for each situation, all the teams met in Marrakech to describe their countries, regions, basins and local case studies. The comparison exercise was beginning to bear fruits. The sites were becoming more familiar, and the issues echoed from one country to another, from one shore to the other. The historical and territorial dimensions were well documented; on the contrary, the social dimensions of irrigation remained in the background. However, an irrigation network is an area of life which comprises different social categories – often competing for the same resources and involved in a power-based relationship. These situations are perceived in different ways in the different cases. The farthest the network is located from the power center – with a relative autonomy of acess to water – the more anthropological is the vision on water management. When the network is at the center, impacted by population policies, land control, and external technical choices, then more priority is given to the global technical and administrative aspect whilst local social issues are underestimated. Yet, a large perimeter is nothing more than a juxtaposition of small rural (and sometimes peri-urban) societies with local players, specific modes of organization within a context defined by top-down decision making processes. Analogies have been identified between socio-hydraulic units, water rights, establishment and modification of water rights. In France, the basic hydraulic system is the *regadoure* in the Pyrénées, and the *filiole* in Provence; in Spain the *Fesa* on the Jucar canal; in Morocco the *mesref*; in Egypt the *Mesqa*. What is the most suitable level for a local association of irrigators? It is not an issue of scale but rather of definition. It must correspond to a canal, a territory, a collective right to administer and distribute effectively water and common charges.

7.8 NOVEMBER 2005 VALENCIA (SPAIN) AND JANUARY 2006 IN MARRAKECH (MOROCCO) – SEMINARS ON BILATERAL SHARING OF EXPERIENCES BETWEEN SPAIN AND MOROCCO: COMPARED MANAGEMENT IN PLAINS AND DELTAS

The system evolved on the basis of the first experience of cross-comparisons between ISIIMM teams and partners from two countries (March 2005, France-Egypt). Spain hosted Morocco for one week in Valencia, then after a few weeks of reflexion, Morocco hosted Spain for one week in Marrakech. Discussions were rich and intense. In Valencia, the Spanish ISIMM team discussed all the themes and scales of water management; speakers were academics, representatives from irrigators and staff from Provincial and State admistrations. The Moroccan ISIIMM team came with staff from the Haouz Office and farmers, presidents of associations. They were able to identify the common arabo-andalousian cultural heritage and the historical and institutional values that have lasted through centuries, such as the very symbolic Water Court. They understood the power of the communities of irrigators on the Jucar canal, structured into the villages, organized into syndicates. They were surprised by the modernization and automation project for the watering systems that is heavily subsidized by the European Union, which is counterbalanced by the Alarcon dam being given to the State. The fact that a central computer will be controlling several tens of thousands of microplots will weaken the local organization. The Spanish ISIIMM team advocated the ISIIMM idea of innovative water management. It challenges the old model of water right attributions which were excessively favorable to some communities of irrigators, as well as the model that makes water an economic commodity which can be given a commercial value. This team proposes a more political pathway, the result of a compromise between environment and development. During the dialogue in Marrakech, the Moroccan ISIIMM team also gathered academics, development and environment staff and irrigator representatives who delivered precise presentations of the principles and difficulties of action or reaction in the case of water crises. This team organized several site visits during which the superimposition of public, community and private networks within a single territory were evidenced, together with the discrepancies and unequalities of access to surface and underground waters. The Spanish team was able to identify the problems of coordination between the players – due to a lack of collective law accepted within the Haouz Office perimeter. They understood the high risk associated with water scarcity and the narrow margins of maneuver provided to the local associations, whose organization bases no longer have direct roots with the ancient arabo-andalousian framework.

7.9 DECEMBER 2005 TREVISE (ITALY) AND APRIL 2006 ZAHLE (LEBANON) - SEMINARS ON SHARING OF EXPERIENCES BETWEEN ITALY AND LEBANON: COMPARED MANAGEMENT IN PLAINS AND DELTAS

Italy and Lebanon took part in the third exchange seminar. The two countries have in common regional and infraregional institutions – the Consorzio di Piave or the Litani Office – and a quasi absence of local associations of irrigators at the level of villages or distribution branches from the main canals. The ISIIMM teams from both countries are close to the managers of these intermediate institutions which organize hydraulic works and act as relays for the public policies. The complexity of the regional and national institutions – partly rival and governed by different directives – prohibits the implementation of a concrete organization of water distribution among village inhabitants. The Lebanese team was interested by the structure of the land enhancement consortia, the Italian institutional base used to manage drains and canals. The idea to adapt this formula to a smaller scale was proposed by the Lebanese team. The Italians develop within ISIIMM a methodology intended to involve the farmers into the modernization of the networks, in view of a form of resistance to the shift from gravity irrigation to pressurized irrigation. In Lebanon there are farmers who use modern technologies in recent networks, but the lack of

solidarity and the contestation against the management economic tools (such as the destruction of the meters) show the limits of the action.

7.10 FEBRUARY 2006 – FAYOUM (EGYPT) – MEDITERRANEAN CROSSROADS OF COMMUNITIES OF IRRIGATORS.

This meeting took place in the Fayoum oasis which is one of the oldest perennial irrigation sites of the Mediterranean world (2,500 years of permanent watering). For three days, the six ISIIMM teams and their association partners discussed modes of community management of agricultural water in the Mediterranean basin. The Fayoum is the site of one of the pilot sites for the creation of Water Boards at the scale of the large inter-village distribution canals, a project of the Ministry of Public Works and Water Resources supported by the Netherlands. The general idea was to promote the local emergence of irrigator institutions, anchored in history, culture, religion and even language. The principles of valid community management were re-asserted: a delimited perimeter, a clear economical advantage in cooperation, procedures designed to foster collective choices, a social and enforceable law system, State's recognition of the right to set up organizations. Yet, in an open and global world, such institutions must group themselves into representative entities able to discuss future framework projects with the public and private players. Small associations of irrigators are necessary to adapt themselves to local hydraulic structures; although, in order to be in a position to negociate, to pool management costs and to share knowledge and training, they should set up their federations according to a relevant territorial base, the joint hydraulic life framework, i.e. the overflow basin, as per the expression proposed by the French ISIIMM team. Beyond the specific regional and national frameworks, the Spanish delegation invited all the partners to join the Mediterranean Irrigator Association, the main mission of which consists in conveying to international entities new discourses on Mediterranean irrigated agriculture and on the situation of rural communities that share water.

7.11 APRIL 2006 – ZAHLE (LEBANON) – INSTITUTIONAL ASPECTS OF INTEGRATED WATER RESOURCE MANAGEMENT ON ARID, SEMI-ARID AND IRRIGATED RURAL ZONES: INVOLVEMENT OF WATER PLAYERS IN THE DECISION MAKING PROCESS

This workshop was attended by ISIIMM teams and the staff of Water Offices and Agencies. The purpose was to compare public institutional devices and the forms of development of associations of users in the six Mediterranean countries. All the countries use the standardized terminology of basin agencies and water user associations, and for some of them the terminology of irrigation development or management offices. However, behind these categories-types of institutions there are very different realities from one country to another. Thus, basin agencies appear either as: central administrations that plan water allocations, or as authorities that arbitrate conflicts of usage, or as tax-collecting and subsidies redistribution entities for medium term equipment projects, or as expert consulting/advisory bodies, or even as water parliament if their members are representatives appointed by their base. Likewise, water user associations have very different functions and roles in their respective countries – be it water user associations without any real representation and decision making power or network management entities in joint properties that enforce laws approved and recognized by the public authorities. In a general way, there are numerous stakeholders at regional and hydrographic basin levels; their responsibilities are heterogenous, competitive and difficult to integrate. There cannot be any "global" answers to such an institutional complexity. Such answers must be formulated through regional inter-institutional dialogue platforms in which water user associations would have more representativeness, means, political independence to express the views of the base users.

7.12 MAY 2006 – AIT BOUGMEZ (MOROCCO) – MOUNTAIN COMMUNITY IRRIGATION, INTEGRATION OF RESOURCES AND CONFLICT RESOLUTION.

In the heart of the High Atlas, three ISIIMM teams – Morocco, France and Lebanon - more concerned by issues of irrigation and society in semi-arid (or dry in summer) Mediterranean mountain areas - gathered for this one-week seminar. The mountain rural communities are very ancient and have established strong community institutions around water resources, often a long time before their integration into modern States. The main conclusion of this seminar – and possibly one of the central contribution to the ISIIMM programme besides the respective knowledge of different situations – is this change of view on local situations: practices, rights and collective organizations for irrigation appear as continuous progressive constructions of adaptations to specific contexts, adjustments reshaped many times which must be understood before in order to accompany the transformation in changing contexts. On the one hand there is the evolution of the perception that engineers from hydraulic services have of such situations, and on the other hand the learning of the richness of the their practices by irrigation practitioners themselves. All agreed that the "mountain irrigation in the Aït Bout Guemez valley" seminar had been rich and fruitfull and that unlike what happened in the other seminars of the ISIIMM programme, it led to unexpected outcomes and to very open discussions. The sharing of experience enabled several participants to achieve a common understanding of specific situations, to look at their own situation through this new prism, and then to identify recurrent aspects between situations otherwise very different such as the irrigation in the High Atlas, in the mountains of the south of France and in Lebanon. In fact, the idea of an association of mountain irrigators seems to have been born during this seminar, even if it still is a project.

7.13 SEPTEMBER 2006 IN MARRAKECH (MOROCCO) –MOROCCO-EGYPT – FRAMEWORK FOR THE RELATIONSHIPS BETWEEN COMMUNITIES OF IRRIGATORS, WATER USER ASSOCIATIONS, AGRICULTURAL DEVELOPMENT AGENCIES AND WATER AUTHORITIES.

The first innovation of this workshop was a linguistic one. Arabic was the working language throughout the whole week between the Egyptian ISIIMM team which came with a delegation of the "Fayum Water Management Project", and the Moroccan ISIIMM team backed up by the Haouz Office and the Tensift basin agency in Marrakech. The workshop included a series of parallel presentations on public institutions and local irrigator associations, as well as various discussions between engineers and academics from the two countries, namely about the historical roots of "arab" hydraulic science and of the forms of water governance resulting from the colonial periods and reconstituted after their independences through strong public action. In both countries, in the last 50 years, irrigation had been developed by means of vast investment programmes for the construction of dams and the enhancement of land. Yet, there are differences between Egypt and Morocco. In Egypt, access to water in the Nile delta and valley is a social and identity issue which leads to continuous and intensive agriculture space where water flows regularly. This is even more remarkable in the Fayoum depression where farmers have set up organizations to share these continuous flows. Water is not invoiced to the users since they have contributed to the payment of the hydraulic infrastructures of the country through their past work and more recently by their contribution to the cotton industry. In Morocco, water resources are scattered and submitted to climate fluctuations. Public hydraulic expansion is discontinuous, it functions on the principle of sequential distribution schemes, with quotas and invoices to be paid in order to keep access to regulated water. The risk of water shortages in modern networks leads farmers to seek alternative solutions, either in groups of users of ancient canals that still have perenial water and flood water, or by means of countless individual pumping wells that tap into the underground water tables. In Egypt problems are more related to water

pollution and to the progressive reduction of water allocations to the ancient lands in order to provide more water to the new desertic lands. In Morocco, quantitative management is the first concern due to the difficulties to fill dams and to the dropping level of the tables. The conclusions of the workshop are to continue direct collaborations through professional and academic exchanges.

7.14 DECEMBER 2006 IN MARRAKECH (MOROCCO) – MOROCCO-LEBANON WORKSHOP – FRAMEWORK OF RELATIONSHIPS BETWEEN COMMUNITIES OF IRRIGATORS, WATER USER ASSOCIATIONS, AGRICULTURAL DEVELOPMENT AGENCIES AND WATER AUTHORITIES.

The Lebanese ISIIMM team and the farming partners of canal 900 and of the Khraizat sources – who had not been able to attend the "South-South" meeting because of the war in Lebanon in the summer 2006 – came to Marrakech to analyze the organization of the Haouz irrigation scheme, especially the relationships between the Office and the associations, using the workshop sites of the Tessaout and of the Nfis. The presence of private wells in a State-organized collective network weakens the public general management system and hinders the transition towards an association-based management since there is no coherence between a canal, a territory, a collective right and a distribution to be organized.

7.15 MARCH 2007 - MONTPELLIER (FRANCE) – FINAL ISIIMM CONFERENCE AND CONCLUSIONS OF THE EXCHANGES BETWEEN COUNTRIES.

The project final conference took place in Agropolis, head office of the ISIIMM coordination unit. The national coordinators presented the results achieved in each country, and described in specific reports published by the project in the different Mediterranean languages as well as in English. The ISIIMM scientific support provided by the IRD was expressed as several synthetic presentations in the matrix of scales and themes. The present synthesis available on the web site like all the documents produced by ISIIMM in the last four years, is the conclusion of this body of work - the compilation of the ISIIMM teams' experiences and of the acompanying works comprised of memos, theses, expert reports and articles. Several initiatives continue beyond the end of the project, as scientific and academic cooperation projects, including South-South exchanges. The web site will remain open and will evolve with the professional exchanges between associations of Mediterranean irrigators and the exchanges between those who have collected knowledge during this collective work. ISIIMM's work must be appreciated not against quantitative criteria but against the quality of the exchanges, the impacts of which will occur in the coming years with the evolution of reflexions specific to each country, region, deversing basin and local sites.

CONCLUSION

Networked action is indispensable. The Association of Mediterranean Irrigators has been established and constitutes a first forum. Each country can take the initiative to coordinate the movement of Mediterranean irrigators as per the modalities it wishes. ISIIMM has contributed to the emergence of an association of professionals and ASA that are specific to the French Mediterranean regions which includes a specific college of scientists.

The university research and training networks continue their traditional alliances around calls for tenders in social, agronomic, water sciences increasingly targeting the Mediterranean world. The IRD is thus facilitating a "Mediterranean irrigation archives" project that concerns the Moroccan and French team as well as an Algerian team of historian experts in Arab manuscripts. In association with the IRC (former Cnearc) for "social water management" in Montpellier, they continue a support programme for students from the South and more specifically the former ISIIMM facilitators, with seminars and experience sharing courses in social water management.

GENERAL CONCLUSION

There are three reasons why the ISIIMM project is complicated.
1) It combines three complex subjects - water, human beings and agriculture – which in a given country are perceived in different and often contradictory ways by the various professional groups that deal with these issues. In order to overcome antagonisms and conflicts between schools of thought and stakeholders, The ISIIMM has proposed an approach that begins with concrete workshop sites in which each participant can contribute to the elaboration of a joint vision based on a tangible and easily comprehensible reality.

2) It combines complex professional environments – research centres, universities, development programmes run by a State or a Region, development experienced by associations and NGOs. The ISIIMM has proposed an approach based on several geopolitical scales – local, regional, national – which enables each professional sector to feel involved at the level it masters whilst remaining open to other sectors.

3) Six countries, eleven regions and twenty local communities of irrigators were involved together in an exceptional endeavour, that is to study in order to act using a work pattern sufficiently open to give enough freedom to the teams to work out their own research-action balance.

In the ISIIMM organisation, the study and mediation action was carried out by "facilitators" who must be congratulated since they were at the interface between rural societies, regional or national administrations and an international coordination structure, itself split between the thematic and scientific steering and the technical and financial constraints.

The realisation at the local level of the diversity of organisations between countries, regions and local sites made the general scope broader albeit more complicated. As the project progressed, the idea of a single irrigation organisation model became less relevant. The "ISIIMM and its facilitators" became the "ISIIMM and its complicators". In fact, for each individual this broadened the scope of knowledge and action. Indeed, it opened other relevant scales of water management and implied taking into account the experiences of the other regions and countries understood as being simultaneously different yet mirrors of known situations. By comparing their experiences, the players in the ISIIMM project were led to reconsider their vision of their own region and their scope of action, focusing on the weaknesses and strengths of each situation rather than considering a model as performing better than the others. By understanding the irrigated landscapes in other countries or regions, the participants were able to revisit their own irrigated landscapes and to identify the signs of dysfunction, fragility, as well as the environmental, social and organisational risks.

What are the concrete results of a complicated project the facilitation of which avoids simplification but induces a complication of the water institutional social devices?

Throughout the project, the participants shared in-depth knowledge of the history and culture of the Mediterranean irrigation, the diversity of territorial organisations, the types or rural societies associated with irrigation, and the multiple regulatory and operating institutions. Owing to the quality of the exchanges and the comparisons of views on the workshop sites and regions, the teams have understood the dimensions to be taken into account in order to organise supporting actions towards local and regional players and they were able to take the floor during discussions at the national level.

At the local level, social and institutional reinforcement comprises five major directions leading to solutions that must come from participative approaches within the framework of local discussion groups. The five issues are:

- the coherence of the hydraulic and sociological territory to anchor the syndicate association of irrigators;
- the definition of a public purpose perimeter to guarantee the authority of the association;
- the mediation to elaborate internal rules;
- the need for a form of local arbitration of conflicts;
- the time scale needed to change the form and the content of the irrigator associations.

At the regional level, social and institutional reinforcement implies the appropriate representation of the associations of water users from the deversing basins that balances – within the consulting entities – the organisms and stakeholders involved in the operation of the catchment basins. Regional forums should be organised to discuss the water management procedures, regardless of the legal and political national framework, in view of elaborating a framework of action as routines in favourable hydro-climatic situations and as complex and progressive management action plans in the case of crises.

At the national level, social and institutional reinforcement implies a very strong effort in technical and political capacity building, as well as in the training of social staff in the mediation of water usage conflicts at the different geographical scales. This also implies a representation of the different local and regional stakeholders which should be able to present their vision and proposals to national consultation bodies, political decision-makers, ministries and representative assemblies.

At the international level, the social and institutional reinforcement of irrigation participative management requires that agricultural organisations be reinforced, and that research efforts and top-level higher training be continued in networks.

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ACRONYMS

ABTH	Tensift Hydraulic Basin Agency (Morocco) Agence de Bassin hydraulique du Tensift, Maroc
ADASIA	Departementale Association of Irrigation and Sanitation Syndicates - Association départementale des associations syndicales d'irrigation et d'assainissement (Pyrénées-Orientales, France)
ASA	Authorized Syndicate Association - Association syndicale autorisée (France)
ASAP	Syndicate Association of privileged farmers (organization of European farmers before the Independence in Morroco) - Association syndicale des agriculteurs privilégiés (organisation en vigueur pour les exploitants européens avant l'indépendance du Maroc)
AIRMF	Association of Irrigators of the French Mediterranean regions - Association des Irrigants des Régions Méditerranéennes Françaises, France
CRDRS	Center of Rural Development Researches and Studies, Cairo, Egypt
CVER	Centre Valencià d'Estudis del Reg, Valencia, España
EIC	Euromediterranean Irrigators Community
FAO	Food and Agriculture Organization, Roma, Italia
FEEM	Fondazione Eni Enrico Mattei, Milano, Venizi, Italia
FSJES	Faculty of legal, economic and social sciences – University of Marakech , Morocco - Faculté des sciences juridiques, économiques et sociales, Université de Marrakech, Maroc
GIRE	Integrated Water Resources Management (IWRM) - gestion intégrée des ressources en eau (GIRE)
GSE	Water Social Management (IRC, former CNEARC) gestion sociale de l'eau (formation de l'IRC ex CNEARC), Montpellier, France
IRC	Hot region Institute - Institut des régions chaudes (ex CNEARC), Montpellier, France
IRD	Development Research Institute - Institut de recherche pour le développement (ex ORSTOM), Paris, Montpellier, France
IWRM	Integrated water resources management (GIRE en Français)
ORMVA	Agricultural Enhancement Regional office (created in Morocco in 1966 on the basis of the regionalization of the former National Irrigation Office) - Office régional de mise en valeur agricole (créées au Maroc en 1966 sur la base de la régionalisation de l'ancien Office national de l'irrigation)
PACA	Provence Alpes Cote d'Azur (région) - France
PO	Pyérénes-Orientales (département des) - France
UCAM	Université Caddi Ayyad de Marrakech, Marrakech, Maroc
UPV	Universidad Politecnica de Valencia, Valencia, España
USUJ	Union de Sindicatos de Usuarios del Júcar, Valencia, España

GLOSSARY

Acequia	Irrigation canal in the Hispanic world
Aspres	Dry land (Pyrénées-Orientales, France)
Catchment basin	Spatial unit of water flow towards a unique outlet to a river.
Outflow basin	Spatial unit for the sharing and utilization of water using gravity flow from a point of entry.
Drainage basin	Spatial unit of collection and extraction of excess water towards an outlet..
Reflow basin	Spatial unit of sharing and utilization of water from a water artificial raising point.
Bour	Dry land (Morocco)
Consorzi de bonifica	Improvement consortium (basis of irrigation organization in Italy)
Chetoui	Winter (Egypte)
Fesa	Local water distribution branch that belongs to community management (Jucar, Spain)
Filiole	Local water distribution branch that belongs to community management (Provence, France)
Khettara	Underground drainage gallery that collects table water (Morocco - Foggara in Algeria, Qanat in Iran)
Markaz	Egyptian administrative unit between the village and the Governorate (province)
Mesqa	Local water distribution branch that belongs to comunity management (Egypt)
Mesref	Local water distribution branch that belongs to comunity management (Morocco)
Reg	Stream in Catalan, meaning canal.
Regadio	Irrigated terroir in Spanish.
Regadoure	Local water distribution branch that belongs to comunity management (Pyrénés-Orientales, France)
Regatiu	Irrigated terroir in Catalan.
Sakkia	Water raising machine with animal power (Egypt)
Secano	Dry land (Spain)
Sefi	Summer (Egypt)
Seguia	Irrigation canal (Morocco)
Trame B	Moroccan expression that designates the geomertical land and hydraulic model used in some large projects to plan the blocks of homogeneous culture and the corresponding water allocations.
Zimam	Village irrigated terroir (Egypt)

FIGURES AND TABS

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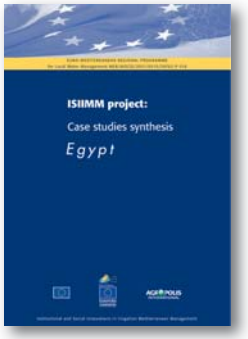

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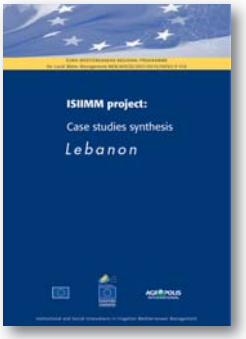

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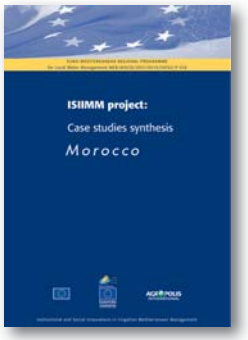

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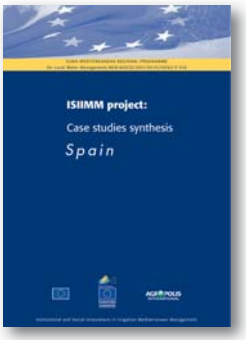

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