



NOSTRUM-DSS
Network on Governance, Science and Technology for Sustainable Water
Resource Management in the Mediterranean-The role of Dss tools

European Commission, FP6, Specific measures in support of international co-operation
Mediterranean Partner Countries (MPC), 2004-2007



NOSTRUM-DSS

Disciplinary Report

REPORT ON SOCIAL ISSUES IN WATER MANAGEMENT IN THE MEDITERRANEAN COUNTRIES

Date: January/2006

Prepared by:

Lourenço, Nelson, Centro de Investigação da Universidade Atlântica
Machado, Carlos, Centro de Investigação da Universidade Atlântica
Rodrigues, Luís, Centro de Investigação da Universidade Atlântica

This report is part of Nostrum-DSS Workpackage 3 **Disciplinary analysis of Dss in support of comprehensive planning**, Task b, Deliverable D3-2.

The work presented in this report received the contribution of several researchers from the different partner institutions, which were responsible for collecting data concerning stakeholders and decision-makers perceptions about water management in the different countries involved in this Coordination Action.

NOSTRUM-DSS

Project Deliverable D3-2: Report on social issues in water management in the Mediterranean Countries

Programme name: **Integrating and Strengthening the European Research Area Specific Programme of the Sixth Framework Programme of the European Community for research, technological development and demonstration activities (2002-2006)**

Program Areas: **Specific Measures in Support of International Co-Operation - Mediterranean Partner Countries (MPC)**

Project acronym: **NOSTRUM-DSS**

Contract number: **INCO-CT-2004-509158**

Project Deliverable: **D3-2: Report on social issues in water management in the Mediterranean Countries**

Related Work Package: **Workpackage 3 - Disciplinary analysis of DSS in support of comprehensive planning**

Type of Deliverable: **Report**

Dissemination level: **Public**

Project Partner: **Partner 3 - Ensino, Investigação e Administração S.A. / Universidade Atlântica (EIA/UATLA)**

Document Author: **Nelson Lourenço, Carlos Russo Machado, Luís Rodrigues**

Edited by:

Reviewed by:

Document Version:

Revision history:

First Availability:

Final Due Date:

Last Modification:

Hardcopy delivered to:

<u>EXECUTIVE SUMMARY</u>	<u>3</u>
<u>1 INTRODUCTION.....</u>	<u>7</u>
1.1 Managing water scarcity.....	7
1.2 Context.....	8
1.2.1 Water and Governance.....	10
1.2.2 Local participation, stakeholder involvement, and social networks.....	11
1.3 Methodology.....	12
1.3.1 Methodological Approach to identify decision-makers and stakeholders.....	13
1.3.2 Structure of the Report.....	14
1.3.3 Problems and shortcomings of methodology.....	14
<u>2 CURRENT SITUATION.....</u>	<u>15</u>
2.1 Planning and participation in water resource management in the Mediterranean countries.....	15
2.2 The Mediterranean Region: physical and human setting for water management.....	18
2.2.1 Rainfall and temperature.....	19
2.2.2 Population and economic growth.....	21
2.2.3 Water abundance and water scarcity.....	25
2.3 Institutional setting and decisional context for water management in the Mediterranean countries.....	27
2.3.1 Mediterranean Countries.....	28
2.3.2 Implementation of Policies.....	28
2.3.3 Country analysis.....	29
2.3.4 Overview.....	40
<u>3 KEY ACTORS AND STAKEHOLDERS IN WATER MANAGEMENT IN THE MEDITERRANEAN COUNTRIES.....</u>	<u>44</u>
3.1 Social Networks and water management.....	44
3.2 Social Networks and decision-making processes.....	46
3.3 Key actors in the case-study areas.....	48
3.3.1 Country analysis.....	49
3.3.2 Overview.....	55
3.3.3 Social Network analysis.....	58
<u>4 CONTRIBUTION TO THE DSS DEVELOPMENT.....</u>	<u>67</u>
4.1 Experiences with DSS in water management.....	67
4.1.1 Overview.....	69
<u>5 CONCLUSIONS AND RECOMMENDATIONS.....</u>	<u>71</u>
<u>REFERENCES</u>	<u>73</u>

Index of Figures

Figure 1 – Water and population dynamics	11
Figure 2 – Sub-regions in the Mediterranean	18
Figure 3 – Topography in the Mediterranean region.....	20
Figure 4 – Distribution of average annual temperature in the Mediterranean region, 1961-1990	20
Figure 5 – Distribution of mean annual precipitation in the Mediterranean region, 1961-1990	21
Figure 6 – Annual Growth of population 1970-2000 in the Mediterranean region.....	22
Figure 7 – Annual Growth of population 2000-2025 in the Mediterranean region.....	22
Figure 8 – Urban population in 2000 in the Mediterranean region	23
Figure 9 – Annual Growth of urban population 1970-2000 in the Mediterranean region.....	23
Figure 10 – Annual Growth of urban population 2000-2025 in the Mediterranean region.....	24
Figure 11 – Distribution Gross Domestic Product per capita, in 2003, in the Mediterranean region	25
Figure 12 – Availability of renewable water resources per capita per year in the Mediterranean region	26
Figure 13 – Dependency ratio of water resources in the Mediterranean region.....	26
Figure 14 – The turn of the water screw	27
Figure 15 – Actors in Formulating Water Management Policies	44
Figure 16 – The structure of a social network present in a catchment.	46
Figure 17 – Base image of stakeholders’ positional analysis within the Caia network.....	61

Index of Tables

Table 1 – Main Institutions involved in water management policy	41
Table 2 – Case studies and key actors involved.....	49
Table 3 – Key actors involved in the selected case-studies.....	56
Table 4 – Type of institutions involved in the selected case-studies.....	56
Table 5 – Type of water use related with institution in the selected case-studies	56
Table 6 – Main objectives of the institution.....	57
Table 7 – Decision process frame of the institutions	57
Table 8 – Experiences with DSS in water management.....	70

Executive Summary

Sustainable development is being seen as the basis for a genuine balance between economic growth and environmental values. In fact, there is a considerable corpus of literature based on empirical evidence showing that the degradation or depletion of the environment affects in different ways people inside societies and among countries, creating, increasing and reinforcing new ways of social and economic discriminations.

To accomplish the necessary growth of well-being, without compromising the capacity of natural resources also producing that well-being for future generations, is a challenge that implies to cut with the existent relationship between economic growth and natural resources use, which has driven to the present situation of environmental degradation. It means also to shift to a paradigm of natural resources management, instead of natural resources exploitation, to bring to a halt the present unsustainable patterns of production and consumption (UNDP, 2001). In fact, it is important, that at the same time man develops technology, which can enlarge the limits of the carrying capacity of ecosystems, to reduce, by means of effective policies, the patterns of consumption and to adapt practices of conservation of natural resources (Bartelmus, 1999).

The UN Millennium Declaration (MD), the Plan of Implementation of the World Summit on Sustainable Development (WSSD), the EU Water Initiative, and the Millennium Development Goals (MDGs), are the focal orientation for the work being carried out in the frame of NOSTRUM-DSS Coordination Action. In particular the following subjects are key references:

- Plan of implementation of the WSSD (WSSD-PI): the development of Integrated Water Resources Management plans by 2005 with strong public participation (IV 26 page 15 of the WSSD-PI), transparency and accountability is a key approach to reaching the targets of the MDGs;
- Goal 7 of the MDGs: Ensure environmental sustainability, and in particular *Target 10* (Halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation) and *Target 9* (Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources).

In a context of economic globalisation it is clear that the linkages of economy and environment, as well as the environmental impacts, are not limited by the boundaries of nation states. Therefore, it is assumed that to correct and solve the environmental problems it is necessary, not only, to correct the economic distortions associated to the inequity of the distribution of benefices resulting from the uses of natural resources, but also to achieve better processes to engage individuals and institutions, at global and local level, in governing themselves. Nowadays the systems that society has developed for governing itself, which are generally based in the nation state, become increasingly complex, and it seems necessary to discuss the basic structures of governance, in order to manage the conflicting and changing economic, social and environmental requirements of modern governance systems. Moreover, individuals, households and communities are seeking greater control over their own destinies, while the boundaries between the public and private spheres are continually shifting (Machado et al, 2002).

Therefore, governance arises as a key issue to the implementation of sustainable development. It is an approach to understand and describe the systems, networks, practices and dynamics of governing. Good governance depends on the legitimacy of the political system and on the respect shown by the people for its institutions. It also depends on the capacity of such institutions to respond to problems, and to achieve social consensus through agreements and compromise (Machado et al, 2002).

The way societies organise themselves and establish rules to govern their actions will play a major role in determining whether they move toward more sustainable paths. But good governance requires reforming decision-making processes to increase opportunities for public participation, including a wide variety of activities ranging from consultation hearings as part of an environmental impact assessment, to co-management of natural resources. Therefore it requires public debate and problem-solving capacity (Risse, 2002).

In the Mediterranean basin, wide differences in water supply and demand characteristics exist and no individual case study may be a representative of the entire region. Some countries suffer problems of overexploitation of groundwater while others suffer from water quality degradation. On the other hand, some have enough or plentiful water but lack institutional structures to manage water efficiently, while others have scarce and limited water and seek non-conventional water like desalination or importation of water.

The Mediterranean region has a key common environmental feature that is related with the existence of a more or less longer dry and hot season. This creates important stress on water resources due to irrigation needs. In fact, in this region, irrigation cannot be seen as a way to increase and improve agricultural productivity. Irrigation in the Mediterranean region is essential to ensure agricultural productivity. Furthermore, there is a clear contrast between northern areas (receiving abundant water resources from temperate regions) and southern areas that are adjacent to semi-arid regions, with very scarce water resources.

Water resources are a societal issue. Considered frequently as a common good, water is essential to life and to numerous human activities, and suffers their negative impacts. In the Mediterranean region, the significance of irrigated agriculture, the intense urbanisation, and the tourism are increasing their demands for water, requiring therefore important efforts to find new strategies to better manage this scarce resource.

In EU countries, the process of water resource management is driven by a clear compulsory end point: the water status has to be good after WFD implementation. However, Mediterranean Partner Countries (MPC) are not bound to any international duty to achieve certain objectives in their watersheds. The responsibility of carry out different measures should be shared among public authorities and stakeholders depending on competencies. This requires building capacity of involvement of all interested partners in catchments' planning and managing. The key measures to be implemented should be:

- Allocation of financial and human resources for responsible administrations (government prerogative). The countries' administrations in the region have some shortages of human resources and funds to carry out the tasks necessary for proper catchments' management. This shortage is also seen about knowledge and skills in the light of new EU perspective, although this kind of capacity is gradually improving;
- Assessment and collection of data needed for decision making by (re) designing monitoring programs, added scientific research and/or by analysing the results of international research projects, experiences, and all available national data;
- Involvement of national experts into water protection projects;
- Design seminars for stakeholders with targeted relevant information (some general information on watershed management) in an easily understood way with possible cooperative proposals (clear

benefits should be stated). Of particular importance is the integration or coordination of spatial planning and basin management, which should discuss with the responsible institutions for spatial planning (municipalities, counties);

- Development of integrated GIS databases for decision making support;
- Assessment of technical equipment needs and filling the gaps;
- Training courses for local and state managers, with experience exchange meetings.
- Curriculum adjustment of academic programs to align contents with water management needs. This will create national human resources and expertise needed for successful management of the water at the national and in catchments.

In the long-term the growing water demand of Mediterranean countries can only be met from three sources. These are the use of renewable water sources; desalinating sea water; and reallocating irrigation water to more productive uses. For many countries the first alternative is no longer possible, and for many others it will provide water for only a decade or two. Desalination of sea water is a solution, but an expensive one. However, in the long-term it seems likely that it will become even more important as other water sources are fully used, having the great advantage of the limitless amounts of fresh water which can be produced. Finally, the reallocation of irrigation water could be the most likely immediate solution to water demand problems over the next two decades, but depends of political decision (Beaumont, 2000).

Water policies in the region need to face:

- A lack of tradition of public involvement and integrated work with other institutions trying to achieve common goals;
- A public more concerned for its well-being than for the environment, posing a challenge for environmental administrators, since raising economic welfare is beyond their jurisdiction;
- Lack of capacity both for the administrations and the stakeholders to effectively manage watersheds;
- Lack of environmental awareness and responsibility among non-environmental and even some environmental administrations, as well as among stakeholders;
- Lack of data for identification of problems, assessment of the state of water resources and economic and stakeholder analysis.

The involvement of local people on the management of scarce resources is a correct approach to try to solve some of the difficulties of decision-making processes. The participation of local stakeholders in decision-making processes has to do with giving them the power to mobilise their own capacities and therefore turning themselves in active actors instead of passive subjects. Of course this type of co-management requires power sharing between government agencies and citizens with a stake in the common pool of resources and territory. It emphasizes a bottom-up rather than top-down process of participation and implies user groups playing an active role in decision-making. Furthermore, it requires the understanding of the functioning of local networks of stakeholders. In fact, in the decision-making process, they operate as an essential tool in terms of transmission of normative systems, which regulate the decision and allow for identification of actual problems and potentialities, evaluation of the validity strengthen of proposals for intervention, and also understanding interactions and conflicts among the various social actors, whether individual or collective.

Strategies aimed at reconciling human development with the sustainable management of water resources must recognise that water accessibility and scarcity increasingly threaten four fundamental aspects of human security:

- food production;
- human health;
- the health of the environment;
- and social, economic and political stability.

1 Introduction

Water resources are essential to life on earth and play a key role in the development and functioning of society:

- Provide habitat and sustenance for a rich diversity of plant and animal species that make up aquatic and riparian ecosystems, providing the basis for many of the goods and services received by society.
- Is a basic resource for activities such as irrigation, livestock production, fisheries, aquaculture, and hydroelectric power.
- Its adequate water use in households, businesses and manufacturing is a prerequisite of economic growth.
- Clean water and sanitation are strongly needed for reducing the incidence of waterborne diseases

Population growth is the most important demographic trend affecting water resources. The past two centuries have seen dramatic increases in world population, from one billion in 1800 to six billion at the close of the 20th century. More people and increasing consumption of food, consumer goods, and water for domestic use have created demands for clean freshwater that in many areas exceed nature's capacity to deliver through the hydrological cycle. In today's world, much water is wasted or used inefficiently, and often demand is growing faster than the supply can be replenished by nature. The growing scarcity and competition for water stands as a major threat to future advances in poverty alleviation. However, while competition over water resources can be a source of conflict, history has shown that shared water can also be a catalyst for cooperation.

1.1 Managing water scarcity

According with the Millennium Ecosystem Assessment, one-third of the world's population is now subject to water scarcity, and population facing water scarcity will double over the next 30 years. Furthermore, drylands have only 8% of the world's renewable water supply and 10–20% of this ecosystems are degraded (UNEP, 2005). This lack of freshwater resource turns existing sources of surface water, groundwater, and wetland habitats critically important for the population well-being as well as for the ecosystem health (Withe et al., 2002). These water-stressed regions are usually associated with infertile and hostile lands, but they support nearly 2 billion people (about 40%) of the world's population (UNDP/UNSO, 1997 and White et al., 2002). Nevertheless, these regions are among the world's most fragile ecosystems, being water one of the most limiting factors. Decrease of water availability, in these regions, can have exponential negative effects on the human population well-being. Water scarcity have a strong burden for women, and to a lesser extent to children, which are the main actors in charge of draw, transport, and store of water for household and animal use. However, their involvement in managing water resource is still nowadays very weak (Morna, 2000; Narayan, 1993).

The agricultural production systems require large amounts of water. The “virtual water” contained in the products is a significant concept, especially for water-scarce regions, in which is important to adapt the production systems to products less intensive in water. Analysing the relations between “virtual water” and physical water can be a significant contribution for achieving a balance of economic and population growth, as well as towards ecological sustainability. The importance of virtual water lies

with its potential to balance water-rich and water-poor regions, at national and global levels, through the regional and international trade in agricultural products (Yasser, 2004). Naturally, this process implies socio-economic changes that should be thoroughly analysed. Nevertheless, “virtual water” trade must be faced as an instrument to achieve water security and efficient water use (Hoekstra, 2003).

Agricultural systems in drylands are at the root of specific ecological, economic and social concerns that should be addressed to move towards more sustainable agricultural practices. Water is the principal resource to support the development of agriculture, and it has been a major limiting factor when is scarce or mismanaged. Negative effects of current agricultural practices are a growing problem, and not only in arid and semi-arid regions, and include the following (Khor, 2004): decline in soil productivity and desertification due to overgrazing; salinisation and contamination of ground and surface waters; overuse of surface and ground water for irrigation; little control of farmers over farm prices; loss of small-size farms and farmers, contributing to the disintegration of rural communities and local marketing systems.

In arid and semi-arid regions, some strategies should be stressed: improving water conservation and storage measures; providing incentives for selection of drought-tolerant crop species; using reduced-volume irrigation systems; managing crops to reduce water loss; and in extreme cases not planting at all (Ching, 2002). Sustainable agriculture can deliver substantial increases in food production at low cost. It can be economically, environmentally and socially viable, and contribute positively to local livelihoods.

1.2 Context

The involvement of state organisms and local communities in the processes of development is a priority for almost all international support programmes. This priority is supported by the perspective that decisions should be taken as close as possible to the affected citizens (the subsidiary principle), as well as by the principles of local participation and decentralisation. It is so, because of the inefficient aspects of current processes of development, which up to a few years ago were very limited in economic terms and somehow rather distant from the local reality (Jorge et al., 2002).

In our time, the concept of sustainable development has inscribed in itself the linkages of economy and environment because the societies base their growth in the extraction, transformation and consumption of natural resources. Therefore, sustainable development demands an integrated and interactive approach that allows for the understanding of the complex relationship between society and nature in respect of human rights, and assuming that environment is one vital dimension of the future of the human kind (Lourenço, 2001).

Integrated water resource management is a cross-sectoral policy approach that requires coordination among the different water uses and institutional sectors to respond to the growing demands for water in the context of finite supplies. This process aims at ensuring the coordinated development of water, land and related resources to optimise economic and social welfare without compromising the sustainability of environmental systems. Therefore, it is a complex and multi-dimensional process that must be customised to the specific geographical, environmental, social, cultural, political and economic conditions of each region and catchments (GWP, 2000). It involves understanding the interactions of the various social, political, economic and ecological processes that influence choices

and strategies within the ecosystem, and addressing issues through the involvement of various stakeholder groups. This ecosystem approaches have been developed, through the concept of integrated watershed management, as a strategy to rebuild agriculture and promote participatory development. (Noronha, 2004). This ecosystem approach is a great tool for an adequate decision-making process, providing stakeholders, decision-makers and policy makers with integrated environmental and socio-economic information to deal with the needs of local populations, and to assess different development options and water management strategies (White et al., 2002).

Many environmentalists, like Robert Paelke (1999), see sustainable development as "...an oxymoron, little more than a political cover for otherwise unacceptable corporate environmental practises...". In contrast, others see sustainable development as the basis for a genuine balance between economic growth and environmental values, and even Paelke (1999) recognises that sustainable development was positively introduced as a "...rebuttal to the common 1970s assertion that zero economic growth was desirable and even inevitable, especially in the long run, given environmental and resource constraints...", and show the evidence that economic restraint, in some context at least, could increase rather than reduce environmental damage. In fact, economic growth provides both environmental opportunities and environmental costs. To achieve the goals of sustainable development it is comprehensible that "...economic growth must remain a legitimate objective of national governments and the world community..." (Pearce & Warford, 1993)¹. Nevertheless, it is clear now that the former models to pursuit economic growth, which don't give the adequate consideration to the environment, are unlikely to be sustainable. In fact, it is important, at the same time man develops technology, which can enlarge the limits of the carrying capacity of ecosystems, to reduce, by means of effective policies, the patterns of consumption and to adapt practices of conservation of natural resources (Bartelmus, 1999).

Water constitutes a resource of high economic value for all countries: its use constitutes a means of communication, corresponds to an important factor of production for agriculture, and industry, it is a source of supply for domestic consumption, and the ecological and landscape structures that are expressed in the diversity of the regions depend on it. Moreover, water constitutes a vital resource for human development. With the population growth, there is an increase in need for this natural resource on the planet surface. This growing need, however, contrasts with a limited supply, frequently generating situations of conflict in the demand for water in quantity and quality. It is therefore necessary to look for decision-making tools that allow for an integrated approach in the planning and management of the various types of use of this resource in a given region.

The management of natural resources considered from the perspective of Sustainable Development requires an integrated approach of social, economic and environmental factors. However, all decision-making systems tend to separate these factors at the level of defining planning and management policies.

It is not easy to apply these principles. However, the environmental, economic and social costs resulting from the degradation in quality and quantity of this natural resource reveal to us that the application of these principles must not be seen as impossible either. In fact, "...Human communities have already shown their ability to anticipate and avoid environmental problems, once they

¹ According to the Brundtland Report "...far from requiring the cessation of economic growth (sustainable development) recognises that the problems of poverty and underdevelopment cannot be solved unless we have a new era of growth..." (WCED, 1987).

understand the connection between ecosystem health and integrity and themselves, their children, and grandchildren...” (Braga, 2000).

Water management presents specific difficulties due to its various uses and to the important functions that it performs in almost all aspects of human activity. It is not always possible to harmonise the various uses of this scarce resource. Thus the sharing of water resources requires management based on rules that render possible its harmonious appropriation, establishing priorities in use, regulating the interactions of the various social actors (individual and collective), or in other words regulating the conflicts not only among these various actors but also among the various users of the water.

1.2.1 Water and Governance

According to the United Nations World Water Development Report we are facing nowadays a Global Water Crisis. The access to safe and easily available water is now considered one of the most critical natural resource issues faced by human societies, and it is clear its relations with other critical issues for the sustainable development: sanitation, health, agriculture, energy and biodiversity (UN/WWAP, 2003). However, this Global Water Crisis is also frequently a crisis of governance (Rogers, 2003), resulting from the failure on determining the roles and responsibilities of public, civil and private interests, as well as of integrating policies and practices in the effective management of water resources and development. Therefore, one of the most significant steps for managing water resources is to involve the scientific community and the community of stakeholders, decision-makers and civil society representatives in the discussion of water management experiences towards the definition of sustainable water management strategies and policy options. Furthermore, one of the key challenges in managing water resources is to develop tools, methods, strategies and policy options, in a context of an ecosystem approach, to satisfy water needs for population and agriculture, ensuring the improvement of livelihoods, diversification of income generation and nature conservation.

The Dublin Principles for good water governance (Solanes, 1999) cover the different dimensions of sustainability (environmental, social and economic) and provide a comprehensive and multidisciplinary frame for approaching the definition of policy options for water resource issues. They have been adopted by numerous international, multi-lateral and bi-lateral agencies including the World Bank. Following these principles, the European Water Framework Directive (WFD, 2000/60/EC) sets out, for the first time, a detailed and integrated framework for the improved protection and management of all Europe's water resources and aquatic environments from each catchment to the sea (Teodosiu, 2003). This directive represents the most significant materialisation of the international concerns with the water as a strategic and limited resource that need to be protected for actual and future generations. This water framework directive pursues the achievement of sustainable development by promoting the integrated management of water resource, using the river basin as management unit.

It is a very complex and challenging strategy, which should integrate all the relations between the natural and the socio-economic environment that contribute to water quantity decrease water quality deterioration This integrated and comprehensive process includes pollution control and prevention, land-use planning, agricultural policy and erosion control, environmental management and stipulates the involvement of all stakeholders within the basin in the process of water resource management.

Access to enough water of sufficient quality is fundamental for all human, animal, and plant life as well as for most economic activity. At the global level, plenty of water is available. But to meet the demand,

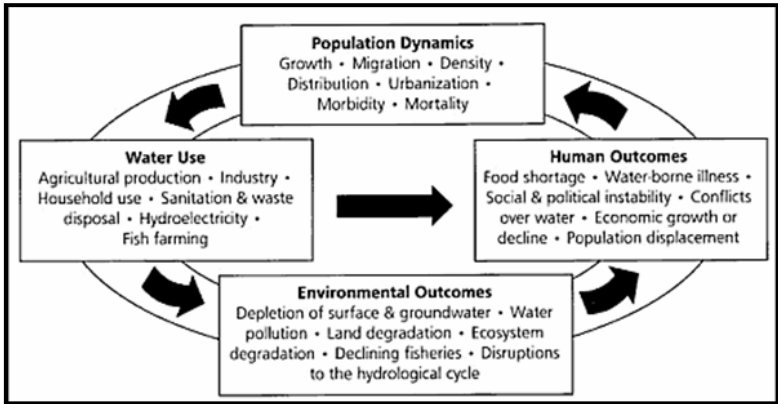
water has to be supplied where and when it is needed. Two ways of dealing with scarcity are to increase supply and limit demand. Increases in water supplies, and especially storage (dams, groundwater aquifers, and small-scale water harvesting), are needed, but so is demand management, including not only economic instruments but also education and other efforts to change behaviours, appropriate technologies and institutions.

1.2.2 Local participation, stakeholder involvement, and social networks

The global water system is defined by the global suite of water-related human, physical, biological, and biogeochemical components and their interactions (*Global Water System Project, 2005*). In fact, society is a significant agent of change within the global water system: not only is exposed to changes in water availability, but also takes various actions to mitigate or adapt to these changes.

Society is forcing unprecedented changes on global water resources through worldwide abstraction and pollution. These changes are not simple cause-effect relationships because of the intense and complex linkages and feedbacks between different parts of the system (Figure 1). For instance, in one hand, population growth impel to an increased use of water for food production and household use, which, in turn, may exacerbate water shortages, food insecurity, and ultimately lead to economic and social crises. On the other hand, naturally scarce water supplies, poor water quality, or uneven distribution of water resources may have adverse affects on the health and ultimately the growth and distribution of populations (Sherbinin and Dompka, 1998).

Figure 1 – Water and population dynamics



Source: Sherbinin & Dompka (eds.), 1998.

In a context of economic globalisation it is clear that the linkages of economy and environment, as well as the environmental impacts, are not limited by the boundaries of nation states. Therefore, it is assumed that to correct and solve the environmental problems it is necessary, not only, to correct the economic distortions associated to the inequity of the distribution of benefices resulting from the uses of natural resources, but also to achieve better processes to engage individuals and institutions, at global and local level, in governing themselves. Nowadays the systems that society has developed for governing itself, which are generally based in the nation state, become increasingly complex, and it seems necessary to discuss the basic structures of governance, in order to manage the conflicting and changing economic, social and environmental requirements of modern governance systems. Moreover, individuals, households and communities are seeking greater control over their own

destinies, while the boundaries between the public and private spheres are continually shifting (Machado et al, 2002).

Therefore, governance arises as a key issue to the implementation of sustainable development. It is an approach to understand and describe the systems, networks, practices and dynamics of governing. Good governance depends on the legitimacy of the political system and on the respect shown by the people for its institutions. It also depends on the capacity of such institutions to respond to problems, and to achieve social consensus through agreements and compromise (Machado et al, 2002).

According to Cernea (1985), participation has to do with giving people power to mobilise their own capacities, be social actors instead of passive subjects, manage resources, make decisions and control the activities that affect their lives. This type of co-management requires power sharing between government agencies and citizens with a stake in the common pool of resources and territory. It emphasizes a bottom-up rather than top-down process of participation and implies user groups playing an active role in decision-making. The local communities of stakeholders should play a central role in identifying resources, defining development priorities, choosing and adapting technologies and implementing management practices.

The participation of local communities involves the different stakeholders present in the region, and therefore applies to an integrated, multi-level and multi-disciplinary approach. The participation in the management of territory and natural resources is justified by the benefits to local communities resulting from the proximity of the local stakeholders to the resources, which could ensure a more adequate use; the expected increase of resource flows to rural populations, which can contribute to alleviate poverty, diversify benefits and achieve a more equitable income distribution; the flexibility of the process, which can ensure a better adaptation to the context of uncertainty and change (BROWN, 1999). However, integrating local people in the decision-making processes is not always a successful process. They should participate in the decision-making process but they must also benefit directly from the decisions taken (Cater & Goodall 1992).

1.3 Methodology

This report is based on two sets of information sources:

- The information previously released with the Deliverable D1-4 National Reports, especially in what concerns the information in part II of those reports.
- Outcomes of recently finished research projects, which were developed in the geographic context of European Union and Mediterranean Basin. This information is here assembled in the logic of the Coordination Action of gathering information from previous or on-going studies that can contribute to push forward the knowledge. The main subject of these projects is related with the development and use of Decision Support Systems in the frame of integrated water management: MULINO - Multi-sectoral, integrated and operational decision support system for sustainable use of water resources at the catchment scale (EVK1-CT-2000-00082); SMART - Sustainable management of scarce resources in the coastal Zone (ICA3-CT-2002-10096)

1.3.1 Methodological Approach to identify decision-makers and stakeholders

Specific information about the stakeholders in each case study was collected through the administration of two questionnaires. The first questionnaire was necessary to achieve general information about each case study, that support the building of the second questionnaire with more detailed questions, which were necessary to develop the analysis of stakeholders, water uses conflicts and decision making processes.

This questionnaire was structured in three sections. The first one intended to provide guidelines for identifying stakeholders at different levels of analysis. On one hand, the identification process should include main actors who have interests and/or specific responsibilities in water management at National, Regional and Local level. On the other hand, it is important to consider the stakeholders whom should have been or have been involved in the decision making process undertaken in the case study under examination. The second section provides a list of questions which should be addressed to the stakeholders of the case study which have been selected as a sample in order to perform the stakeholders' analysis. The last section contains the information needed in order to let EIA/UATLA carry out a simplified local network analysis. Main aim of the analysis is to highlight the main interactions of the policy makers and stakeholders at the case study level.

Social network studies have almost never collected information about all the relationships that actors have with all the other members of the social network. Such an effort would be prohibitively expensive. These studies focus on the more relevant relationships of stakeholders with a set of their network members, e.g., those network members who provide a support to understand the decisional context in analysis.

Social networks have a key role in the effective management of catchments. These networks should co-ordinate the contact between the various individual and collective actors present in a given region and encourage them to work together in order to harmonise their objectives and preoccupations. The final decisions have a greater probability of integrating the expectations of the various actors that have interests at play in the case study area.

For the analysis of social networks the following guidelines should be present:

- Every social system is already structured in (formal or informal) networks. These social networks are structured by the different social, economic and political actors that are involved in the catchment;
- The acknowledgement and understanding of the different social networks already present in the study areas is fundamental in order to establish the network that will assist the NOSTRUM-DSS project, as well as to understand the methods that are used by these social networks to influence the decision making processes concerning water management;
- Therefore we need to build one local network to co-operate with the NOSTRUM-DSS teams. This network should be representative of decision makers, water uses, DSS users, and stakeholders of each case study.

Three institutional levels were considered:

National (Ministries, Councils, Administrations, Governmental agencies...)

Regional/River basin (Regional authorities, basin authorities...)

Local (Municipalities, local authorities...)

Identification of decision makers and stakeholders to be contacted should, firstly, rely in a work with privileged informers to determine the individuals and institutions (farmers, industrial entrepreneurs, environmentalists, technicians and or managers of public agencies, water suppliers, etc.) to be questioned. The number of interviews will depend on the level of diversity desired, as with any usability study, but it is suggested that at least 8 stakeholders and/or decision makers be contacted. The following concepts should be taken in attention:

- **Policy-maker:** the social actor that will use DSS to examine alternative strategies in water management. They are essentially institutional decision-makers who could use the results of the project in their activity as water managers.
- **Stakeholder:** the social actor (individual, group or institution) that is an actual or a potential user of water resources for different purposes (agriculture, industry, domestic consumption, recreational, communication, etc.). They have an interest in the decision taken and they are directly and indirectly affected by the decisions taken. They can be classified according to the following criteria (Bianchi, and Kossoudij, 2001):
 - Primary stakeholders: those ultimately affected by the decision, either positively (beneficiaries) or negatively.
 - Secondary stakeholders: intermediaries in the process of decision making and implementation
 - Key stakeholders: those who can significantly influence, or are important to the success/failure, of the decision taken.

1.3.2 Structure of the Report

This report has three main chapters: section 2 refers to the current situation in terms of planning and participation in water resource management in the Mediterranean countries. It also describes the institutional setting and decisional context for water management in the Mediterranean countries; section 3 outlines the key actors and stakeholders involved in water management in the Mediterranean Countries as a means to illustrate the importance of social networks in water management and in decision-making processes; section 4 highlights the use of DSS tools in each country.

1.3.3 Problems and shortcomings of methodology

The most important problem is related with the information concerning the main interactions of the policy makers and stakeholders at the case study level. In fact, the information collected in almost every country is not enough to allow the identification of the relationships within the social network. However, the continuous work with the stakeholders during the Coordination Action will allow deepening the analysis.

2 Current situation

The involvement of local people on the management of scarce resources, such as water available for agriculture activity, is a correct approach to try to solve some of the difficulties of decision-making processes. The participation of local stakeholders in decision-making processes has to do with giving them the power to mobilise their own capacities and therefore turning themselves in active actors instead of passive subjects. Of course this type of type of co-management requires power sharing between government agencies and citizens with a stake in the common pool of resources and territory. It emphasizes a bottom-up rather than top-down process of participation and implies user groups playing an active role in decision-making. Furthermore, it requires the understanding of the functioning of local networks of stakeholders. In fact, in the decision-making process, they operate as an essential tool in terms of transmission of normative systems, which will regulate the decision and allow for identification of actual problems and potentialities, evaluation of the validity strengthen of proposals for intervention, and also understanding interactions and conflicts among the various social actors, whether individual or collective.

2.1 Planning and participation in water resource management in the Mediterranean countries

Water Management issues are recognised by the scientific community and policy institutions as a key area for international cooperation. Integrated water resource management is a cross-sectoral policy approach that requires coordination among the different water uses and institutional sectors to respond to the growing demands for water in the context of finite supplies. This process aims at ensuring the coordinated development of water, land and related resources to optimise economic and social welfare without compromising the sustainability of environmental systems. Therefore, it is a complex and multi-dimensional process that must be customised to the specific geographical, environmental, social, cultural, political and economic conditions of each region and catchments (GWP, 2000).

According to the United Nations World Water Development Report we are facing nowadays a Global Water Crisis. The access to safe and easily available water is now considered one of the most critical natural resource issues faced by human societies, and it is clear its relations with other critical issues for the sustainable development: sanitation, health, agriculture, energy and biodiversity (UN/WWAP, 2003).

However, this Global Water Crisis is also frequently a crisis of governance (Rogers, 2003), resulting from the failure on determining the roles and responsibilities of public, civil and private interests, as well as of integrating policies and practices in the effective management of water resources and development.

The way societies organise themselves and establish rules to govern their actions will play a major role in determining whether they move toward more sustainable paths. But good governance requires reforming decision-making processes to increase opportunities for public participation, including a wide variety of activities ranging from consultation hearings as part of an environmental impact assessment, to co-management of natural resources. Therefore it requires public debate and problem-solving capacity (Risse, 2002).

The involvement of water users and keystone stakeholders in the decision-making processes is an advantageous process because promotes (Lourenço, 2004):

- Increasing of innovative policies and better-informed operational decisions departing from dialogue and interaction among organisations with different responsibilities and perspectives according the problems under analysis;
- Resolution of conflict and disagreement through consultation of all social actors present in a given region or catchment and increase stakeholders acceptance, fewer delays and more effective policy implementation;
- Increasing the continuity and consistency in policy within individual organisations as a result of the building of expectations and interaction with other actors;
- Coordination and integration of disparate actions and aggregation of separate budgets, to enhance policy impacts;
- Increasing the level of strategic planning and decision-making, through shared agreement reached on essential needs and priorities.

Social networks are the essential means for linking different groups of stakeholders that share similar interests related to some subject, and are the mechanism for the exchange of information and services in support of water management processes. Beyond the local networks, the stakeholders identified require the commitment of the decision-makers to cooperate.

The Dublin Principles for good water governance (Solanes, 1999) cover the different dimensions of sustainability (environmental, social and economic) and provide a comprehensive and multidisciplinary frame for approaching the definition of policy options for water resource issues. They have been adopted by numerous international, multi-lateral and bi-lateral agencies including the World Bank.

Following these principles, the European Water Framework Directive (WFD, 2000/60/EC) sets out, for the first time, a detailed and integrated framework for the improved protection and management of all Europe's water resources and aquatic environments from each catchment to the sea (Teodosiu, 2003).

It is a very complex and challenging strategy, which should integrate all the relations between the natural and the socio-economic environment that contribute to water quantity decrease water quality deterioration. This integrated and comprehensive process includes pollution control and prevention, land-use planning, agricultural policy and erosion control, environmental management and stipulates the involvement of all stakeholders within the basin in the process of water resource management.

At EU level, the Water Framework Directive (WFD) represents the third generation of standards intended to establish common policies and EU laws regarding water resources. Since the 1970's, the EU law system regarding water resources has been characterised by a set of regulations with considerable importance for the improvement of the quality of the water resources shared within the European Union boundaries. The two previous attempts to approach this matter which preceded the elaboration of the WFD (one in the 1970's/1980's², and another in the 1990's³) can be, more or less,

² Through the Directive n° 80/778/CEE, from the Council, published the 15th July 1980; Directive n°84/491/CEE, Directive n°86/280/CEE, Directive n°88/347/CEE and Directive n°91/162/CEE.

³ Fundamentally through the Directive 91/271/CEE from the Council, published the 21st May 1991; and the Directive 91/676/CEE from the Council, published the 12th September 1991.

considered as failures. The lack of success in applying them is fundamentally a consequence of the non-fulfilment of such directives by the Member-states of the EU, the considerable deficiencies of the EU law system and the lack of control by the European Commission (INAG, 2001).

However, in 1995, the EU Council and the European Parliament appealed to the Member-states to review the EU water policy in order to create a new framework-directive which should establish the basic principles of a sustainable water policy in the EU. In 1996, the European Commission initiated the process which was designed to create the above mentioned framework-directive, with the purpose of improving and eliminating some of the inconsistencies and shortcomings of the EU law system regarding water resources and to define the principles upon which the common policy regarding the water should be based.

The purpose of this framework-directive, which was approved in 2000⁴, was to establish the framing for the protection of interior superficial waters, transition waters, coastal waters and groundwater with view to:

- Avoiding the continuation of aquatic ecosystems degradation, protecting and improving their present condition, as well as the one of land ecosystems and wetland which directly depends on
- The aquatic ecosystems in what concerns its water supply needs;
- Promoting a sustainable water consumption based upon the long term protection of available water resources;
- Reinforcing the protection and improving the water environment, namely through specific measures regarding the gradual reduction of discharges, emissions and losses of primary substances and the suspension or elimination in different phases, of discharges, emissions and losses of such primary substances;
- Ensuring the gradual reduction of groundwater pollution; and
- Contributing to mitigate the effects of floods and droughts

The Water Framework directive (WFD) adds a fundamental principle of management to the existing EU law system regarding water resources: that of the hydrographic basin as a management unit, with view to integrating different types of water masses as well as the associated ecosystems which depend on them. This directive stipulates that Member-states must identify the existing catchments within their territory and include them in river basin districts.

The use of catchments as management units confronts us with two different types of questions: questions which regard the conciliation of these with the administrative units, a fundamental aspect for the use of statistic data collected and produced by the different institutions and questions which concern the sharing of water resources. This is the case with international catchments, as the Member-states involved should, in the scope of the WFD, designate an international hydrographic region. Only an integrated approach, bearing in mind the surface waters and the groundwater can respect their natural interaction both in terms of quality and quantity. This integrated approach also implies the association of environmental goals concerning water quality and reduction of pollution at the source.

⁴ Directive 2000/60/EC of the European Parliament and of the Council of 23rd. October 2000, establishing a framework for Community action in the field of water policy.

The European Water Framework Directive (WFD) introduces several innovative concepts for sustainable water management, of which public participation is one of the most important. Although some provisions concerning public participation are contained in Annex VII A.9 and 11, the starting point for the consideration of participation is found in Article 14 of the WFD which provides that “member States shall encourage active involvement of all interested parties in the implementation of the Directive, not only regarding the development of a river basin management plan, but from the very beginning of the implementation of the WFD (EU, 2000)”. Therefore, the identification and analysis of local networks is of utmost importance task to follow the governance principle displayed on the WFD.

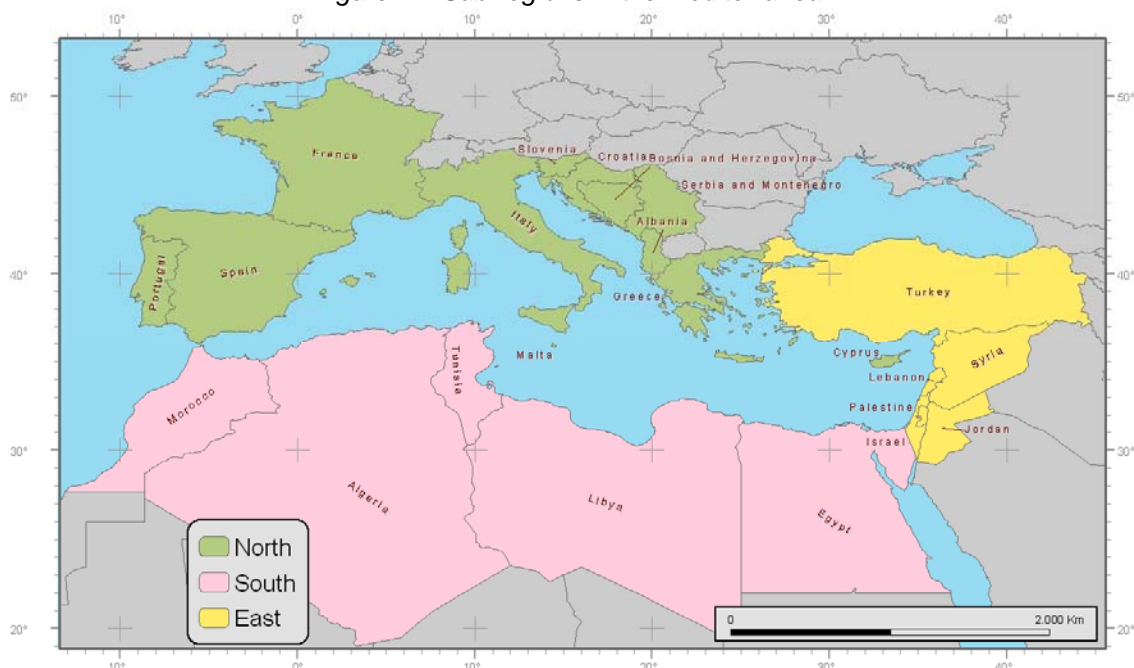
Water management presents specific difficulties due to its various uses and to the important functions that it performs in almost all aspects of human activity. It is not always possible to harmonise the various uses of this scarce resource. Thus the sharing of water resources requires management based on rules that render possible its harmonious appropriation, establishing priorities in use, regulating the interactions of the various social actors (individual and collective), or in other words regulating the conflicts not only among these various actors but also among the various users of the water.

2.2 The Mediterranean Region: physical and human setting for water management

The Mediterranean region is defined as countries bordering the Mediterranean Sea (or within the influences of the Mediterranean climate) between about 27° to 47°N and 10°W to 37°E. It includes 25 countries that, according with Margat and Vallée (2000), can be sub-divided in three major sub-regions (Figure 1):

- **The North:** Portugal, Spain, France, Italy, Malta, Bosnia-Herzegovina, Croatia, Slovenia, Serbia-Montenegro, Albania, and Greece;
- **The East:** Turkey, Cyprus, Syria, Lebanon, Israel, Palestinian Territories, and Jordan;
- **The South:** Egypt, Libya, Tunisia, Algeria, and Morocco.

Figure 2 – Sub-regions in the Mediterranean



This region was chosen (since the Bronze Age) by different people to settle, being the place where some of the oldest cultures of the planet began their development. Nowadays, the Mediterranean can be seen as a border region, separating contiguous regions with contrasted levels of development and opposite demographic trends. The coasts of the north are characterised by intense concentration of urban population and industrial activities, while the south and east is for the most part arid with little urbanisation or industrialisation.

The climatic conditions of the region favoured the development of agricultural systems (and of important irrigation systems) where olives, citrus fruits, grapes, and cork play a major role. However, tourism is today a major source of income for many of the countries in this region, corresponding to 33% of the world's international tourism (Benoit and Comeau, 2005). Both of these activities exert strong pressures over water resources, which in a region located in the border of the desert require a special attention from decision-makers, water managers and water users.

2.2.1 Rainfall and temperature

Water is one of the features of the physical setting that more clearly contributes to the individuality of the Mediterranean region. The strong seasonality of the precipitation (together with its strong irregularity, which makes difficult the development of effective strategies for water management) produces a summer-dry, winter-wet rainfall pattern that is extremely rare, and is only found in a small number of regions on Earth.

During summer, the Mediterranean region is dominated by the subsidence of subtropical high pressure cells, which suppresses cloud development and precipitation, while during winter the subpolar low pressure cells with its associated cyclone belts provide the uplift of air masses and brings rain to the region. During spring and autumn intense downpours can cause rapid runoff, and initiate landslides on unstable slopes.

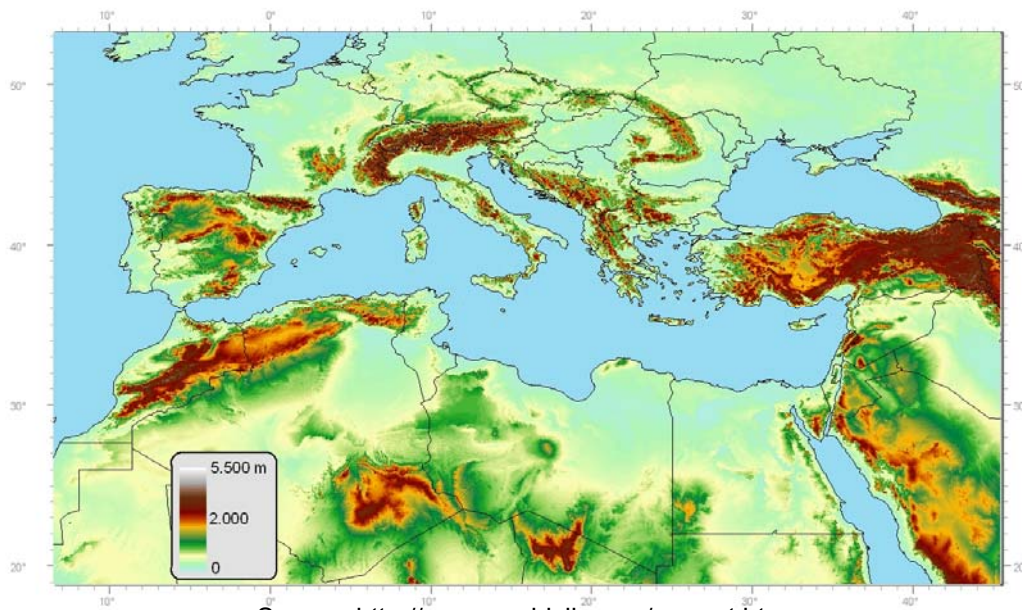
As a result the Mediterranean region receives almost all of its yearly rainfall during the winter season. Summer drought, which can stretch from 2-5 months, produces great stress on the local vegetation, but plant structures have evolved to adapt to it.

Temperatures during winter rarely reach freezing (except in areas with a high elevation), and snow is very exceptional. Inland locations sheltered from or distant from sea breezes can experience severe heat during the summer.

The mountain regions that surround the Mediterranean Sea (Figure 3), through the altitude and slopes, introduce some variation to this rainfall and temperature regimes, and the regions where the hot summer-dry, mild winter-wet rainfall pattern is more intense correspond to a fringe that borders the Mediterranean Sea.

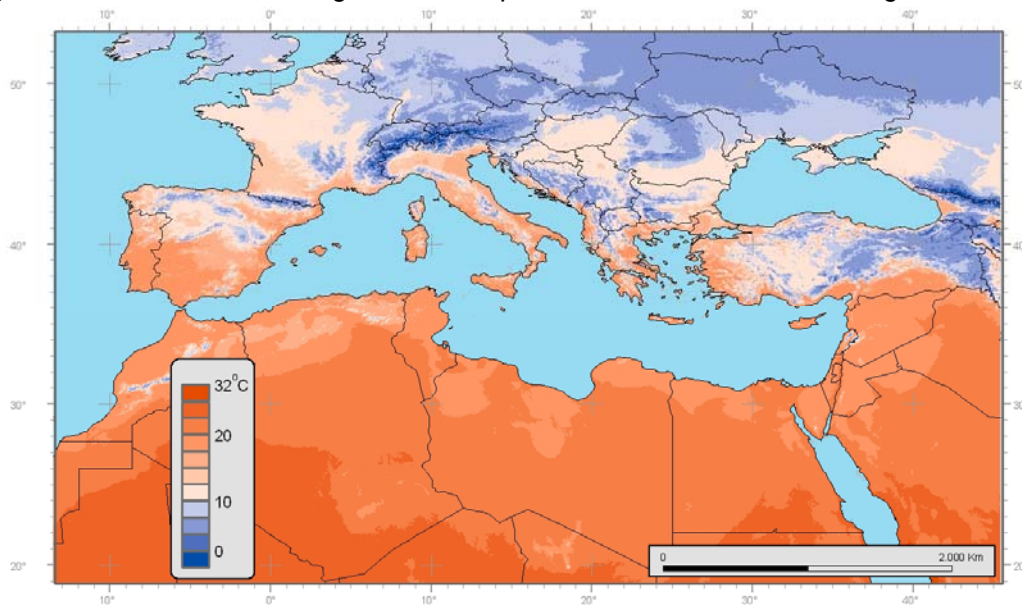
The maps in Figures 4 and 5 show the clear contrast between the north and southern margins of the Mediterranean Sea in what refers to average annual temperature and average annual rainfall, for the period of 1961-1990. Average annual temperatures lower than 10°C are felt in higher latitude regions and in the areas undergoing the effects of altitude in temperature decreasing (Figure 4), specially in the most important mountain ranges, where the annual average temperature is lower than 5°C.

Figure 3 – Topography in the Mediterranean region



Source: <http://www.worldclim.org/current.htm>

Figure 4 – Distribution of average annual temperature in the Mediterranean region, 1961-1990

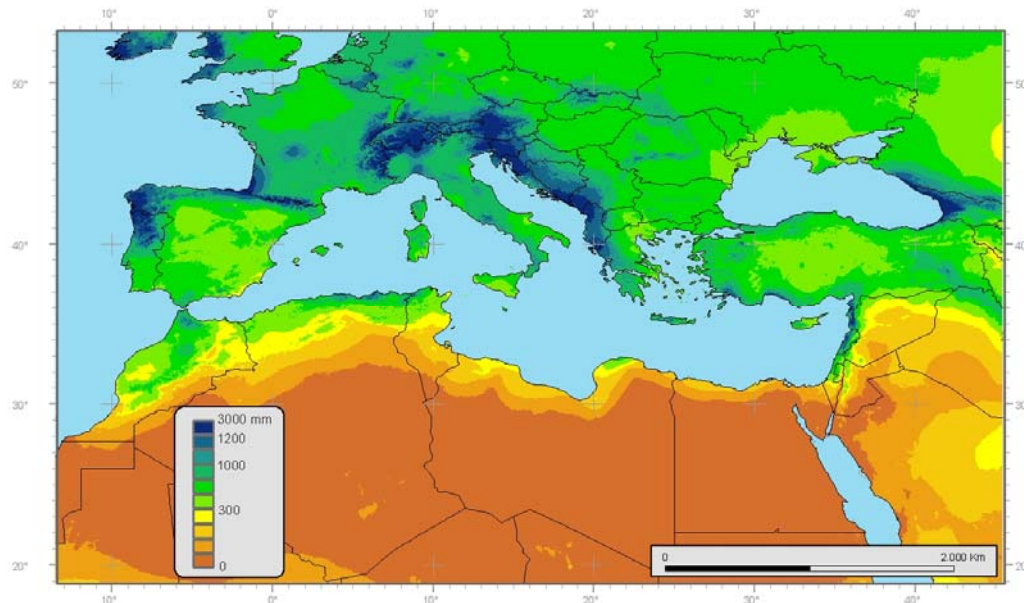


Source: <http://www.worldclim.org/current.htm>

The spatial distribution pattern of precipitation (Figure 5) shows also the influence of the mountain areas as a factor of rainfall. The north-western sector of Iberian Peninsula (subjected to the influences of wet Atlantic air masses) the Pyrenees, the Alps and the Adriatic Coast are the regions with higher rainfall with more than 1200mm of annual precipitation. However, the most striking distinction is between the regions to the north and to the south of the Mediterranean Sea. The mean annual precipitation in the Mediterranean regions is about 560mm/year (Vallée and Margat, 2003). The southern regions (where the influence of the subsidence of subtropical high pressure cells is more

permanent), are much drier (171mm/year) than the northern regions (852mm/year). In fact the less dry areas are located in a narrow fringe in the north of Morocco, Algeria and Tunisia.

Figure 5 – Distribution of mean annual precipitation in the Mediterranean region, 1961-1990



Source: <http://www.worldclim.org/current.htm>

2.2.2 Population and economic growth

Water resources are a societal issue. Considered frequently as a common good, water is essential to life and to numerous human activities, and suffers their negative impacts. In the Mediterranean region, the significance of irrigated agriculture, the intense urbanisation, and the tourism are increasing their demands for water, requiring therefore important efforts to find new strategies to better manage this scarce resource.

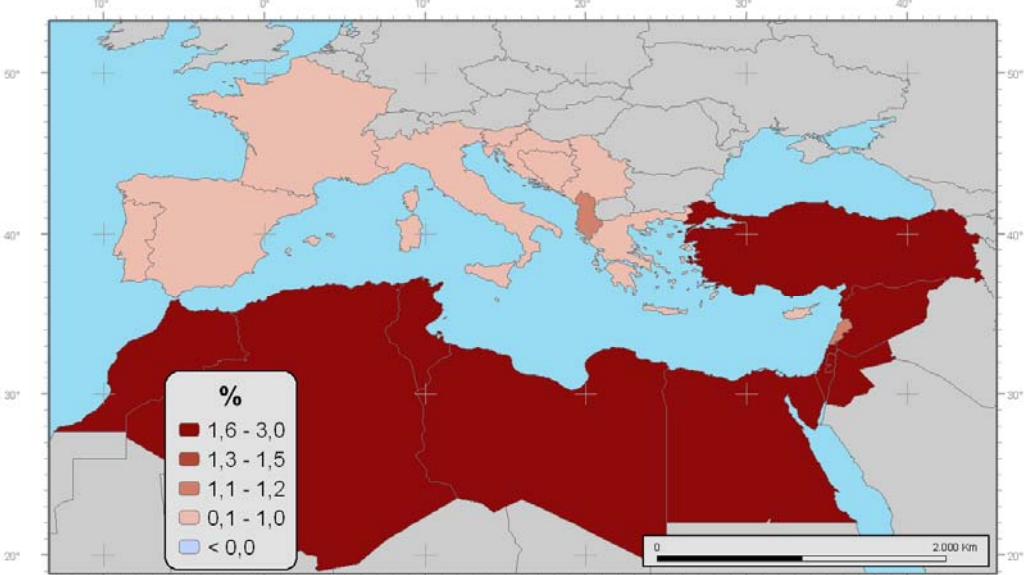
Population issues are the dominant factor in the drivers for changes in water resources management. According to the United Nations (UN) estimations, the total population in the Mediterranean region will rise from around 299 million inhabitants in 1970 to 448 millions in 2000, to about 562 millions in 2025 (UN, 2005). These figures show a decrease in the rate of the annual population growth. From 1970-2000 it was registered a annual growth of 1.6%, while for the period 2000-2025 the estimated annual growth is 0.8%. Furthermore, the growth of total population for 2000-2025 is estimated higher (as it was already in the previous period) in the South and East countries (1.4% and 1.6% respectively) that in the North (0.1%) where the population trends to stabilize or decrease (Figures 6 and 7).

These figures show clearly that there are two different population dynamics in the region. An ageing population with low growth rates in the countries of the North, and a young and rapidly increasing population in Southern and Eastern countries.

Furthermore, these demographic dynamics are intensified by the increasing growth of urban population (Figures 8, 9 and 10). Urban culture was always a significant feature of the societies

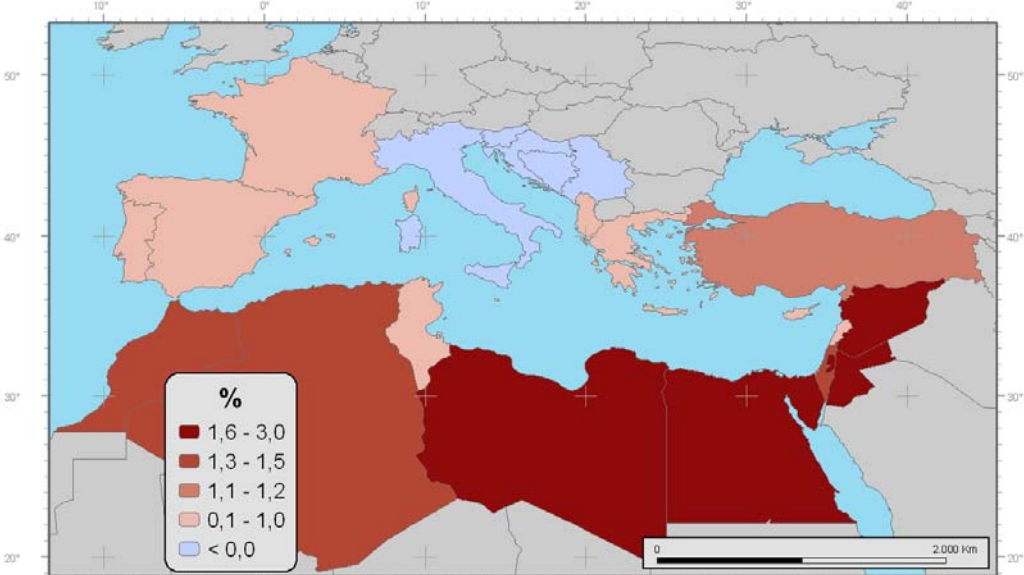
developed in the Mediterranean Region. Nevertheless, it was mainly in the 20th Century that a strong movement of the population towards cities took place. According to the United Nations estimations, in 1970, 48.5% of the total population lived in urban areas. This figure increased to around 64%, in 2000, and is estimated to growth to about 73% in 2025.

Figure 6 – Annual Growth of population 1970-2000 in the Mediterranean region



Source: UN, 2005

Figure 7 – Annual Growth of population 2000-2025 in the Mediterranean region



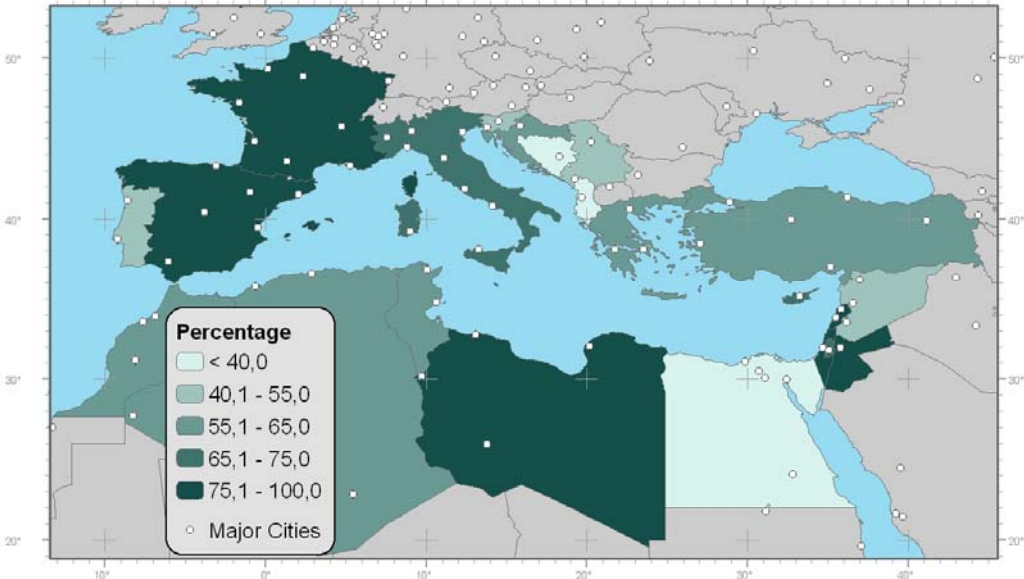
Source: UN, 2005

The UN estimations show that there will be a decrease in the rate of urban population growth in the Mediterranean region. In the period 1970-2000, the urban population increased at an annual rate of 2.6%, while for the period 2000-2025 the estimated annual growth is of 1.4%. Moreover, the annual

growth of urban population continues to be higher in the South and East countries (2.0%) than in the North (0.7%). Nevertheless, this continuous (although slower) growth of urban population shows converging rates of urbanisation but different urban dynamics (Benoit and Comeau, 2005):

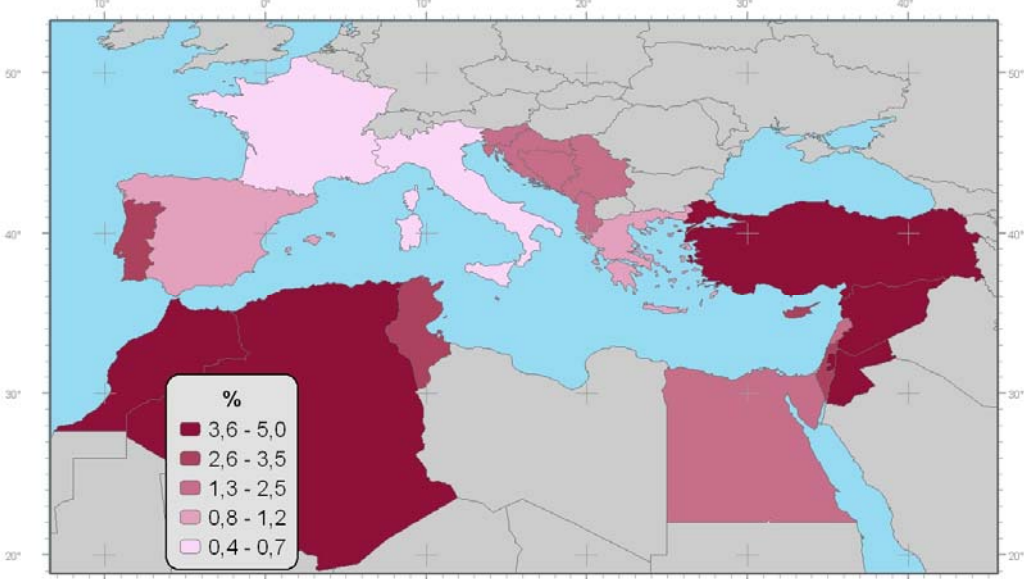
The northern countries register less inhabitants in city centres, and strong urban sprawl with dispersed population and employment, inducing the growth of built-up areas and loss of agricultural lands, requiring the implementation of new water supply and treatment systems.

Figure 8 – Urban population in 2000 in the Mediterranean region



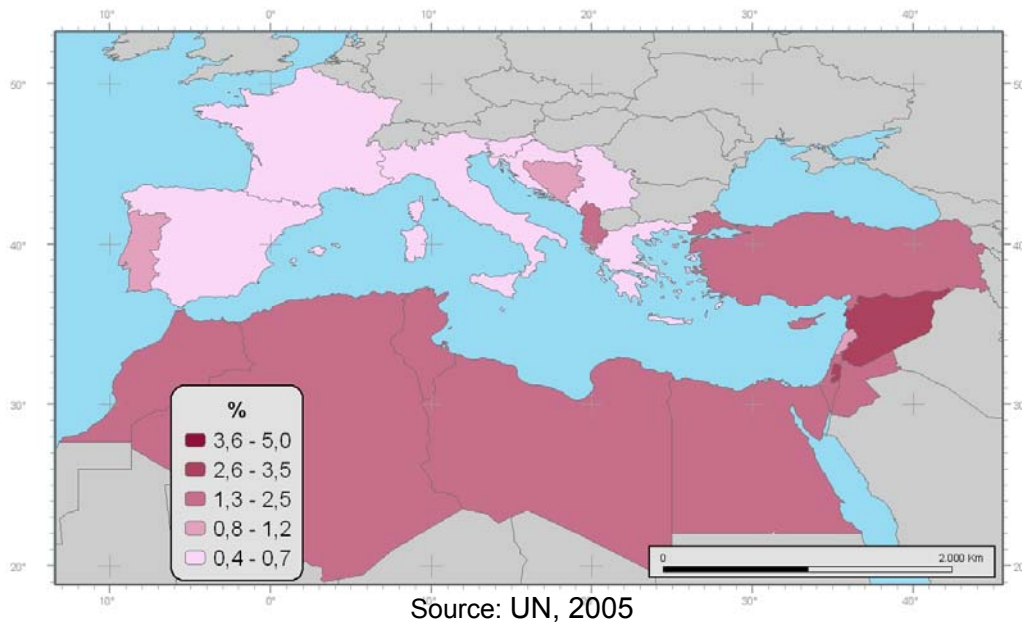
Source: UN, 2005

Figure 9 – Annual Growth of urban population 1970-2000 in the Mediterranean region



Source: UN, 2005

Figure 10 – Annual Growth of urban population 2000-2025 in the Mediterranean region



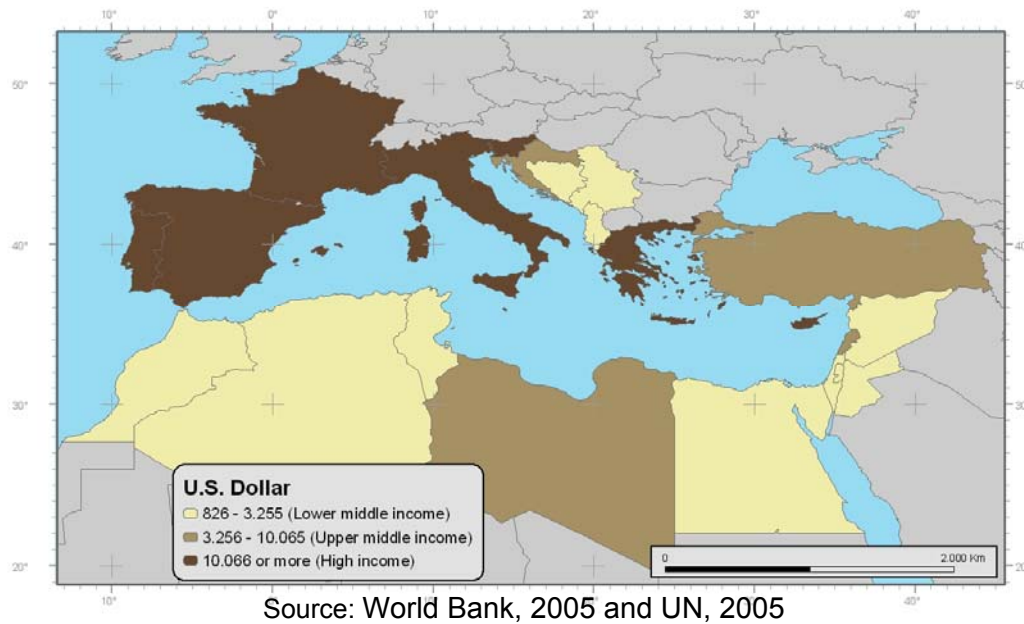
The southern and eastern countries register a strong urban growth without any real economic development, very young urban population with high rates of unemployment, expanding urban areas with increasing unregulated housing, limited technical and financing capacities in the cities to face the needs of adequate water supply and treatment. In 2025, about 390 million of people will be living in urban areas, and a great amount of this total will be concentrated in the coastal areas. The pressures exerted over water resources, both in freshwater and coastal waters, will contribute to increase their scarcity and degradation of the quality. Measures to manage water demand are required to ensure the sustainability of water resources in the region.

The differences in terms of economic development between North, South and East Countries of the Mediterranean region are clear (Figure 11). According to the classification of World Bank, the high-income economies (Gross National Income higher than 10 066 US\$) are represented by the European Union countries. The South and East countries are mainly lower middle income economies (Gross National Income between 826 US\$-3 356 US\$), with the exceptions of Libya, Lebanon and Turkey that are countries with upper middle income economies (Gross National Income between 3 356 US\$-10 066 US\$).

Furthermore, the economic disparities between North, South and East countries are also revealed by the contribution of each of the three sub-regions for the overall GDP of Mediterranean region (about 5141 billions of US\$, in 2003): 87% is produced in the North countries, 5% is produced in the South countries, and 8% is produced in the East countries (World Bank, 2005 and UNDP, 2005). The GDP per capita, in 2003, was about 8000 US\$ in the region. However there are sharp contrasts. The GDP per capita of North countries is 5.7 and 3.2 higher than it is in South and East countries, respectively.

One of the main results of these economic disparities is the intensification of the migrations towards urban areas and from the South to the North countries.

Figure 11 – Distribution Gross Domestic Product per capita, in 2003, in the Mediterranean region



2.2.3 Water abundance and water scarcity

The Mediterranean region has a key common environmental feature that is related with the existence of a more or less longer dry and hot season. This creates important stress on water resources due to irrigation needs. In fact, in this region, irrigation cannot be seen as a way to increase and improve agricultural productivity. Irrigation in the Mediterranean region is essential to ensure agricultural productivity. Furthermore, there is a clear contrast between northern areas (receiving abundant water resources from temperate regions) and southern areas that are adjacent to semi-arid regions, with very scarce water resources.

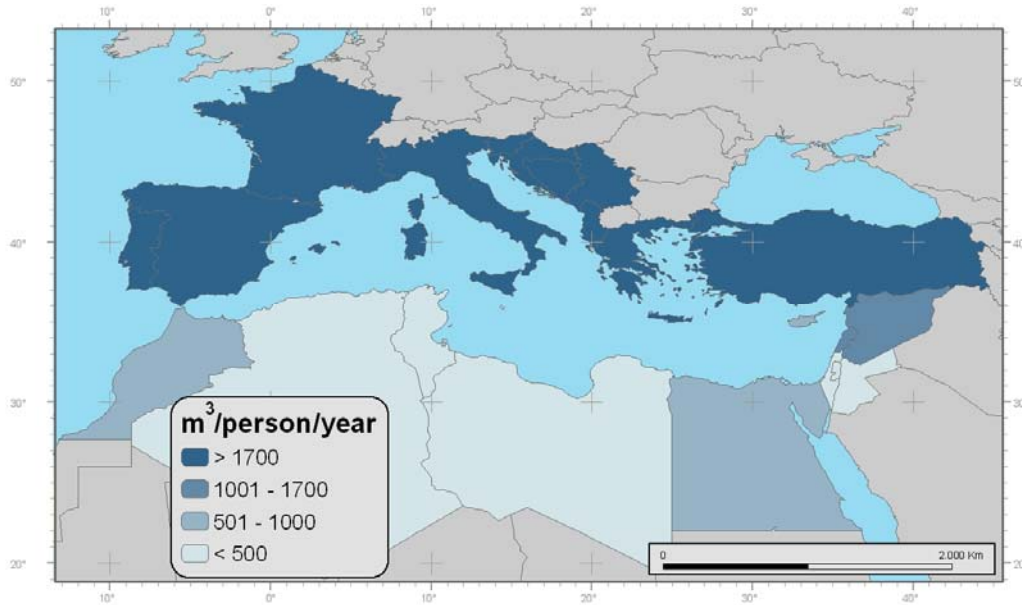
Water in the Mediterranean region is a scarce and unevenly distributed resource. Agriculture accounts for 65% of the total demand in the region, especially in the countries from the South and East, where 80% of the demand is related with agriculture (Benoit and Comeau, 2005). However, the pressures over water resources induced by human activities are contributing for the degradation of water quality, triggering other situations: the rising of costs due to the need of water treatment; health risks; and conflicts of use between users, major sectors, regions or countries.

According with Benoit and Comeau (2005), in the Mediterranean region 108 million of people were living, in 2000, in countries with access to less than 1000m³/person/year. This amount formed the water-poor populations. Of these, 45 million of people were living in absolute scarcity, with access to less than 500m³/person/year.

Figure 12 shows how water resources are unevenly distributed in Mediterranean region. According to the classification of Falkenmark and Widstrand (1992), the North countries (plus Turkey) have a situation of no water stress (access to more than 1700m³/person/year). In clear contrast the South and East countries are living in situation of water stress, especially Algeria, Tunisia, Libya, Israel, Palestina and Jordan that have access to less than 500m³/person/year.

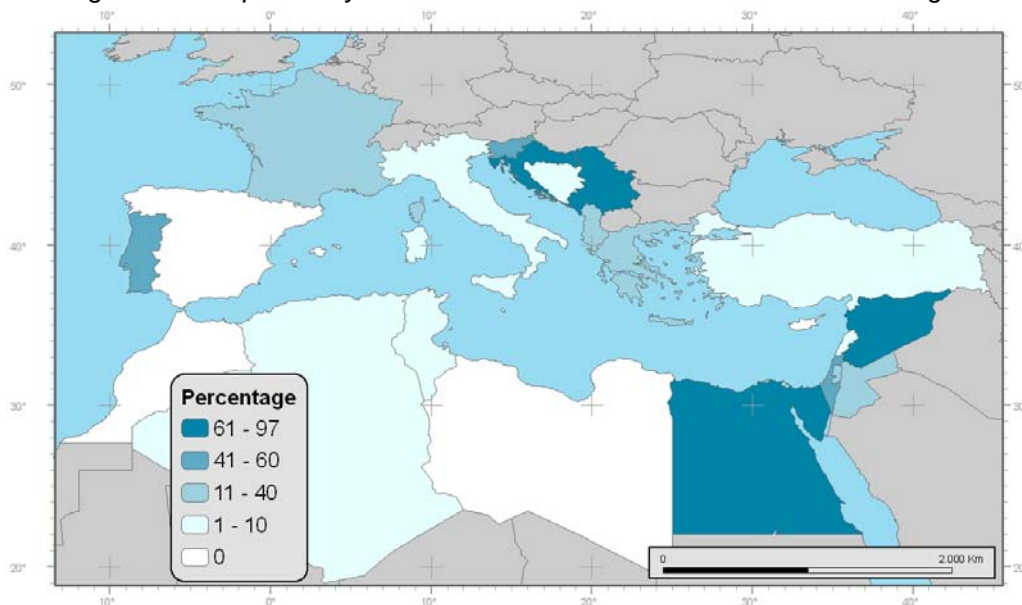
Furthermore, the dependency ratio from external water resources is also very different among the countries of the region (Figure 13). This figure shows us the potential for tension, and also for cooperation in sharing water resources in the Mediterranean Region.

Figure 12 – Availability of renewable water resources per capita per year in the Mediterranean region



Source: WRI, 2005

Figure 13 – Dependency ratio of water resources in the Mediterranean region



Source: WRI, 2005

2.3 Institutional setting and decisional context for water management in the Mediterranean countries

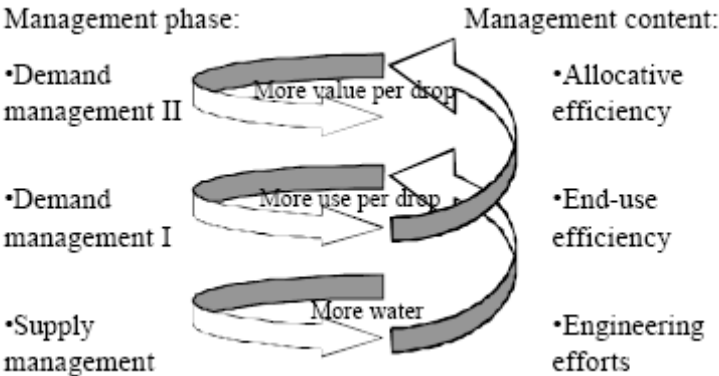
In the Mediterranean basin, wide differences in water supply and demand characteristics exist and no individual case study may be a representative of the entire region. Some countries suffer problems of overexploitation of groundwater while others suffer from water quality degradation. On the other hand, some have enough or plentiful water but lack institutional structures to manage water efficiently, while others have scarce and limited water and seek non-conventional water like desalination or importation of water.

The modalities of water appropriation and management have evolved during long-time, but water remains a focal issue of the interactions nature/society being submitted to different types of policy options. However, these interactions have also been since long-time regulated through the law (PNUE/PAM/PLAN BLEU, 2004). In the last years, the increasing scarcity of water resources, and the induced tensions and conflicts, were responsible for the recognition of water as belonging to the public domain.

Managing water resources was traditionally approached by the supply sector, building reservoirs, and distribution network systems, finding new water sources. It was considered that the major strategies should comply with the needs of humans in terms of drinking water, food, etc. Although this continues to be a major obligation for human societies, it is also clear that water is necessary for more than domestic use or production of food (Lundqvist, 2000). Water is also crucial for the functioning of ecosystems, and for the goods and services these ecosystems produce to society, therefore to the sustainability of societies' development. Nowadays water management must be dealt in terms of change and adaptation: both in society itself and in society's interactions with nature.

Lundqvist (2000) approaches the changes in water management as different turns of a screw (Figure 14). In a first moment, scarcity is recognised as a pure natural resource scarcity and the remedy is to "get more water", which is accomplished by large-scale engineering efforts. On a second moment, it is recognised that it may no longer be possible to develop additional large volumes of water. The effort at this stage is re-directed towards efficiency measures, predominantly to get "more use per drop". This often induces significant changes in national policies, through the adoption of demand management strategies aiming at producing more with less water or to produce higher economic values from available water resources.

Figure 14 – The turn of the water screw



Source: Lundqvist, J. (ed.) (2000)

2.3.1 Mediterranean Countries

The water demand management is almost absent from the water sector in almost of the involved countries. This is mainly the result of cheap water prices that encourages wastes, shortage of conservation and lack of knowledge among users of methods and techniques to use efficiently water resources. All of this reasons, encouraged by the low water prices policies in these countries, had led to water shortages with serious environmental and health hazards to part of population.

In the past, water policies in this region focused on the supply management of water resources (Ahmed, 1993). Water policy was synonymous of irrigation policy, the objective being to expand irrigated areas through investments in irrigation and drainage systems. Water development projects included building dams, reservoirs, well fields, and canal or pipe networks.

Demand management of water resources was not directly included in water policies in the past in most of the Mediterranean countries partly because the focus, initially, was on expanding the supply and partly because socio-culturally water was believed to be free. Lack of demand management practices in the past also contributed to low efficiency in water use and consequent water losses. In addition, improvements in water stemming from introduced high technology in the past diverted attention from demand management and reduced emphasis on low-cost alternatives such as improving efficiency, conservation and decline of losses through maintenance (Ahmed, 1993).

Although other economic and social factors were responsible, water policies contributed to the trend in decreasing food security in many of the countries of the Mediterranean Basin in the short run and to an overexploitation of the water resources. In addition, the pressure of population, which is growing has increased the vulnerability of the economies of most countries of this region.

2.3.2 Implementation of Policies

In EU countries, the process of water resource management is driven by a clear compulsory end point: the water status has to be good after WFD implementation. However, Mediterranean Partner Countries (MPC) are not bound to any international duty to achieve certain objectives in their watersheds. The responsibility of carry out different measures should be shared among public authorities and stakeholders depending on competencies. This requires building capacity of involvement of all interested partners in catchments' planning and managing. The key measures to be implemented should be:

- Allocation of financial and human resources for responsible administrations (government prerogative). The countries' administrations in the region have some shortages of human resources and funds to carry out the tasks necessary for proper catchments' management. This shortage is also seen about knowledge and skills in the light of new EU perspective, although this kind of capacity is gradually improving;
- Assessment and collection of data needed for decision making by (re) designing monitoring programs, added scientific research and/or by analysing the results of international research projects, experiences, and all available national data;
- Involvement of national experts into water protection projects;

- Design seminars for stakeholders with targeted relevant information (some general information on watershed management) in an easily understood way with possible cooperative proposals (clear benefits should be stated). Of particular importance is the integration or coordination of spatial planning and basin management, which should discuss with the responsible institutions for spatial planning (municipalities, counties);
- Development of integrated GIS databases for decision making support;
- Assessment of technical equipment needs and filling the gaps;
- Training courses for local and state managers, with experience exchange meetings.
- Curriculum adjustment of academic programs to align contents with water management needs. This will create national human resources and expertise needed for successful management of the water at the national and in catchments.

In the long-term the growing water demand of Mediterranean countries can only be met from three sources. These are the use of renewable water sources; desalinating sea water; and reallocating irrigation water to more productive uses. For many countries the first alternative is no longer possible, and for many others it will provide water for only a decade or two. Desalination of sea water is a solution, but an expensive one. However, in the long-term it seems likely that it will become even more important as other water sources are fully used, having the great advantage of the limitless amounts of fresh water which can be produced. Finally, the reallocation of irrigation water could be the most likely immediate solution to water demand problems over the next two decades, but depends of political decision (Beaumont, 2000).

Water policies in the region need to face:

- A lack of tradition of public involvement and integrated work with other institutions trying to achieve common goals;
- A public more concerned for its well-being than for the environment, posing a challenge for environmental administrators, since raising economic welfare is beyond their jurisdiction;
- Lack of capacity both for the administrations and the stakeholders to effectively manage watersheds;
- Lack of environmental awareness and responsibility among non-environmental and even some environmental administrations, as well as among stakeholders;
- Lack of data for identification of problems, assessment of the state of water resources and economic and stakeholder analysis.

2.3.3 Country analysis

Algeria

The Ministry of Water Resources is responsible for the management of the water resources in the country. Eight directorates are specialised in the various aspects of water management: Studies and Hydraulic Works; Mobilisation of the Water Resources; Water Supply; Protection of the Environment; Irrigation; Budget; □ Human resources, Training and Co-operation; and □ Planning and Economic Affairs.

The Ministry for Water Resources co-ordinates the activities related to water management at national level while each wilaya (department) has a bureau for hydrological questions; the "Direction de l'Hydraulique de Wilaya". Yet the Wilaya itself falls under the responsibility of the Ministry of Interior.

The present and implemented juridical scheme is mainly based on legislative laws dealing with the following domains: water resources, health, environment, regional and local administration, and finance.

Recently the Government has set-up new agencies, which report to the Ministry of Water Resources, for management of the water supply and the wastewater management. All of these agencies report.

- The "Algérienne des Eaux" (ADE) is a national public agency with an industrial and commercial character) with the task of: ensuring the needs for water; ensuring an efficient management of the resources; and of giving water its true value in order that the costs of management and operation can be recovered.
- The "Office National d'Assainissement" (ONA) was established after it was found that there was a complete lack of interest in the matter of waste water management within the government. An important task of the ONA is to develop a policy of re-utilisation of treated waste water.
- The "Agence Nationale des Barrages et des Grands Transferts" (ANBT) will be created in the near future as an EPIC. This new agency will be responsible for the dam and the transfer of water over great distances.
- The "Agence Nationale de l'Irrigation et du Drainage" AGID will be established as an EPIC out of the present Agency for the management of the irrigation infrastructure.

Croatia

In Croatia Two ministries share the responsibilities in the fields of water resources management at national level. The Ministry for Environmental Protection and Physical Planning and Construction has (among others) the responsibility for governance at the country level of water protection. The Ministry for Agriculture, Forestry and Water Management through its Directorate for Water Management controls and monitors overall water resources management process in the country.

The major part of the country water system (State waters) management has been entrusted to Croatian Waters. It is a public institution with the following main activities: general water management; studies, data and project assignments and revisions; investing and other financial issues; co-ordination of plans for water use; set-up and maintenance of integrated data systems in water management; control, survey and informing upon water conditions; maintenance and regulation of watercourses; ice and flood control; construction and maintenance works in water management; designing water control systems and other systems in water-related activities; protection of water resources; development and monitoring of water supply; usage control and other protective measures; and, enforcement of legal sanctions in water conservation.

At lower administrative levels, water management varies significantly, according to specific hydrological conditions of the area. In many cases, the same institutions are entrusted with water supply, sewerage management and solid waste management.

The "Water Law" was effective on January 1996, and it is a basic water law, which regulates water management. This Act regulates legal status of water and water resources, mode and conditions of

water resources management (use of water, water protection, development of watercourses and other waters and protection against harmful effects of water).

Generally speaking law is well enforced especially in relation to collection of the water and wastewater charges and control of water use. Water authorities are well organised and that's why most of the requirements by law are strictly implemented. However, there are several areas where law is not enforced. Planning of water resources management is the one area, which is not implemented at all in accordance with The Water Law. A second example of bad enforcement of the law is the National Water Protection Master Plan, especially because is not harmonised with a Water Resource Plan which does not exist. Such situation jeopardises all needs related to protection of water resources against pollution.

Cyprus

In Cyprus, water management is mainly in the hands of the Water Development Department (WDD) of the Ministry of Agriculture, Natural Resources and Environment but in a lot of cases only in an advisory capacity. The WDD is responsible, amongst other tasks, for the following: Suggestion of water prices; Water allocation for all sectors on an annual basis; Management of Governmental Water Schemes; Selling of water in bulk quantities from Government Water Schemes to Town and Municipal Water Boards and Community Boards; Monitoring of aquifers and streams; and Technical support for the District Officers. However, legal power lies mainly with the District Officers of the Ministry of the Interior.

The existing legislation is rather complex and is covered by numerous laws some of which have been in existence since the colonial administration of Cyprus by the United Kingdom (1878-1960). Legal power is currently divided between several Ministries: The Ministry for Agriculture, Natural Resources and Environment, the Ministry of the Interior, the Ministry of Health etc. Within the Ministry for Agriculture, Natural Resources and Environment, different Departments are responsible for specific water related issues.

This situation with overlapping jurisdictions, leads to decisions taken by one authority without seeking concurrence from the other authority, which is responsible too. The consequences are conflicting resolutions that do not always contribute to the efficient and integrated management of water. The reason for which conflicting resolutions arise is due to the fact that there is no overarching "National Water Authority" yet in Cyprus that will resolve disputes arising among Government Departments.

Egypt

In Egypt three main public agencies share the responsibilities in what concerns water management.

The Ministry of Water Resources and Irrigation (MWRI) plays a key-role and is the main Government organisation responsible for the development and management of the main water system in Egypt. The ministry is in charge of development, distribution and management of water resources, and development, operation and maintenance (O&M) of the associated water works. The Ministry is also responsible for collection and disposal of agricultural drainage water, monitoring and assessment of water quality of the various water sources, and protecting the coastal lakes and the shoreline.

The Ministry of Agriculture and Land Reclamation (MALR) is involved in improving agricultural activities and land reclamation, including water management at the on-farm level. The jurisdiction/mandate of the MWRI extend from the Nile river down to the main- and secondary-canal

levels, as water assets are publicly/state owned down to the secondary-canal level. The tertiary-canal and on-farm levels are privately owned by farmers. However, the MWRI and MALR are entrusted to help farmers improve water management at the mesqa and on-farm levels respectively.

The Ministry of Housing, Utilities and New Communities (MHUNC), provides water services to the municipal and industrial subsectors. The main water system managed by the MWRI feeds the water infrastructure system managed by the MHUNC. On the other hand, the wastewater treatment plants managed by the MHUNC are essential water pollution control facilities to maintain water quality in the main system.

The main characteristics of water rules are set by Law 4/1994. This law deals with marine pollution in general and land based sources which need treatment before disposal. It sets limits on possible discharge in the marine environment. In addition, the National Organisation for Potable Water and Sanitary Drainage, (NOPWASD), through the Water and Wastewater Institutional Support project (WWISP) had proposed water and wastewater standards.

France

The current French Water Management System rests on underlying principles which appears through the successive Water Acts from 1964 to 2004.

The principle of water management at hydrographic basin level stems from the 1964 Water Act and was reinforced by the 1992 Water Act. It involves the participation of waters users in the design of water policies integrating local and natural scale in the decision-making process. In this system it is stressed the great importance of implementing dialogue processes between stakeholders. However, these processes require reliable information flows between all stakeholders and technical staffs to research and deal with data, which is face to the large number of Water actors involved.

Six administrative units were created corresponding to Hydrographic Basins, Decision Authorities are implemented (Basin committees) and linked to financial agencies (Water Agencies). These agencies take royalties being used to finance through multiannual programs: investments intended to protect the resource; to fight against diffuse pollution; and the capital expenditures corresponding to measurements of depollution and cleansing.

The organisation of basin management is implemented through the Basin Committee composed of territorial elected (40%), water users¹¹ (40%), government departments representatives (15%), socio-professionals organisms representative or members of socials and economics regional Councils. These committees should develop Water Development Plans and Water Management Master Plans at basin level valid for 15 years.

The national water policy is defined by the Interdepartmental Water Mission, which gathers the central directions of all concerned ministries, and the National Water Committee, composed of Government, and elected users' representatives.

Greece

The most pressing issue when analysing the Greek water resources management system, seems to be the fact that there are many government departments dealing with water problems, but their activities are compartmentalised and not well-coordinated. Added to that is a water law system which is old-fashioned and widely scattered, thus permitting overlapping functions, multiple advisory bodies and insufficiently decentralised management responsibilities through regional organisations.

The law tends to be also deficient in the case of pollution issues, where quality standards for water bodies and/or effluent have not been clearly established. Furthermore, the sporadic consideration of water quality from a policy point of view and the absence of systematic, uniform and enforceable pollution charges have compounded problems of integrated water management (Dalacu, V.P., 1998). Finally, an important problem relates to the fact that Greece shares water with neighbouring countries. Agreements are still pending with regard to various water uses, as well as water discharges and water quality levels for the watercourses crossing the Greek frontiers (Karavitis, C. A., 1999b).

All of the above imply for Greece that there are not only continuous conflicts at all levels (individual, local, national, and transnational), but that incongruence and conflicts will further increase as demands change and the social structure of the country is transformed. Such observations are reinforced by increasing demands, misuses and abuses of water arising from rapid urbanisation, industrialisation, uncontrolled agricultural practices and the overall economic pressures from rising standards of living. Thus, present and potential future conflicts become the driving reasons for a comprehensive framework of integrated planning and management of water resources and for developing an institutional framework capable of implementing properly conceived and articulated resource policies (Vlachos E.C., and Karavitis, C. A. 1996).

Israel / Palestine

Both Israel and Palestine have national legislation dealing with the management of water resources. Both countries have laws dealing with water quality control, pollution prevention, water use and allocation and water pricing. The legislative system in both countries is extremely centralised with little room for direct stakeholder input. They both share the idea that water is deemed public property and as such is owned by the people and not the state. The state is however responsible for management and private use requires a license.

In Israel there is now a move to some form of decentralisation with the privatisation of some municipal water services in the form of water utilities. In Palestine in the past, local control of water use existed in certain villages and localities although today this is rare and the Palestinian Water Authority (PWA) makes most water-related decisions. However, the issue of sovereignty over water resources has still not been successfully dealt with between Israel and Palestine.

Israel's Water Law was legislated in 1959 and amended in 1971 and 1996. A water commission, headed by a water commissioner was established overseen by Minister of Infrastructure. The Water Commissioner is responsible for allocation of resources, development of new water sources and water policy in general, with a Water Council serving a marginal role as "advisor". Since 1989, Israel's Ministry of Environment has been empowered to promulgate secondary legislation and to initiate criminal prosecutions of violators. The Ministry of Health oversees drinking water standards, as well as sewage treatment and wastewater reuse standards. In addition, sewage treatment itself is the responsibility of local authorities that are overseen and largely funded by the Interior Ministry. A recent law seeks to privatise the treatment via municipal overseen corporations.

In 1994 as an outcome of the Oslo Accords the Palestinian Authority was created and in 1995 the Palestinian Water Authority (PWA) was established by Presidential decree. The PWA possesses the mandate to manage the water sector, prepare and execute a national water policy, supervise and monitor water projects and ensure cooperation among stakeholders. The PWA will set tariffs and will license and monitor well drilling, abstraction and discharge.

In 2000/2001 the PWA prepared a comprehensive water law in 2000/2001, aiming to develop and manage water resources, increase capacity, improve quality and preserve and protect against pollution and depletion.

It also established Water Council chaired by the president of the PA, with membership consisting of water user associations, ministries, academicians and regional utilities. The Water Council sets the policies for the water sector and ratifies PWA planning.

Also in 2000 the PWA established the National Water Plan with a planning horizon until 2020. The plan provides for a measure of decentralisation by shifting the functions of the PWA to the regional utilities in terms of operations, maintenance, repairs, waste water collection and treatment, bulk water supply, water reuse and water allocation.

Italy

Until recently, the legislation on water in Italy has been highly fragmented in many laws and legislative acts addressing the issues of water exploitation, civil protection, environmental and water quality; only over the last few years some efforts have been made to integrate different objectives, strategies and responsibilities in a coherent framework that takes into account a higher degree of complexity and decentralisation. Current legal background is essentially based on three major pieces of water legislation:

a) The law n.183/89 deals with the protection of watersheds and water resources, the safeguarding of the water heritage and the uses and management of water. The different uses of water (for industry and agriculture) have to be coherent with the guarantee of not compromising the water minimum constant vital flow. It introduces the division of the Italian territory into 29 River Basins with the creation of the Basin Authorities.

b) The Law n.36/94 deals with the consolidation of water services (both water supply and wastewater treatment) into larger management units and authorises regions and municipalities to set user charges and raise finance. This law clarifies the public ownership of all water resources and declares the priorities of human consumption among the various uses of water.

c) Legislative Decree n.152/1999 aims at the integration of environmental, health, economic and productive policies towards a global policy of water resources management. This decree anticipated the content of the EU Framework Directive on Water and amended all previous laws regarding water quality of surface and groundwater, drinking water, effluents and other water-related environmental issues.

In Italy, the framework of responsibilities in the management of land and water resources has a long history and it has been changing according to the evolution of water legislation and to the broader evolution of the administrative organisation of Italian State. Three institutional levels involved in the planning and management of the water sector can be considered:

At National Level the Ministry of Environment is responsible for the planning and co-ordination of national programmes in the fields of environmental protection, pollution prevention and control, recycling and waste, land and soil protection, water quality issues; The Ministry of Infrastructures and Transportation is responsible for the planning and co-ordination of national programmes related to main infrastructures such as dams, aqueduct, water delivery network, sewage water network; The Supervising Committee on the Use of Water Resources, has the task of monitoring the efficiency of

the integrated water service supply, the regulation of water tariff and the consumer protection; The Italian National Environmental Protection Agency carries out scientific and technical activities to protect the environment, water resources and the soil.

At regional level, the regional administration has the responsibility of formulating regional water plans and water protection plans; monitoring of water resources; controlling the implementation of legislation; data collection for surface and drinking waters; release of concessions on water use; collection of abstraction fees.

At sub-regional level, it is made the inventory of discharge of sources and the delivery of water supply and waste water treatment services;

Lebanon

The Lebanese law governing the water sector dates back to the Ottoman and the French regimes. The archaic law, coupled with the “political instability” in Lebanon witnessed in the period extending between the years 1975 and 1989, brought about many tribulations associated with the mismanagement of the water sector (MOE *et al.*, 2004). However, recognising the significance of sustaining the water resources prompted the decision makers to develop new set of laws pertaining to:

a) *The management of the water sector (Law No. 221 of 2000)*, which aimed at inducing institutional changes and assigning the responsibilities to parties governing the water sector (mainly the MEW and the water and wastewater establishments). However, the law was not based on a profound study that took into consideration the current politico-legal, socioeconomic, and environmental situation in Lebanon. This resulted in several drawbacks such as: i) the modification of many laws, decrees, and decisions, which are often contradictory to one another, and ii) the generation of conflicting rather than complementary roles among the institutions.

b) *Environmental protection (Law No. 444 of 2002)*, which emphasised the role of the Ministry of Environment (MOE) in promoting the sustainable utilisation of the natural resources, the prevention of environmental pollution and degradation, and the promotion of a safe life characterised with a stable environment. However, the lack of enforcement decrees and mechanisms for this law results in its defective implementation.

The previously mentioned weaknesses are the grounds for the non-implementation of many of the laws, decrees, and regulations. The lack of financial, human, and technological resources aggravates the situation.

To date, the water sector is governed by a centralised system and is under the jurisdiction of the following governmental institutions: a) the Ministry of Energy and Water (MEW), b) the Ministry of Environment (MOE), and c) the Ministry of Public Health (MOPH). Other parties such as; the Ministry of Agriculture (MOA), the Ministry of Public Works and Transportation (MPWT), the Ministry of Interior and Municipalities (MIM), the Ministry of Displaced (MOD), the Regional Water and Wastewater Establishments, the Litani River Authority (LRA), and the Council for Development and Reconstruction (CDR). The municipalities are responsible of implementing water projects according to the National Master Plan set by the MEW.

Morocco

Morocco has committed to a program to rationalise and optimise water management that follows the international consensus on water management articulated with the Dublin Declaration. The key step in

this restructuring was taken with the Water Law in 1995, which considers water resources as public property. This law introduces the legislative, economic and organisational instruments necessary to the institution of a decentralised and participative water resources management and use program.

Other important components of water law concern the: clarification of functions, responsibilities and mandates of each institution involved in water management; elaboration of national and river basin master plans; establishment of a mechanism for recovery of costs through charges for water abstraction; creation of a water pollution tax based on the principles "user-pays" and "polluter-pays"; protection of water quality, which is an innovative decision in Moroccan decisional context.

In the sequence of the water law, two major institutions were created:

a) the High Water and Climate Council, in the dependence of the State Secretary for water that was launched in 2002 under the authority of the Ministry of land management, water and environment, as a forum allowing all national actors concerned by water resources to debate the water policy and the fundamental orientations concerning water resources management.

At national level, the High Water and Climate Council, ruled by an inter-ministerial body, has the mandate to coordinate the development of the water resources by examining policies related to water resources management and use, approving the regional master plans, resolving conflicts over the allocation of the water resources and establishing rules for water quality preservation;

b) the creation of 7 river basin agencies, which are considered the instruments to achieve an effective decentralisation, at regional level, of water resources management and encompassing all regional parts concerned in the decision making process.

At regional level, the River Basin Agencies were created to promote the participative decisions of water management. Their principal responsibilities consist of the development of water resources, the allocation of water as defined by master plan and the control of water quality. These institutions have also legislative functions and are responsible for the allocation of the different types of uses of water (irrigation, domestic and industrial).

At local level, many Water Users Associations were created because the trend is to transfer irrigation management responsibilities from the state to "communities" or local user groups. In other terms, the role of these institutions is participatory.

Portugal

There is a tradition for a centralised administration and decision making processes in Portugal, although water resources planning is usually equated in terms of river basins and approached in a quite integrated manner. The Ministry of Cities, Territory Management and Environment has the responsibility of water resources management. This ministry is composed of three horizontal organisations, four sectoral institutes and five regional directorates.

One of the horizontal organisations is the Directorate-General for the Environment (DGA) with a key role in defining strategic objectives and coordinating all areas of environmental management including water as an essential part of the environment; The sectoral agency with major responsibilities for water planning and management at the national level is the Institute for Water (INAG). The five Regional Directorates for the Environment and Natural Resources were responsible for all aspects of environmental management, including water, and for coordinating, at the regional level, all

environmental policies. They report directly to the Minister for the Environment and coordinate all sectors of activity, such as water, air, waste, nature conservation, consumer protection, and interfacing with other regional policies like industry or agriculture, corresponding thus to a sort of "Ministry" at regional level.

However due to tremendous lack of human and financial resources and the very strict and rigid conditions imposed on public administration, these regional structures are strong in theory but weak in practice; as the other and central structures keep playing a very relevant role at the regional level. Under these circumstances the Institute for Water must perform not only its assigned duties, such as helping defining a national policy for water or negotiating at the international level (EU and international river basins), but it must also interfere at the regional and local level in most situations. The municipalities used to play a very important role in the management of water and wastewater systems. In fact, until now, municipalities were the only entities responsible for domestic water supply and wastewater disposal.

Water resources management in Portugal can be characterised by a multiplicity of organisational forms and management structure of the services, along with an insufficient level of provision of water and of collect of sewage and treatment of sewage. In 2001 the Water National Plan (WNP) was presented, according to the already established by WFD and an exhaustive survey was made, concerning the national hydrographical resources. Based on the diagnosis of the situation, in this domain, a plan was made in order to improve the management of these resources (Martins and Furtado, 2002). One of the challenges of the WNP, by imposition of WFD, is to change this state of things and conduct the State strategy, as the regulator, to a rational and efficient use of water or either to a management of demand. So, one of the domains of the actuation of the regulator must be the definition of adequate tariff schemes in order to discriminate prices as a function of the use of the resource and to conduct to a rational use of water. Currently is in process of implementation the new Water Law which will transpose the Water Framework Directive to internal law.

Spain

In Spain, two instrumental laws are identified as the main precursors of water management: The Water Law (1986) and the Law of the National Hydrological Plan (2001).

(a) The Water Law is a modern and comprehensive water code, covering all issues and aspects related to water policies, organisation, procedures, finance, civil works, planning, and public participation. For planning purposes, users or right holders are ordered according to priorities explicitly established in each Basin Hydrological Plan. In case of a non-defined order of priorities, the priorities are: (1) urban (2) irrigation; (3) industry for power generation; (4) other industries; (5) aquaculture; (6) recreation; (7) navigation; and (8) others. Basin Authorities can create Water Exchanging Centres, through which right holders can offer or demand use rights in periods of droughts or severe water scarcity situations (Article 71). This initiative must be proposed by the Environment Ministry and be approved by the Ministerial Cabinet.

(b) The Law of the National Hydrological Plan consolidates all Planning decrees for the different interregional basins, and lays down the basic principles of the Water Planning at the national level. The Environment Ministry will establish a system of hydrological indicators to support the formal declaration of alert situation and droughts by Basin Authorities. All public administrations that are responsible of supplying urban water services to cities with more than 20,000 inhabitants must develop an Emergency Plan. This Plan must be approved by the relevant Basin Authority.

At National level, two ministries share the responsibilities of water resources management: The Ministry of the Environment, through the Secretariat of Water and Coasts and the Directorate General of Hydraulic Works, is directly responsible for water management. The Ministry of Agriculture, Fisheries and Food is responsible for irrigation planning, the implementation of publicly funded water schemes and the development of irrigation improvement schemes.

Water management in Spain is coordinated at the Basin level. Therefore River Basin Authorities are the key stakeholders at the national, regional, and local levels. They are headed by a Chairman appointed by the Council of Ministers at the proposal of Ministry of Environment, for inter-regional basins, and at the proposal of the Autonomous Communities the when is an intra-regional basin. River Basin Authorities also include groups and representatives of different central and regional government bodies. Their main responsibilities are to: define the Basin Hydrologic Plan, control of the public water domain, design, development and management of hydraulic works, granting of licenses and permits for the use of water resources and the public water domain and hydrological monitoring (gauging, floods, quality).

Syria

In Syria, several governmental bodies have some function, duties, and relations in water management issues, water resources development, water usage, and water quality control.

As defined in the laws of the country, all the water resources in Syria belong to the Ministry of Irrigation as public owner, and to the bylaws of the Ministry of Irrigation, unless special laws regulate the water supply for domestic or other uses. Therefore, the usage of public water is subject to approval to be given by MOI.

The State Planning Commission (SPC) has the role of setting the priorities for implementation (according with nation-wide development plan and financial issues) of water development projects. The Ministry of Irrigation (MOI) is responsible for water resources development and management through its General Directorates, which should design, plan, implement, execute, and maintain the development projects of water utilisation. The MOI's role in the field of water use includes: setting the maximum amount of water to be used in each hydrological / hydro geological area and water basin; preparing irrigation plans in the area and the basin; setting restrictions to be imposed on drilling method and extraction of groundwater; setting conditions of conservation; and approving / licensing water use by canals and wells. The Ministry of Housing and Utilities is responsible for domestic water supply. The Ministry of Agriculture and Agrarian Reform is responsible for controlling water usage in farm lands, supporting farmers and farmers' unions through technical advice in construction of canals and small scale irrigation works.

Tunisia

Since the independence (1956), the Tunisian public administration plays a major role in all domains and notably in hydraulic domain. In Tunisia, the domain of water is a prerogative of the state. The "Code des Eaux", promulgated in 1975, constitute the legislative basis text that governs all interventions in the water sector. The responsibility of the application of the laws on water, the scheduling of studies, the realisation of the big hydro-agricultural amenities, the development of management strategies is confided to the Ministry of Agriculture, Environment and Hydraulic Resources.

All strategies of water management in Tunisia are elaborated to the national ladder and remain a prerogative of the state. Stakeholder's contribution is only introduced at the level of the application of these strategies and is considered as a tool to improve the management of water demand.

In 1990, a decennial strategy of water resource mobilisation (1990-200) was setting up. The objective of this strategy was to satisfy the demand of the different sectors and foresaw the growth of water resource exploitation. The aim was to optimise the management of existing water by avoiding situations of intensive exploitation and by having recourse to alternative resources (brackish water desalination, re-use of drainage waters, artificial recharge of aquifers,...), but also to control water demand.

To the middle of years 1990, in the setting of the application of the Agricultural Structural adjustment Plan elaborated in 1986, the State tried to decentralise some tasks. The old services being a matter for the central administration are transformed on autonomous public establishments. Thus, the distribution of water to farmers has been confided to regional institutions; the regional commissions of agricultural development (CRDA), responsible of public perimeters of irrigated agriculture.

The Ministry of Agriculture, Environment and Hydraulic Resource (MAEHR) manages water resources that belong to the State, which means that it manages the hydraulic public domain; it is responsible of the scheduling of studies; the follow-up and the hydraulic project assessment; the building of dams and big hydro-agricultural amenities; and of water management in the big dams.

The National Water committee has for mission to give opinions on the relative general questions to the planning and the scheduling of waters, on projects of planning and distribution of waters at national as well as regional level. Besides, it can be consulted on all questions concerning conservation and protection of waters. It can make all necessary general investigations for the programming of domestic, industrial or agricultural water uses as well as for the protection against harmful effects of water. It arbitrates conflicts of water uses.

The National Office of Purification (ONAS) is a financially autonomous public organism, which is charged of the management and the exploitation of purification works. It has for mission the protection of hydric environment, the development and the realisation of projects carrying out the treatment of used waters, pluvial waters and domestic garbage.

Turkey

In Turkey, water is considered a public good, and surface water is a public good which everyone can use subject to the rights of prior uses. Surface water use is normally free of any obligation to obtain prior authorisation. The Civil Law defines water as part of the land owned. Furthermore, there is no registration system for water rights or water use. This system is generally unable to solve conflicts with claimed prior rights, and this is leading to serious problems of over allocation in some basins.

Water resource management is framed by several key elements of the Turkish legislation, but the foundation of modern water management in Turkey was established in the Turkish Constitution of 1982, which defined water resources as the wealth of the nation, under the authority of the State, to be used for the benefit of the public. Consistent with this principle, recent environmental legislation stressed this theme, a legal notion of "the Commons." The responsibility of the State is to protect the Commons against individual interests that may lead to environmental degradation. This is clearly seen in enactment of the Environmental Law of 1983, introducing into Turkish regulations the approach that

environmental protection and pollution prevention can be enhanced with a “polluter pays” principle. That is, a legal distinction is made between the public interest and private interests.

Over the past two decades, a new legal structure of environmental protection and water management has emerged driven by an increased emphasis in domestic law; the expansion of activity in terms of bilateral and multilateral international agreements; and the nation’s efforts to meet EU criteria toward accession to full membership. The combined result of these three approaches is to raise both the visibility of water and the environmental issues in Turkey and to enhance the ability of the government to act effectively in protecting what its Constitution refers to as its “national wealth”.

In Turkey, the enforcement and implementation of existing laws are difficult due such factors as: the presence of too many laws, rules and regulations that apply to the same problem; the presence of vaguely stated rules and regulations for which several interpretations may exist; most of the laws in the water resources area are so old that they cannot provide solutions to newly emerging problems.

In Turkey, there are a number of central and local organisations and agencies active in the water sector. General Directorate of State Hydraulic Works (DSI) is the main executive agency of the Government of Turkey for the country's overall water resources planning, execution and operation, and is attached to the Ministry of Energy and Natural Resources. DSI's main responsibilities cover the issues of observation, field investigation, master plan, pre-feasibility, feasibility, design, construction and management for irrigation, hydraulic energy generation, domestic water supply (for cities with a population of more than 100,000), flood control. Development, management and conservation of groundwater resources are also exclusively under the responsibility of DSI. It is also the major agency that is responsible for water allocation. DSI acts at regional scale through its 26 Regional Directorates established in each of the 26 basins of Turkey. The General Directorate of Bank of Provinces has the basic functions of financing, insuring, and supporting of water supply and sewerage projects for municipalities. Following the completion of work, the Bank transfers the facility concerned to the Municipality, which is then responsible for its operation and maintenance. Municipalities give priority mainly for the services of providing water supplies and sanitation.

2.3.4 Overview

In Table 1 it is presented a brief overview of the main institutions involved, in each country, in the development and implementation of national water policy.

In the majority of cases a rather centralised system is the responsible for the governance of water resources. However, some countries are increasing not only the decentralisation of decision-making processes, but also the participation of local stakeholders in these processes.

The process of water management is framed by a normative system that evolved in the 20th century. However, in the last 10-15 years these normative frames were strongly restructured in the majority of the countries involved. In EU countries, this process is marked by the development of EU Water Framework Directive, which as a clear compulsory end point: the water status has to be good after its implementation. On the other hand, Mediterranean Partner Countries (MPC) are not bound to any international duty to achieve certain objectives in their watersheds.

Table 1 – Main Institutions involved in water management policy

Countries	National Water Policy		
	Main Institutions involved	Main responsibility	Legislation Frame
Algeria	Ministry of Water Resources	Coordinating the activities related to water management at national level while each wilaya (department)	Normative system split in different laws
Croatia	Ministry for Environmental Protection and Physical Planning and Construction	Governance at national level of water protection	Unified normative system through the Water Law of 1996
	Ministry for Agriculture, Forestry and Water Management	Controls and monitors overall water resources management process at national level	
Cyprus	Strong overlapping jurisdictions of different governmental departments, but the Water Development Department (Ministry of Agriculture, Natural Resources and Environment) has the main responsibilities in water management.	Advisory capacity in water management. Legal power lies mainly with the District Officers of the Ministry of the Interior	Normative system rather complex and split in numerous laws that drives to significant overlapping jurisdictions of multiple governmental departments
Egypt	Ministry of Water Resources and Irrigation through the Planning Sector, Sector of Public Works and Water Resources, Nile Water Sector, Irrigation Department, and Mechanical and Electrical Department	Development, distribution and management of water resources, and development, operation and maintenance of the associated water works; Responsible at central level for data collection, processing and analysis for planning and monitoring investment projects; coordinates water resources development works; is in charge of cooperation with Sudan and other Nile River's countries; and provides technical guidance and monitoring of irrigation development, including dams.	Unified normative system through the Law 4/1994. In the long-term, the government envisages creating the National Organisation for Potable Water and Sanitary Drainage that illustrates the government's commitment decentralization.
	Ministry of Agriculture and Land Reclamation	Improving agricultural activities and land reclamation, including water management at the on-farm level	
	Ministry of Housing, Utilities and New Communities	Provides water services (water supply and wastewater treatment) to the municipal and industrial subsectors	
France	Interdepartmental Water Mission, which gathers the central directions of all concerned ministries	The national water policy is defined by the Interdepartmental Water Mission and the National Water Committee. However, water management involves the participation of waters users in the design of water policies. Basin Committees develop Water Development Plans and Water Management Master Plans at basin level.	Unified normative system through the Water Law of 2004 that transposes to the French Law the European Water Framework Directive.
	National Water Committee, composed of Government, and elected users' representatives		
Greece	Ministry for the Environment, Physical Planning and Public Works	Handling with environmental policy.	Aged normative system split in different laws that drives to significant overlapping jurisdictions of multiple governmental departments. Law 3199/2003 transposes to the Greek Law the European Water Framework Directive
	Ministry of Development	Conducts the final studies for the Water Resources Management of the 14 water departments of Greece	
Israel / Palestine	Water Commission from the Israel's Ministry of Infrastructure	Allocation of resources, development of new water sources and water policy in general	Normative systems extremely centralised with little room for direct stakeholder input. Israel's Water Law from 1959-1971; Palestine's Water Law from 2000/2001
	Palestinian Water Authority	Manage the water sector, prepare and execute a national water policy, supervise and monitor water projects and ensure cooperation among stakeholders. Established the National Water Plan	

Table 1 – Main Institutions involved in water management policy (continuation)

Countries	National Water Policy		
	Main Institutions involved	Main responsibility	Legislation Frame
Italy	Ministry of Environment	Planning and co-ordination of national programmes in the fields of environmental protection, pollution prevention and control, recycling and waste, land and soil protection, water quality issues	Recent efforts have been made to produce a more unified and coherent normative system. European Water Framework Directive not yet transposed for the Italian Law.
	Ministry of Infrastructures and Transportation	Planning and co-ordination of national programmes related to main infrastructures such as dams, aqueduct, water delivery network, sewage water network	
	Supervising Committee on the Use of Water Resources	Monitoring the efficiency of the integrated water service supply, the regulation of water tariff and the consumer protection	
Lebanon	Water sector is governed by a centralised system in which the Ministry of Energy and Water plays the major role	Setting the National Master Plan for the management of the water and wastewater sectors; planning and implementation of water projects; and protection of quantity and quality of water resources	The Management of the Water Sector Law (2000) and the Environmental Protection Law (2002) are the basis of the normative system
	Council for Development and Reconstruction	Implementation, rehabilitation and modernisation of irrigation schemes and support for on-farm activities	
	Ministry of Agriculture	Responsibilities for agricultural development	
Morocco	High Water and Climate Council	Coordinates the development of the water resources by examining policies related to water resources management and use, approving the regional master plans, resolving conflicts over the allocation of the water resources and establishing rules for water quality preservation	Unified normative system through the Water Law from 1995, which introduced a decentralised and participative water resources management program.
	River basin agencies	The instruments to achieve an effective decentralisation, at regional level, of water resources management and encompassing all regional parts concerned in the decision making process	
Portugal	Water sector is governed by a rather centralised system. The Institute for Water, from the Ministry of Cities, Territory Management and Environment, is the national authority for water resources management	Responsible for the definition of the national policy and planning for water resources; negotiation at the international level (EU and international river basins); coordination of activities at regional and local levels.	Unified normative system through the Water Law from 1998. The new Water Law (December 2005) transposes to the Portuguese Law the European Water Framework Directive
Spain	The Ministry of the Environment, through the Secretariat of Water and Coasts and the Directorate General of Hydraulic Works	Responsible for water management. However, water management is coordinated at the basin level	Unified normative system through the Water Law (1986) and the Law of the National Hydrological Plan (2001). European Water Framework Directive not yet transposed for the Spanish Law.
	The Ministry of Agriculture, Fisheries and Food	Responsible for irrigation planning, the implementation of publicly funded water schemes and the development of irrigation improvement schemes	
	River Basin Authorities	Define the Basin Hydrologic Plan, control of the public water domain, design, development and management of hydraulic works, granting of licenses and permits for the use of water resources and the public water domain and hydrological monitoring	
Syria	Ministry of Irrigation	All the water resources in Syria belong to the Ministry of Irrigation, which is responsible for water resources development and management (design, planning, implementation, execution, and maintenance of development projects of water utilisation) through its General Directorates. The State Planning Commission has the role of setting the priorities for implementation of water development projects	Normative system split in different laws. Recent efforts are being made to implement a new Law on Water Resources Management
Tunisia	Ministry of Agriculture, Environment and Hydraulic Resources	Application of the laws on water, the scheduling of studies, the realisation of the big hydro-agricultural amenities, the development of management strategies, monitoring and evaluation of water resources, irrigation, rural equipment and drinking water supply to the rural population	Unified normative system through the Water Law (1975)
Turkey	State Hydraulic Works	Responsible for the planning, design, construction and operation of water development for various purposes like irrigation, flood control, swamp reclamation, hydropower development, navigation and water supply to cities with over 100 000 inhabitants	Aged normative system split in different laws that drives to significant overlapping jurisdictions of multiple governmental departments. As an EU candidate, the EU-Turkey Accession Partnership Agreement of 2003 urged Turkey to approve the European Union's water standards.
	General Directorate of Rural Services	Responsible for the development of small-scale irrigation schemes and small reservoirs, rural roads and water supply to rural areas.	

The role of institutions in water management has increased in importance significantly over the last decade, in line with the claim that “for the next several decades the most important question related to water resources development is that of institutional design rather than engineering design” (Ostrom,

1993). This is also true in the involved Mediterranean Countries, where many of the Governments are investing in the restructure and improvement of water management institutions to achieve better performances in managing this scarce natural resource.

Nevertheless, in some countries, a normative system split by numerous laws is still present. These rather complex normative systems are responsible for significant overlapping of functions and jurisdictions of multiple governmental departments, which drives to several competence conflicts responsible for some backwards in the process of sustainable water resource management.

3 Key actors and Stakeholders in water management in the Mediterranean Countries

Water management policies have implications for social, agricultural, industrial, and environmental sectors, and therefore will involve a range of actors (Figure 15) at local, regional, national, and international levels. Their involvement is a critical first step toward finding lasting solutions.

Figure 15 – Actors in Formulating Water Management Policies

International	<ul style="list-style-type: none">• Water, environmental, and international population organizations• Legislators and other elected leaders• River basin authorities• International NGOs
National	<ul style="list-style-type: none">• Government ministries: economic planning, agricultural, environmental, and social sectors• Local governments• Development agencies and international donors• NGOs
Local	<ul style="list-style-type: none">• Environment and development NGOs• Community residents• Designated "national water commissions"• Private industries and business

Source: Sherbinin & Dompka (eds.), 1998.

The way societies organise themselves and establish rules to govern their actions will play a major role in determining whether they move toward more sustainable paths. But good governance requires reforming decision-making processes to increase opportunities for public participation, including a wide variety of activities ranging from consultation hearings as part of an environmental impact assessment, to co-management of natural resources. Therefore it requires public debate and problem-solving capacity (Risse, 2002).

3.1 Social Networks and water management

Social network analysis is the measuring and visualisation of relationships and flows between people, groups, organisations or other information/knowledge processing entities. The nodes in the network are the people and groups while the links show relationships or flows between the nodes. Social network analysis provides both a visual and a mathematical analysis of institutions relationships. This type of analysis aims at examining the patterning of the social connections that link sets of actors (Freeman, 1979). Actually, this analysis tries to describe two types of patterns: social groups (sets of actors closely linked together) and social positions (sets of actors who are linked into the total social system in similar ways).

One of the methods used to understand networks and their participants is to evaluate the location of institutions in the network (mainly with the analysis based on the visualisation). Measuring the network

location is finding the centrality of a node. These measures help determine the importance, or prominence, of an institution in the network.

When a subject, such as water management, connects organisations, it is a social network. This social network approach facilitates the study of how information flows through direct and indirect network ties, how the stakeholders are linked with water resources and how these institutions operated among the network, if its connector is stronger or weaker.

The social networks related with water management research could concentrate on how the different intensity or communication types might affect the ways to manage more efficiently the water in the catchment.

Networks are the essential means for linking different groups of stakeholders that share similar interests related to some subject, and are the mechanism for the exchange of information and services in support of water management processes. Beyond the local networks, the stakeholders identified require the commitment of the decision-makers to cooperate.

In the decision-making processes, social networks operate as an essential tool in the transmission of normative systems, which regulate the decision and allow for the identification of existing problems and potentialities. Social networks constitute structures of opportunity and constraint for the stakeholders and they have proven to be crucial to:

- Facilitate the flows of information;
- Produce better-informed and more creative decision making (reducing uncertainty);
- Increase stakeholders acceptance, fewer delays and more effective implementation;
- Stimulate a more open and integrated governance and more transparency in the decision process;
- Develop a broader knowledge base through the use of stakeholders knowledge and experience;
- Promote social learning as a consequence of a constructive dialogue in which all interests involved identified at the networks (stakeholders, governments and experts) learn from each other.

Social networks have a key role in the effective management of territories and resources. These networks should coordinate contact between the various individual and collective actors present in a given region and encourage them to work together in order to harmonise their objectives and preoccupations. The success of the local network, as a support instrument for managing the territory and the natural resources, partly depends on the type of participation of the various stakeholders present in the region. Since the various actors find themselves involved right from the beginning of the process, this is a way of ensuring the success of responses by the development and implementation of decision-making support tools. Therefore, the final decision has a greater probability of integrating the expectations of the various actors that have interests at play in the territory.

The relationships among the various social actors (whether individual or collective), in any area, are structured in the form of networks. In reality, *"...the people belong not only to groups but to networks as well, the groups being the reflection of the structural relationships that tie the individuals together..."* (Degenne and Forsé, 1994).

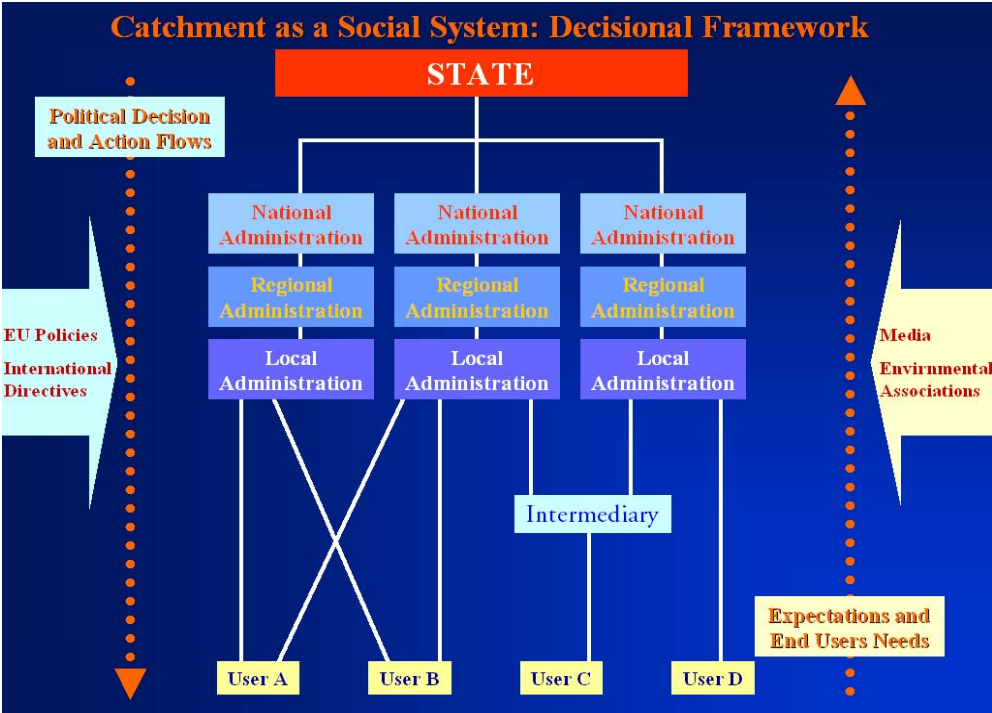
According to Wasserman and Faust (1994), a social network consists of a finite set of actors and the relation or relations defined on them. The actors are social entities, discrete individuals, corporate or collective social units. A basic assumption of the relationships formed to provide a network is that the social actors in a network are mutually dependent upon resources controlled by each other, and that there are benefits to be gained by pooling their resources. In a relatively static way, networks can be defined as “...systems of social actors that propagate among themselves information and resources across structures with strong connectivity with the objective of making common a variety of their internal environment. Aside from this, it is observed that the interactions with the external environment of the network arise from structures with a lesser degree of connectivity...” (Lemieux, 1999).

3.2 Social Networks and decision-making processes

In the decision-making process, social networks function as an essential tool in the transmission of normative systems, which will regulate the decision and allow for the identification of existing problems and potentialities, the evaluation of the validity of proposals for intervention, and also the understanding of interactions and conflicts among the various social actors, whether individual or collective (Lourenço et al, 2001). Thus, it becomes imperative to consider, at local level, the relationships among the various social actors as real interactions and therefore as local potentials and liabilities, thus guaranteeing the success of the decision-making process.

Analysis of Figure 16 shows how the networks that are established at a local level are integrated into larger networks (regional, national, and even international). Moreover, the diagram shows how the networks that are established within the context of the decision-making process are relatively centralised (Lourenço et al, 2001).

Figure 16 – The structure of a social network present in a catchment.



Source: Lourenço et al, 2001

Thus, it can be observed that the transfer of resources and information fundamentally follows a chain, somewhat hierarchical, which encourages top-down communication and makes the reverse more difficult. It is therefore noted that horizontal communication among the various levels of the diagram is of lesser importance, although not non-existent. This fact indicates that we are not in the presence of a *perfect network* in which all the actors are at the same time transmitters and receptors of equal importance.

The diagram implies that in the internal environment of the network there are preferential transmission (and imposition) flows of the normative framework, as all the actors are not of equal position. Nevertheless, this fact does not mean the acceptance of all the decisions, information, or actions transmitted from the higher levels. There can be diversity in perceptions about the potentials and problems of a given region due to the individual actor's proximity to the rational that determines the various activities. These different perspectives may be configured in different views about development.

Thus, it is observed that the social networks are frequently conflicting. The awareness of these conflicts is essential in order to understand the rationale of these networks and to understand where the obstacles to decision-making and implementation of the various policy measures lie. Sometimes the conflict or obstacle arises, not from various perspectives of development, but from a lack of awareness of policy measures, or a lack of adequate training for their correct understanding and effective implementation. In this sense, it is very important to identify and characterise the various social actors (individual and collective) to understand their functions and levels of intervention, and to comprehend the types of relationships that are found among these actors that comprise the network.

On the other hand, within the context of the management of a finite natural resource, such as water, another significant type of conflict is observed. These conflicts are those among the various uses to which this natural resource is subjected. It is thus important to identify the various water uses of the catchments to be analysed. In the end, this contributes to the identification of the stakeholders, or in other words, the social actors that are found at the base of the local network. The various uses of water (agriculture, agro-industry, industry, tourism, recreational activities, urban domestic use, etc.) correspond to the various rationales of intervention in the territory, which are important to be aware of and integrate in the local network. In some other cases, it is likewise important to know if the use of water in a particular catchment is made exclusively in the catchment, or if it is to be used in other areas outside the catchment. This is because the development of one region based on natural resources coming from another region could be the source of possible conflicts. This situation, which, at a local or regional level, could be seen in a negative way, provides a rationale for inter-regional solidarity, possible only at a higher administrative level. Therefore, it can be observed that there is a need to give perspective to local networks within a larger decision-making context, or in other words, it becomes important to understand in what way the driving forces act on the local network.

As for the driving forces, it is necessary to proceed with their identification, both in terms of the internal environment of the network (for example: the main water uses, and the territorial dynamics that exert pressure on this resource), and in terms of those driving forces that determine the way the network works from a point external to the network, i.e., national and supranational normative frameworks. These laws may be understood as external factors that influence the behaviour of the network by defining intervention norms and policy measures. They are restrictions that are imposed in general from the highest levels of the social network and to which the lowest levels must adapt.

However, they are not the only external factors that determine how these local networks operate. In fact, depending on the needs, expectations and conflicts of the local actors (water users) sometimes protest movements are generated that have an influence on the network of social relations, encouraging certain decisions and opposing others. The influence from these types of external factors has a direction opposite from that of the normative framework: bottom-up, instead of top-down. Thus, transmission of information and intervention can be observed from the lowest levels of the network moving towards the higher ones. Here it becomes necessary to know about the types of external factors that tend to constrain action, creating difficulties or guiding the process of decision-making along another path. Moreover, it is important to understand the capabilities of water users to organise themselves in group action as well as the efficiency of their organisations. Therefore, it is observed that although complex, it is not impossible to understand and grasp the way social networks operate.

3.3 Key actors in the case-study areas

In the Mediterranean basin, wide differences in water supply and demand characteristics exist and no individual case study may be representative of the entire region. Some countries suffer problems of overexploitation of groundwater while others suffer from water quality degradation. On the other hand, some have enough or plentiful water but lack institutional structures to manage water efficiently, while others have scarce and limited water and seek non-conventional water like desalination or importation of water.

The case-study areas selected for the NOSTRUM-DSS have mainly a regional approach. In Table 2 are summarised some of the specificities of these case studies. With the exception of the French case study, that is related with an issue of national relevance concerning the privatisation scheme of drinking water management and sewage, all the others are grounded in a specific area at local or regional levels.

Although the differences, allocation of water and construction of infrastructures are the main issues concerning the decisional context in the selected case-studies.

Table 2 – Case studies and key actors involved

Countries	Case Study			
	Designation	Context	Level of analysis	Number of key actors interviewed
Algeria	Great Sebkhia of Oran	Allocation of water and construction of infrastructures	Regional/Catchment	7
Croatia	Cetina River	Allocation of water; construction of infrastructures; and impact on estuary and marine processes	Regional/Catchment	-
Cyprus	Tamassos Dam/Reservoir	Construction of infrastructures	Local	15
Egypt	South Egypt Development Project	Allocation of water for irrigation, investment plans; and construction of infrastructures	Regional	14
France	The trend to Delegation	Privatisation scheme of drinking water management and sewage in France	National	8
Greece	Island of Paros	Allocation of water for irrigation and tourism; definition of prices for water; and construction of infrastructures	Regional and Local	8
Israel / Palestine	Dead Sea Basin	Allocation of water minimising ecosystem impacts; definition of prices for water; and construction of infrastructures	Regional and Transboundary	4
Italy	Irrigation Water Management in Southern Italy	Allocation of water for irrigation; and definition of prices for water	Regional/Catchment	3
Lebanon	Damour river	Allocation of water; investment plans; definition of prices for water; construction of infrastructures; and changes in demand/supply	National, Regional and Local	6
Morocco	Tadla Plain	Allocation of water for irrigation and domestic supply; definition of prices for water; and construction of infrastructures	Regional/Catchment	8
Portugal	Caia river catchment	Allocation of water for irrigation of different crops and domestic supply	Regional/Catchment	8
Spain	Tagus river basin	Allocation of water; investment plans; definition of prices for water; and construction of infrastructures	Regional/Catchment	-
Syria	Asnober river basin	Allocation of water; and interaction with groundwater	Regional/Catchment	1
Tunisia	Jeffara aquifer	Allocation of water for irrigation and domestic supply; and construction of infrastructures	Regional/Catchment	8
Turkey	Gediz River Basin	Allocation of water for agriculture, domestic supply, industry and environmental use; and Water Pollution Control	National and Regional/Catchment	36

3.3.1 Country analysis

Algeria

The selected case study is the “Great Sebkhia of Oran” which is a closed hydrographic basin located south of Oran within the whole Oranie Chott Chergui Hydrographic Basin. The Great Sebkhia

constitutes with its environment a specific ecosystem. The Sebkhha is a salt lake. This global system (lake and catchment) is the heart of a problem linking between local development and ecological preservation.

In the case study area were identified seven key actors with intervention at national level (two), regional level (three) and local level (two). These key actors are: policy makers (three) one primary stakeholder and three secondary stakeholders.

The Ministry of Water Resources (MRE) played a major role. The other actors often had a marginal position (local communities, specialised agencies, scientists, NGOs). The calendar and the objectives were mainly decided by the MRE which had entrusted the study to an external engineering private institution (France). The debates took place during presentations of the phases of the project.

The links with NOTRUM-DSS were concentrated first on a major player, the Hydrographic Basin Agency – ABH (and its Basin Committee). The agency is the fruit of a new vision of the water resources policy in Algeria. Through its committee, it is possible to identify the main needs of the most pertinent partners (ministries, other agencies, civil society, executive administrations, representatives of wilayas and municipalities). ABH was deeply involved in the process of identifying a definitive management scenario and status for the Sebkhha.

Croatia

The selected case study is the Cetina catchment, which is a typical karstic water course with its watershed and riverbed formed in the area surrounding the deep Dinara karst. A karstic terrain characteristic is that the underground dividing line does not coincide with that of the surface. The most important uses of the Cetina relate to hydro-electric applications, which have long been recognised as the river's most resourceful potential. In addition to the regulation of its utilisation and the constructions required for its hydro-electric exploitation, several other measures have been undertaken to ensure the water supply of the broader area, including agricultural irrigation and the prevention of flooding.

The key actors in the selected case-study area are: Ministry of Agriculture, Forestry and Water Management; Ministry for Environmental Protection, Physical Planning and Construction Zagreb; and Hrvatska elektroprivreda - Zagreb. These are stakeholders as well as decision-makers on national level. They have authorities by law to make final decisions (Water Law).

Cyprus

The selected case study is related with the construction of Tamassos Dam/Reservoir (that became operational in 2002), which was decided by the Water Development Department (WDD) primarily to achieve the enrichment of the deep water aquifer in the area. The construction of the Dam would also achieve an additional two important objectives: increase the quantity of drinking water available to the area served by the Dam; and alleviate the occasional flooding that occurs in the Tamassos area.

In the case study area were identified fifteen key actors with intervention at national level (three), regional level (one) and local level (four). These key actors are: policy makers (seven), one primary stakeholder, three secondary stakeholders and three key stakeholders.

The key actors in the selected case-study area are: the Water Development Department, which decided the construction of Tamassos Dam/Reservoir, the farmers represented by the Irrigation Divisions/Associations of the village Pera Orinis, environmental action groups, and the neighbouring municipalities. All of these stakeholders are satisfied with the operation of the Dam.

Egypt

The South Egypt Development Project (Toshka Project) was chosen as case study. It is an irrigation project that is planned to form the core of an integrated agricultural and agro-industrial development in the region. The established communities will thus be provided with roads, transport and communication facilities as well as full social services such as health and education. The Environmental Impact Assessment-DSS has been applied to predict the impacts associated with this programme.

In the case study area were identified fourteen key actors with intervention at national level (nine), and local level (twelve). These key actors are: policy makers (three), eight primary stakeholders, three secondary stakeholders and one key stakeholder.

The key actors in the selected case-study area are: Ministry of Water Resources & Irrigation; the Soils, Water & Environmental Research Institute; Irrigation and Hydraulics Department of Cairo University.

France

The trend to delegation is the subject of the French case-study, which is related with the specific privatisation scheme of drinking water management and sewage in France.

For this case study subject were identified eight key actors with intervention at national level (six), and regional level (two). These key actors are: policy makers (five), two primary stakeholders, and one key stakeholder.

Greece

Paros Island was chosen as case-study due to the area's special characteristics. As an island, Paros is a water stressed area with finite water resources. The main economic activities (agriculture and tourism) require large amounts of water especially during the summer months, the driest period of the year. Paros Island was also ideal for the DSS implementation due to the information availability, and the good relations with local stakeholders.

In the case study area were identified eight key actors with intervention at national level (three), regional (one) and local level (four). These key actors are: two policy makers, two primary stakeholders, three secondary stakeholders and one key stakeholder.

The stakeholders involved in water management issues in the case study region have been selected as representatives from the main decision making bodies and end users in the region: Ministries, Administrations, Governmental agencies (at national level) and Municipalities, and End-users' associations (at regional and local level).

Israel / Palestine

The Dead Sea Basin was chosen as the case-study area. It has a size of about 44,000 km² and its watershed is shared by Israel, Jordan and Palestine. This basin plays a major role for regional economic development, and has also a global importance, expressed in the efforts to promote it as a UNESCO Man and Biosphere Reserve and a World Heritage site.

In the case study area were identified four key actors with intervention at national level (one), regional (two) and local level (one). These key actors are: two policy makers, one primary stakeholder, and two key stakeholders.

The stakeholders involved in water management issues in the case study region have been selected as representatives from the main decision making bodies and end users in the region: Ministries of Agriculture and of Planning; Environmental Quality Authority; Palestinian Water Authority; Dead Sea Research & Development; Tamar Regional Council; Megilot Regional Council; Neot Hakikar Community; Mineral water company; Tamar Drainage Authority; Arava Institute for Environmental Studies.

Italy

The role of the *Consorzio per la Bonifica della Capitanata* in the context of irrigation water management in Southern Italy is the subject of the Italian case-study.

In the case study area were identified three key actors with intervention at national level (one), regional (one) and local level (one). These key actors are: one policy maker and two secondary stakeholders.

The key actors for the selected case-study are: The Capitanata Land Reclamation Consortium that may be considered both a decision-maker and a key stakeholder; the Acquedotto Pugliese (a joint stock company); Local Communities; and Archaeologists and environmentalists, which can be considered both as primary stakeholders, since they are affected by the decision, and as secondary stakeholders since they can contribute to the decision-making process.

Lebanon

The Damour case study was selected in Lebanon to highlight the problems that local authorities face in the water sector, their role, and their relationship with other stakeholders. The sustainability and availability of the water resources, in terms of quantity and quality are threatened due to: overexploitation and pollution of the Damour River; overexploitation of the BWA public wells, and of private wells; water losses through the network; and improper irrigation practices. All these issues are aggravated by the absence of legislations for the management and monitoring of both surface and groundwater resources in the village and basin as a whole, and the lack of awareness among the community to prevent or mitigate such issues.

In the case study area were identified six key actors with intervention at national level (three), regional (one) and local level (two). These key actors are: two policy makers, one primary stakeholder and three key stakeholders.

The ministries of: a) Energy and Water, b) Public Health, c) Environment, d) Agriculture, and e) Public Works and Transportation are the policy makers, especially given that the water sector is under the jurisdiction of these governmental institutions. The Beirut and Mount Lebanon Water and Wastewater Establishment is considered also to be a policy maker since it has the potential to use the DSS tool for the management of the water resources. It has however also a role in securing potable water to local users. In this sense it can also be considered as a key stakeholder.

Regarding the private companies and international organisations, they are considered to be secondary stakeholders since they are involved in research that would facilitate the process of decision making. The municipality is considered to be the key stakeholder since it facilitates the process of implementing the project within its municipal boundaries. As for the community, which was represented by the Damour Youth Club, it is considered as the primary stakeholder since they are positively or negatively influenced by the decisions taken.

Morocco

The irrigated perimeter of Tadla is one of the oldest perimeters of Morocco and it was selected as case-study area. Since 1960, the underground waters had already been the subject of intensive (deep) and excessive exploitation; the waters of surface remained a weakly valorised resource. It is the decision of launching of the national program of irrigation of a million of hectares that led to the exploitation of surface water of the Tadla perimeter. This perimeter is part of the Oum Er Rbia basin and hence it is administrated by the irrigation agency of Tadla (ORMVAT) and by the Oum Er Rbia River Basin Agency. Over time, the three main interacting objectives of ORMVAT for developing the irrigation and hence contribute to other water uses are: improving hydraulic efficiency of irrigation systems; increasing productivity; and strengthening the managerial capacities of the ORMVAT.

In the case study area were identified eight key actors with intervention at national level (two), regional (two) and local level (four). These key actors are: three policy makers, three primary stakeholders, one secondary stakeholder and one key stakeholder.

The key actors involved in the selected case-study are: the ORMVAT (service of irrigation management), which prepare the annual irrigation program and informs the municipalities and the representatives of farmers; the municipalities, which contribute to solve some conflicts among farmers; and farmers and their representatives.

Portugal

Caia catchment was selected as the Portuguese case-study. In this catchment, usually, more than 95% of water use is to supply the agricultural irrigated areas. The other percentage of the water available is to supply urban uses, mainly for the domestic consumption. According to the problem framework, social and economic activities are in touch with the natural resources. As a consequence of the Dam Management Process, the life conditions, the efficiency of water use, the conflict between users and some biophysical conditions (water remaining in the dam; Minimum Vital Stream and Stream Flow), might change.

In the case study area were identified eight key actors with intervention at national level (two), regional (two) and local level (four). These key actors are: four policy makers, one primary stakeholder, one secondary stakeholder and two key stakeholders.

The key actors involved in the selected case-study are: Water Institute and Hydraulics Institute, at national Level; the regional directorates of environment and territorial planning, at regional level; and the Caia Irrigation Board, the municipalities, farmers associations and water suppliers, at local level.

Spain

The river Tagus was selected has the Spanish case-study. This is the longest river on the Iberian Peninsula and the third with regards to total contributing area (about one ninth of Spain) and in amount of water carried (about one tenth of Spain). The Tagus Basin is the one that has the largest population weight in Spain and in the Iberian Peninsula (over 6 million people). The volume of water that provides to other basins is a concern, since the Tagus is the one that provides the largest share to other basins. The Tagus basin is the most regulated one (about one fourth of the regulated water in Spain is from the Tagus Basin). It is a trans-boundary basin and a certain amount of water has to reach the river in Portugal, determined by the Albufeira convention. The Tagus basin also supplies water to the Segura basin, a water scarce basin in the eastern Mediterranean area of Spain.

River Basin Authorities, headed by a Chairman appointed by the Council of Ministers, are the key actors in the case study area. They integrate: representatives of the Ministries of Environment, Agriculture, and Energy and of regional governments; water users including NGOs and different professionals.

Syria

The pilot basin of Asnober river is the case-study area in Syria. Part of the water in this catchment is used for domestic, agricultural, and industrial purposes. Other part interacts with the groundwater system, and the remaining runoff flows into the Mediterranean Sea.

The Syrian regime gives priority to security, that means the final decisions are made by the Syrian President at all levels (especially National level), by the Security Council at all levels (especially in the counties and regions), and by the party groups at local level. The decision was supported to keep the social balances, which mean to look to lower classes for fighting the poverty. This means also that the stakeholders were not included in the final decisions.

The key actor in the case-study area is the Ministry of Irrigation.

Tunisia

The Jeffara aquifer (Southern Tunisia) is the case-study selected. It concerns a zone of interdiction of groundwater exploitation. The "interdiction" decision is based on several studies showing that the intensive exploitation of the inshore aquifers of Jeffara risked causing, besides considerable resources decreases, an important deterioration of water quality by salinity increase and especially a serious marine intrusion.

In the case study area were identified eight key actors with intervention at national level (two), regional (three) and local level (three). These key actors are: three policy makers, three primary stakeholders, and two key stakeholders.

Decision making processes are traditionally restricted to the level of policy makers. Actually, national strategies involve so called “participative actions” but only for the application of the decision. That’s why, in the presented case study, the farmers have limited confidence in of the importance of the interdiction perimeters. For them, it is difficult to pay, even weak costs, to obtain water from State when they can capture good quality water by their own wells.

The key actors involved in the selected case-study are: General Direction of Resources in Tunisian Water; National Society for the Exploitation and the Distribution of Waters; Gabès Governorate, Regional Commission of Agricultural Development; and farmers association.

Turkey

The Gediz Basin in Western Turkey was selected as case-study area. The Basin is currently caught up in a very dynamic period of reassessment and change, which began with the onset of the drought in 1989. Before the drought, there was little competition for water, and the established mechanism for allocating water to different users through a set of bilateral agreements worked well. When the drought struck, irrigation issues in the peak summer season were reduced sharply, return flows diminished, and, as a consequence, water quality in the lower third of the Basin deteriorated. Rural residents began to complain that water was unsuitable for irrigation. At the same time there was widespread desiccation of the important wetland areas in the Gediz Delta, leading to large reductions in bird populations and, possibly, loss of species diversity.

In the case study area were identified thirty-six actors with intervention at national level (five), regional (five) and local level (twenty-six). These key actors are: nine policy makers, eleven primary stakeholders, and sixteen secondary stakeholders.

The key actors involved in the selected case-study are: General Directorate of State Hydraulic Works (DSI); Ministry of Environment and Forestry; Municipalities and Villages; State Planning Organization; General Directorate of Rural Services; Irrigation Associations; and Environmental NGOs.

3.3.2 Overview

From the interviews and meetings with policy-makers and stakeholders a total of 126 institutions answer to the questionnaire developed in the frame of NOSTRUM-DSS (Table 3). A total of 40 of these institutions represent the national level, 21 have an influence at regional level and 65 intervene at local level. In what concerns the position of the institution in the decision-making processes, Table 4 shows that 45 have responsibilities in terms of policy making. The stakeholders that were positively or negatively affected by the decision correspond to 33. Other stakeholders that intervene by influencing the decision or because they are intermediaries in the decision-making process, amount to 48.

Table 3 – Key actors involved in the selected case-studies

Countries	Level of intervention of the institution interviewed				Type of institution interviewed				
	National	Regional	Local	Total	Policy-Maker	Primary stakeholders: those ultimately affected by the decision	Secondary stakeholders: intermediaries in the process of decision making	Key stakeholders: can significantly influence the decision taken.	Total
Algeria	2	3	2	7	3	1	3	0	7
Croatia	-	-	-	-	-	-	-	-	-
Cyprus	3	0	12	15	3	8	3	1	15
Egypt	9	1	4	14	7	1	3	3	14
France	6	0	2	8	5	2	0	1	8
Greece	3	1	4	8	2	2	3	1	8
Israel / Palestine	1	2	1	4	2	0	0	2	4
Italy	1	1	1	3	1	0	2	-	3
Lebanon	3	1	2	6	2	1	0	3	6
Morocco	2	2	4	8	3	3	1	1	8
Portugal	2	2	4	8	4	1	1	2	8
Spain	-	-	-	-	-	-	-	-	-
Syria	1	0	0	1	1	0	0	0	1
Tunisia	2	3	3	8	3	3	0	2	8
Turkey	5	5	26	36	9	11	16	-	36
Total	40	21	65	126	45	33	32	16	126

Table 4 – Type of institutions involved in the selected case-studies

Countries	Type of institutions						
	Public agency	Private company	Farmers' association	Industrial entrepreneurs' association	Other stakeholders' association	NGO	Other type of institution
Algeria	4					2	1
Croatia	5					1	3
Cyprus	14					1	
Egypt	7	3				2	2
France	7				1		
Greece	2	3	2		1		
Israel / Palestine	2		1			1	
Italy		1					2
Lebanon	4					1	1
Morocco	5		3				
Portugal	5		2			1	
Spain	-	-	-	-	-	-	-
Syria	1						
Tunisia	5	1	1				1
Turkey	21		14			1	
Total	82	8	23	0	2	10	10

Table 5 – Type of water use related with institution in the selected case-studies

Countries	Type of water use related with institution					
	Agricultural	Industrial	Domestic Consumption	Electric power generation	Recreation	Others
Algeria	6	7	7	4	3	
Croatia	5	4	6	5	4	
Cyprus	12	15	15		5	
Egypt	14	10	11	10	11	
France	6	6	7	4	5	2
Greece	5	4	5	2	4	2
Israel / Palestine	4	2	2		2	
Italy	1		1			1
Lebanon			5			1
Morocco	8	3	3	3		
Portugal	5	1	4	2	3	2
Spain	-	-	-	-	-	-
Syria	1	1	1	1	1	1
Tunisia	3	1	2			1
Turkey	30	16	19	16	30	
Total	100	70	88	47	68	10

Table 6 – Main objectives of the institution

Countries	Main objectives of the institution															
	Water manag.	Water distrib.	Policy making	Develop inform. systems	Promote integ. manag.	Estab. tariff rules	Water resources conservation and protection	Infrastructure's maintenance and security	Promote new infrastructures	Agricult. production	Indus. production	Tourism	Electric power generation	Promote a water network	Research	Others
Algeria	4	3	3	4	4	1	5	1	1	1	1	2	1	1	4	
Croatia	3	2	4	4	3	1	4	4	3				2	1	4	4
Cyprus	14	9	2	6	6	1	14	14	13	8				4	2	
Egypt	3	2	3		4		1	1	1	1				3	5	5
France	5	1	3	6	5		6	3	1					1	7	4
Greece	6	3	2	1	4	3	4	3	4	4	3	5	1	3	3	
Israel / Palestine	1		1	1	1		1								1	
Italy	1	2				1	1	2	2						1	
Lebanon	1	3	2	2	3	3	5	3	3			2		3	2	
Morocco	5	5	3	4	4	1	7	3	1	4			1	5		
Portugal	4	4	2	2	4	3	3	2	4	2		2	2	1	3	1
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Syria	1	1	1	1	1	1	1	1	1					1	1	1
Tunisia	2	2	1				2	1		3	1					
Turkey	31	17	8	4	20	2	18	14	16	14		10	13	12	8	
Total	81	54	35	35	59	17	72	52	50	37	5	21	20	35	41	15

Table 7 – Decision process frame of the institutions

Countries	Autonomy in the decisions			External opinions considered in decision process		External opinions					
	Autonomous	Dependent	Autonomous with restrains	Yes	No	Consultants	Stakeholders	NGO's	Media	Local community	Other
Algeria	2	1			3	2	2	1	1	3	
Croatia			2	1	3	3	2	1		2	1
Cyprus	1			2	3	3	3	3		3	
Egypt	4	2	1	7	6	4	5	1		1	1
France	4	1	1	6	2	6	4			6	2
Greece	1		1	2	2	2	2				
Israel / Palestine	1		1	1	1	2	1	1		1	
Italy	1			1		1	1				
Lebanon	2			2		2	2	1		1	
Morocco	1	1	1	3		2		2	1		2
Portugal	1	1	2	4		5	4	2		1	
Spain	-	-	-	-	-	-	-	-	-	-	-
Syria	1			1		1			1	1	1
Tunisia		3		3		2	1			2	2
Turkey	5	3	1	8	1	5	6	3		3	
Total	24	14	11	47	2	40	33	15	3	24	9

From the analysis of Tables 4 and 5, it is possible to see that the institutions contacted in the frame of NOSTRUM-DSS are mainly public agencies (from the central and local administration and farmers associations). This reveals two major characteristics of the water management in the countries involved in the coordination action: the strong influence of state institutions and the agricultural use of water.

However, the objectives of the institutions interviewed are often more broader than the agricultural production. In fact, Table 6 shows us that other type of involvement in water resources management is important for the institutions (both stakeholders and policy-makers) involved in NOSTRUM-DSS.

Independently from the autonomy in the process of decision-making, globally these institutions consider the need for integrate external opinions in the process of decision-making (Table 7). External consultants, stakeholders and the local communities are the more frequent sources of these external opinions.

3.3.3 Social Network analysis

The examples of Lebanon, Portugal and Turkey illustrate how the analysis of interactions of the actors contacted in the frame of NOSTRUM-DSS can contribute for the understanding of difficulties and potential of involving local actors and policy-makers in the issues of water resource management.

Lebanon - the Damour case study

Several policy makers and stakeholders, at the national, regional, and local levels have interests in the integrated management of the water resources in the area:

National Level:

- Ministries of: a) Energy and Water, Public Health, Environment, Agriculture, Public Works and Transportation
- Public agencies: NCRS
- Private Companies (ELARD)
- Academic institutions (AUB)
- International Organizations (ESCWA)

Regional Level:

- Beirut and Mount Lebanon Water and Wastewater Establishment
- Barouk Water Authority

Local Level:

- Municipalities of villages located along the river basin
- Community represented by CBOs, such as the Damour Youth
- The industrial, agricultural, and recreational sectors

The ministries of: a) Energy and Water, b) Public Health, c) Environment, d) Agriculture, and e) Public Works and Transportation are the policy makers, especially given that the water sector is under the jurisdiction of these governmental institutions. The Beirut and Mount Lebanon Water and Wastewater Establishment is considered also to be a policy maker since it has the potential to use the DSS tool for the management of the water resources. It has however also a role in securing potable water to local users. In this sense it can also be considered as a key stakeholder.

Regarding the private companies and international organizations, they are considered to be secondary stakeholders since they are involved in research that would facilitate the process of decision making. The municipality is considered to be the key stakeholder since it facilitates the process of implementing the project within its municipal boundaries. As for the community, which was represented by the Damour Youth Club, it is considered as the primary stakeholder since they are positively or negatively influenced by the decisions taken.

All the stated stakeholders have a direct interest in water management, due to the following reasons:

- The ministries are involved in the development of policies for the proper management of the water resources and implementation of the policies.
- The Water and Wastewater Establishments are involved in the implementation of regional water projects according to the plans.
- The international organizations and private companies are involved in research activities that facilitate the decision making process,
- The municipalities facilitates the water works within its boundaries, and
- The water users are affected by the quality of the services provided.

As previously mentioned, the coordination and cooperation among governmental institutions does not exist. As such, it is difficult to indicate the periodicity of interaction among the different stakeholders. On the other hand, the interactions were determined based on the role of the stakeholders in the case study. The interaction activities were mainly associated with:

- Giving advice to the municipality for the management of the water resources
- in the area;
- Providing technical support for specific projects by the academic institutions (AUB) and consultancy companies (ELARD) for the integrated management of the water resources in the area;
- Discussing and developing recommendations on specific water quality and availability issues in the area, and
- Discussing and developing recommendations on environmental issues in the area.

In summary, the MEW would be primarily responsible for water availability issues, and would give advice and technical support to local water authorities and municipalities related to such issues.

The MOE in turn would be primarily responsible for water quality and environmental issues. The MOPH is mainly concerned with the quality of potable water. The MOA is responsible for the agricultural practices, including irrigation practices in the study area, and therefore is concerned with water availability issues as well as water quality issues related to agro-chemicals use.

MOPWT is mainly responsible, through the directorate general of urban planning, for the spatial planning in the area. The water authorities (BWA and BIWA) are responsible for the distribution of potable water to the local communities and deal mainly with water availability and quality issues.

Private companies (such as ELARD), universities (such as AUB) and international organizations (such as ESCWA) are key advisors and provide technical support to the different government and local authorities, as well as local communities with respect to water availability, water quality and environmental issues. The municipality is also a local provider of water resources (particularly in the case of Damour), and is responsible for the implementation of local infrastructure works and the provision of necessary services to the local communities. These in turn are main users of water resources, and would like to have sufficient water quantity of appropriate quality.

Portugal - Caia catchment

In order to obtain the identification of stakeholders and the main groups of stakeholders whom have been involved in the decision making process it is proposed an analysis based on a previous definition of Caia Water Resources Social Network (CWRSN).

To create a significant CWRSN with the objective of understanding the relationships between stakeholders was firstly defined a series of 14 interviews. Thinking in the dimensions of the Caia's basin, after consulting end users (INAG and IHDRA – key stakeholders) and according to the socioeconomic characteristics was intended that 14 was a right number of to know the water resources problems and the interactions moved by its subject.

After the initial interviews was necessary to append more four stakeholders to complete these contacts with local actors.

Social Network in a multi-level analysis:

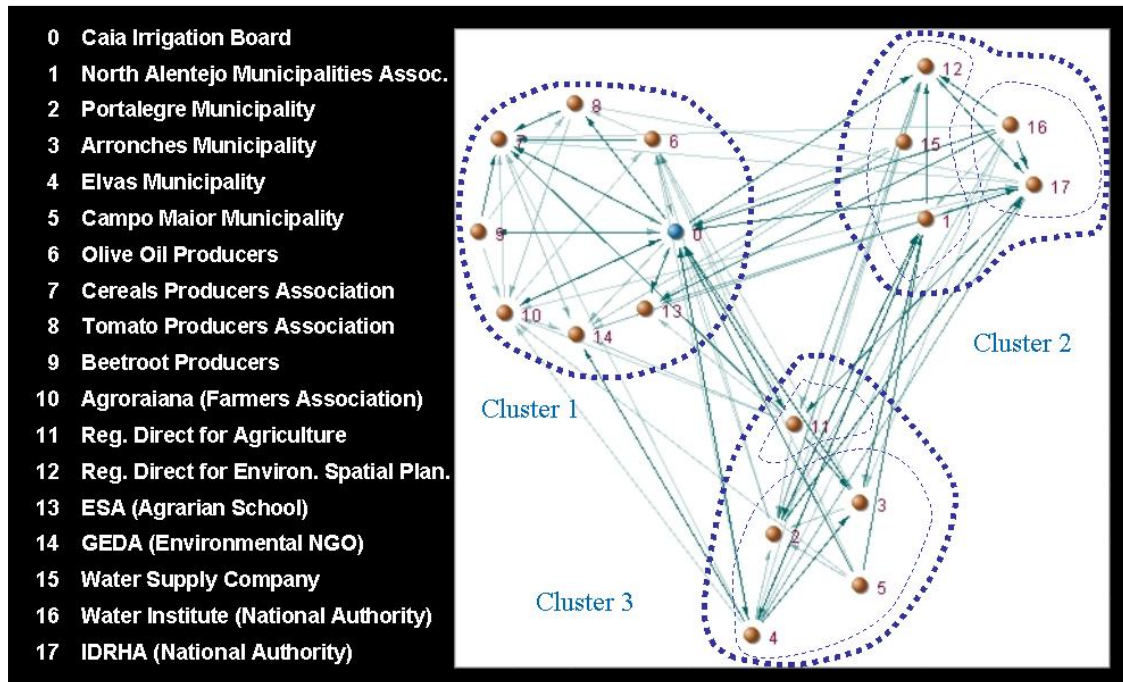
- National (Lisbon - end users): INAG; IDHRA;
- Regional (Évora and Portalegre) : DRAOT; DRA;
- Local (Elvas, Arronches, Campo Maior and Portalegre): Caia Irrigation Board (ABC); Olive Oil Producers; Cereals Producers Association; Tomato Producers Association; Beetroot Producers; Farmers Association (Agroraiana); Arronches municipality; Campo Maior municipality; GEDA (environmental ONG); Portalegre Municipality, North Alentejo Municipalities Association;

The main goal of the CWRSN was to determine possible interactions among stakeholders (actors) which imply looking not only at individual's social actors, but also at groups (Figure 17).

Based on the field contacts it was expected to find a sparse network because, in the theoretical point of view reinforced with the principals of WFD, water management activity required an existence of regional authorities with decision making power. Traditionally in Portugal, the national authorities had

most important information and played important roles (controlling) groups of farmer's associations and municipality unions. The problem of water management in the Caia's catchment required frequently the intervention of national and regional authorities, that's the reason because it is necessary to append these levels of analysis to identify and understand the Caia local networks.

Figure 17 – Base image of stakeholders' positional analysis within the Caia network



However, the last strategies and plans indicate some transformation of traditional centralization decision making process to the creation of a regional and local entities with power to manage water resources, i.e.: Águas do Norte Alentejano, for urban water consumptions; and Conselho de Bacia do Guadiana that is the first step to create a Regional authority to manage the water resources at the river basin level (as it is proposed in WFD).

Could be, this recent changes, revealed in the Caia network interrelationships flows patterns?

Low density is the main characteristic of Caia's local network, not only within the entities located inside the Caia river basin, but also between different levels of decision making process, national authorities, regional authorities, municipalities and farmer associations.

The main goal of the CWRSN was to determine possible interactions among stakeholders (actors) which imply looking not only at individual's social actors, but also at groups (15). Based on the field contacts it was expected to find a sparse network because, in the theoretical point of view reinforced with the principals of WFD, water management activity required an existence of regional authorities with decision making power. Traditionally in Portugal, the national authorities had most important information and played important roles (controlling) groups of farmer's associations and municipality unions. The problem of water management in the Caia's catchment required frequently the intervention of national and regional authorities, that's the reason because it is necessary to append these levels of analysis to identify and understand the Caia local networks.

However, the last strategies and plans indicate some transformation of traditional centralization decision making process to the creation of a regional and local entities with power to manage water resources, i.e.: Águas do Norte Alentejano, for urban water consumptions; and Conselho de Bacia do Guadiana that is the first step to create a Regional authority to manage the water resources at the river basin level (as it is proposed in WFD).

Could be, this recent changes, revealed in the Caia network interrelationships flows patterns?

Low density is the main characteristic of Caia's local network, not only within the entities located inside the Caia river basin, but also between different levels of decision making process, national authorities, regional authorities, municipalities and farmer associations.

Starting from 17 stakeholders interviewees it is identified 95 ties connecting them. As a result the density observed (0.31) is considered very low. The source for this phenomenon could be perceived with a deeper analysis of the interactions inside the groups and between them. This level of density is also founded in the dispersion of decision making process according water resources. The level of cohesion (0.11) reflects also the main characteristics of Caia network: the very low networks cohesion is just another indicator to confirm which in Caia network the relationships between stakeholders could improve the water management if the interconnectivity between stakeholders increases a little more.

From inspecting results of local networks images is possible start to consider immediately three structural features (Fig. 3). First, there is a clean separation between the farmers associations, municipalities and institutional entities. And second, in global values, network has low density of relationships; however the level of connections between groups is moderately high. This point is important to understand the reason because is verified too much low level of density in Caia network, because this structure very well defined represents that inside of the main network it is possible to identify important sub-groups. This could be relevant to minimize the effects of low density, for the reason that it is identified some important connections inside these groups and it is also visible an important number of ties connecting different groups.

Other aspect that gives it another indicator to minimize the general main characteristics of low density network is the medium level of weight density (0.66). This value represents that in Caia network a large number of stakeholders have some kind of contacts with the other stakeholders in the network. This contact could have just one direction, independently of the harrow aspect; therefore a majority of contacts inside the Caia network is assumed just for one stakeholder (is unidirectional contact).

On the other hand, a low density at interrelationships flows, as a consequence of the main characteristics of water management in Portugal (decision making process to much centralized) is balanced with a very large density of relationships between stakeholders which sharing same interests.

At first, it was expected to observe relative higher density in operationally flows; however difficulties emerged in consequence of some lack of communication between fundamental sectors to maintain the decision process flowing. On more time the heterogeneity of this network could be the source of this problem.

On the other hand, it is predicted a high density in the flows of information between stakeholders sharing same interests. Inside of the farmer's association group it is observed a high level of interconnections, mainly because water resources management process involves the opinion of all

stakeholders. Every stakeholders (except GEDA) could participate in the decisions about the water management because all of them could participate in the assembly where is taking the decisions.

Finally, with the levels of density and cohesion observed in is very difficult to implement any kinds of change, or answer positively at the main questions regarding to the implementation of WFD, or just to reform the urban water supply, as it is the objective of authorities with responsibilities about water management in Portugal.

Turkey - Gediz Basin in Western Turkey

Five categories of water users in the Gediz Basin were identified and their respective water uses outlined. Some of these water users are able to represent their own interests (industries and municipalities), while others may be either many and unorganized (small system irrigators) or unable for other reasons to represent themselves (ecosystems). In addition there are other State actors such as DSI involved in Gediz Basin water management which, while not water users, are important players. The range of Basin stakeholders is thus different, and broader, than the group of actual water users. The major ones of these are described below.

a) Public Agencies

DSI. The General Directorate of State Hydraulic Works (DSI) is the main executive agency of the Government of Turkey for the country's overall water resources planning, execution and operation. It was established in 1954 and is currently a part of the Ministry of Energy and Natural Resources. The mandate of the DSI is "to develop water and land resources in Turkey" (DSI, 1995). It is responsible for major irrigation, flood control, drainage, hydropower development, and supplying water to cities with a population over 100,000. DSI centralizes most of the state functions involved in planning and developing large-scale water resources.

Until recently, DSI's policy has been to manage the irrigation schemes it designs and constructs. Current policy and practice is to transfer schemes to locally-based Irrigation Associations (IAs) to manage. DSI also transfers hydropower and municipal water supply schemes that it designs and constructs to other agencies to operate. DSI is also responsible for managing and allocating groundwater to prospective users. It does this through the permitting system described in the previous section. Its responsibilities for groundwater quality are limited to monitoring.

DSI maintains 26 regional offices across the country, organized along watershed lines. The Gediz Basin lies entirely within one of these regions and is serviced by the regional office in Izmir.

Ministry of Environment and Forestry. The Ministry of Environment and Forestry (MoE) is the public agency with overall responsible for surface water quality. In spite of this general status, however, its mandate and capacities extend to cover only some of the functions that implementing this responsibility entail. Its major responsibilities include coordinating plans among the various public and private agencies involved with protecting the environment, commissioning environmental impact assessments of major water resources projects, and setting standards for and monitoring surface water quality. Actual monitoring and reporting of water quality and wastewater discharges are carried

out by provincial offices of MoE. The explicit mandate of the MoE does not extend to groundwater quality. Neither the national nor the provincial offices of MoE possess direct enforcement powers.

Municipalities and Villages. Towns and villages play three important roles in the water resource arena. First they are water users and dischargers of wastewater. There are 19 settlements in the Basin with a combined population of 1.35 million. All draw their domestic water supplies from groundwater. Of the 19, only 3 have completed wastewater sewage systems and treatment plants. The remainder discharge untreated wastewater into the Gediz and tributaries.

The second important role played by towns and villages is that of representing irrigation water users in their areas. They do this (a) through their statutory dominance of the boards of large-scale Irrigation Associations, (b) as owners and operators of municipal irrigation wellfields, and (c) as representatives of the interests of otherwise unorganized farmers irrigating from private wells or small surface water sources who make up parts of their constituencies.

The third role is that of environmental regulation. Municipal and village administrations are responsible for operating water and wastewater treatment plants within their jurisdictions and monitoring the quality of domestic water supplies. They also have some authority to monitor industrial wastewater discharges, although most are not active in this area.

Provinces and Districts. Provincial and district governors, appointed by the Ministry of the Interior in Ankara, are the only authorities with the power to assess fines or issue and enforce prohibitions against violators of water quality regulations. All other actors, including MoE, MoH, DSI, and municipalities, may only report cases that contradict laws for which they are responsible to the provincial or district governor. District governors must secure approval from the provincial governor before taking action. Provincial governors are thus singularly responsible for water quality enforcement proceeding.

State Planning Organization. The State Planning Organization is an arm of the prime ministry which prepares a rolling 5-year investment plan for the nation. It is responsible for planning all public capital investment in the country, including investments for water resource development, wastewater treatment, and environmental problem mitigation.

General Directorate of Rural Services. The General Directorate of Rural Services (GDRS), a part of the Prime Ministry, is responsible for developing small-scale groundwater resources for irrigation, developing surface water sources with flows of less than 500 liters per second for irrigation, on-farm irrigation development, and the construction of rural roads and village water supply systems. GDRS's minor irrigation schemes are transferred to farmers' cooperatives or local governments upon completion. GDRS does not have an operation and maintenance capacity.

b) Semi-Public or Private Groups

Irrigation Associations. Thirteen Irrigation Associations (IAs) were established in the 7 large canal irrigation commands in the Basin in 1995 under the accelerated irrigation management transfer program of DSI and have assumed operational control of canal irrigation in those areas. DSI continues to operate the main reservoir and river diversion structures, but operational management below that level is now in the hands of the IAs. The legal basis for forming IAs is a law allowing the establishment of associations of local governments, and the present governance structure of the IAs is dominated by elected village headpersons, town mayors, and elected members of local municipal councils. Irrigation

Associations are public bodies that enjoy tax exemptions and are non-profit, but are not bound by standard government civil service regulations and financial procedures. Although this system has drawbacks, it does provide valuable links with local government structures. IAs operate the canal systems within their areas, employing hired staff and financing operations and maintenance through fees collected from water users. The 13 IAs collaborate extensively on an informal basis and have discussed the possibility of forming a more permanent association to represent their common interests. They are the most important water users in the Basin and retain a strong functional tie to DSI, which provides their bulk water supply and serves as the Basin water allocation authority in the absence of a more explicit system of water right allocation.

Other Irrigators. Other irrigation water suppliers and users not encompassed by IAs include towns and villages which have developed well-fields for irrigation supply in their areas, individual farmers and groups of farmers who have invested in irrigation wells, and farmers who employ small surface water diversions in upper parts of the Gediz catchment to irrigate crops. There is no formal organization tying these water users together, though their number is significant. To some extent, local village heads and town mayors are able and generally willing to represent the interests of these irrigators when a need arises. Such representation is not coordinated among villages, however, and in general would not be expected to be particularly potent in competition with larger better organized interests.

Environmental NGOs. There are many NGOs active in the field environmental conservation in Turkey. A 1995 directory lists 98 of them, and there are others which are not included in the directory. With respect to water-related issues in general, and the Gediz in particular, the following are among the most important.

- Turkish Erosion Control, Reforestation, and Environment Foundation (TEMA). TEMA was established in 1992 with strong business community support. It currently has about 50,000 members and in 1997 operated on a budget of US\$ 2 million. TEMA publishes a monthly bulletin on environmental issues and every two-years publishes an *Environmental Profile of Turkey*, which is now also available in English. It enjoys good contacts with the Ministry of Environment and has been instrumental in shaping the new national environmental laws and regulations. It is the most influential of the national environmental NGOs.
- Gediz Basin Erosion Control Reforestation and Environment Foundation (GEMA). This NGO has interests similar to those of TEMA but is concerned specifically with the Gediz Basin.
- Society for the Protection of Wildlife. This society was established in 1975 and works to raise awareness of shrinking populations of various wildlife species, with a special focus on birds. The society works extensively with elementary school children, publishing a newsletter and guidebooks for schools and others. It collaborates with the World Wildlife Fund and other international organizations.

Although concerned with water, none of these organizations place a priority focus on it. Most of NGO activities to date have been concerned with education, awareness raising, and lobbying, with little independent scientific or information collection effort evidenced so far.

Industries. Although industrial plants are scattered throughout the Gediz Basin, the largest concentration is in two Organized Industrial Districts, one in Kemalpaşa in İzmir Province with about 180 enterprises, and the second near Manisa in Manisa Province with about 50 enterprises. The owners of these industries are organized into several associations which wield considerable political

power. These include the Aegean Chamber of Industry, the Businessmen's Association, and the Young Businessmen's Association.

Environmental Assemblies. Local environmental assemblies (Mahalli Cevre Kurulu) have recently been formed in several Basin areas. Authorized under the Environmental Law, assemblies are broadly constituted, comprising mayors, DSI, the Chamber of Industry, and so on, and are typically chaired by the provincial governor. They meet monthly and are authorized to make fairly influential decisions on issues relating to urban environmental quality. Such an authority, chaired by the district governor, exists also for the Kemalpaşa Organized Industrial District.

4 Contribution to the DSS development

From the analysis of the available information in the countries involved in this Coordination Action, the development of DSS tools, with application towards water resource management, is almost the result of academic efforts.

4.1 Experiences with DSS in water management

Algeria

There is no real DSS process in the water domain. Recently some projects dealing with GIS and management have been conducted within the bilateral cooperation between Algeria and Germany (GTZ). In our context, those actions concerned the Regional Water Plan (PRE). The main outputs are: multi-sources data collection and organization, GIS, management approaches.

Croatia

DSS for water management in Croatia has not been developed and used in operative terms. However, various elements of the system, such as hydrometeorological and water resource data base and the information system are partially developed.

Cyprus

There has been no systematic endeavour at developing a Decision Support System (DSS) in Cyprus; hence no specific reference can be made to past successes and failures. The mechanisms in place to take decisions related to water policy were developed during the last decades since the foundation of the Republic of Cyprus in 1960. This could be described as an evolutionary process where mechanisms are adapted continuously as available knowledge and data, but in particular the pattern of water use, changes.

Egypt

Several Decision Support Systems have been developed during the last twenty years to assist in proper water resources management on the national scale in Egypt. Three examples are briefly introduced herein. The Egyptian National Water Research Center (H. Fahmy et al.) has developed a DSS entitled Egypt's Water Resources and Associated Socio-economic & Environmental Dynamic System (EWRSES). The model aims at capturing the complex network of relationships relevant to Egypt's development linked with water resources and land-use. Being a dynamic system model, it allows investigating whether the desired end-of-horizon state can be actually reached or not, and how the system will evolve.

France

In France, DSS Tools are very often used by public services or industrials in wide or specific way. The term of Decision Support System covers a large variety of Tools laying emphasis on knowledge access (data bases) or more complex analytical systems such as optimisation or simulation models.

Greece

DSS models for water management in Greece have been developed to serve the purposes of the Water Framework Directive and, consequently, are expected to play important role in the implementation of the WFD in the country and in influencing the relevant policy making. The DSS developed for EYDAP S.A. – the Athens Water Supply and Sewerage Company has been widely used by the company and the up to date results have been utilised to improve water management in Athens focusing on the interrelation of water resource usage, efficiency, and economic viability.

Italy

Although several DSSs have been made available thanks to the efforts of the academic community and of specialised private companies, these tools still are not widespread in Italy.

Lebanon

In Lebanon, several attempts have been made to apply DSS tools for the management of the water resources at the national and regional levels. Such projects have been primarily initiated by international agencies, mainly the United States Agency for International Development (USAID) and the European Commission (EC). Unfortunately, to date there is not a single successful experience of use of DSS in decision-making. Most tools were either left at the developmental stage or are currently under development.

Morocco

DSS for water management in Morocco has not been developed and used in operative terms. Nevertheless, to rationalise the use of water and hydraulic infrastructures and to optimise underground water utilisation, while serving the myriad of demanding sectors, Morocco has adopted an integrated approach to water resources management through reinforcement of policy and institutional reforms.

Portugal

In Portugal some DSS were developed (mainly through the efforts of the academic community) to help decision makers in the process of design and selection of on-farm surface irrigation systems, at the local scale. The aim of this modernisation is to increase a performance in the use of water, energy and labour, and the conservation of natural resources. The DSS are composed by an input data base, design models for alternative design and impact analysis, and a multiple criteria decision making model that evaluates and ranks the alternative designs. However, the experience of using DSS as a software tool to support decisions related with water resources management is very recent and fragmented. Some references about this subject don't result really from the application of DSS tools; in part of the cases are just simple GIS or DB without any task with multivariate analysis.

Spain

Decision Support Systems relevant to water management are developed and used at two levels: for indicator development and monitoring; and for contingency planning. This last level is very significant for Basin Authorities work on water management: they developed contingency plans that rely on DSS.

Syria

DSS were first used in policy making for water management in Syria in the project of the pilot basin of the Asnober River. It starts with modelling as proper tool to evaluate the alternative water resources development strategies in the costal basin. This phase is followed by the study of options for using the river basin trough simulation modelling software. This approach proved to be useful for supporting decisions regarding water management for the following issues: conceptual analysis of the existing surface water resources system; evaluation and optimisation of the use of surface water resources; and evaluation of new water resources infrastructures.

Tunisia

Water management in Tunisia benefits a particular high authority attention, with objective to assure the sustainability of resources.

DSS are known in Tunisia, especially if one considers them as «expert systems», «multiagents system» or simply «integrated management». However, even if it is extensively used in industrial and socio-economic studies, the DSS concept remains of limited utilisation in water management. Dss-tools are always considered downstream the problematic, like a way to synthesise data and strategies. However, some research projects are centered on the use DSS in water management. For the most, these projects are achieved at regional and even local level. Very few projects can be extrapolated to the national level because results remain tightly related to specificities of the studied hydrosystem. In the same way, these projects remained to the stadium of «research project» without being integrated in decisional strategies. This fact is due to the fact that decision-makers are rarely included as such in these projects but as technicians and supplier of data on waters.

Turkey

The development of DSS in Turkey is essentially an emerging issue, with a history of only a decade. Efforts towards DSS applications in water management have started in the early 90's, basically at academic levels through research carried out at universities and other research institutions. Major water resources agencies, who make the decisions, have been and are still pretty slow in adapting DSS tools in actual water management practices. Since cooperation between research institutions and these agencies is rather weak, it has not been possible to convey research results to practice. Only very recently has there been the recognition of the significance of DSS tools by decision makers and governmental water agencies.

Interestingly enough, within the last 2-3 years, these agencies have started to favour DSS tools; yet, they fail to use DSS effectively and sufficiently in decision-making since there is a strong need for capacity building, personnel training and data availability.

4.1.1 Overview

According with Table 8, the development and implementation of DSS tools in water management is not widespread among the NOSTRUM-DSS countries.

The significance of DSS tools to support decision-making is somehow recognised by decision makers and governmental water agencies, especially when considered as GIS or DB tools. However its

effective implementation is only marginally accomplished. Some reasons are usually pointed out: weak cooperation between research institutions and these decision-makers; strong need for capacity building, personnel training and data availability.

Table 8 – Experiences with DSS in water management

Countries	Experience with DSS in water management	
	DSS development at national level	DSS implementation at national level
Algeria	Yes	No
Croatia	Partially	No
Cyprus	No	No
Egypt	Yes	Yes
France	Yes	Yes
Greece	Yes	Yes
Israel / Palestine	-	-
Italy	Yes	Partially
Lebanon	Yes	No
Morocco	No	No
Portugal	Yes	Partially
Spain	Yes	Yes
Syria	Yes	Yes
Tunisia	Partially	Partially
Turkey	Yes	Partially

5 Conclusions and recommendations

Decades of human pressure on natural resources resulted in a new approach to development, which also points to the future but, contrarily to prior approaches, "...to a bleak future of scarcities rather than a bright future of progress..." (Sachs, 2000). Development is only possible when economic fairness, social equity and environmental sustainability are guaranteed. To find solutions to these problems is one of the main challenges of our society.

Water is a crucial natural resource for the sustainable development of world societies. The growing demand of water resources (caused by population and economic growth) and climatic conditions are driving to an increasing water scarcity as well as to the degradation of their quality. In arid and semi-arid regions, the management of surface and groundwater resources creates significant challenges for the development of local populations. The competition for these resources can be an ongoing source of tension and conflicts.

According to the United Nations World Water Development Report we are facing nowadays a Global Water Crisis. However, this Global Water Crisis is also frequently a crisis of governance (Rogers, 2003), resulting from the failure on determining the roles and responsibilities of public, civil and private interests, as well as of integrating policies and practices in the effective management of water resources and development.

The EU Water initiative stresses water governance, capacity-building and awareness as important steps towards reaching the water-related MDGs and WSSD targets which emphasise the need for integrated water resources management at basin level. In its White Paper on Governance published in 2001 (CEC, 2001), the Commission has recommended to open up the decision making process by confronting scientific experts and other types of knowledge and broadening the fields of scientific fields called upon. The Commission recommended in particular that opportunities for true public debate and a greater participation of the civil society in the decision making process be increased. The Water Framework Directive follows these recommendations encouraging Member States to involve stakeholders in water planning and requiring the implementation of procedures of public consultation.

Involving stakeholders in environmental decision-making is still facing constraints to be implemented, and in some countries outside European Union, strong administrative limitations exist to the public participation in the definition of environmental policy options (Gonsalves, 2005). In fact, in EU countries, the process of water resource management is driven by a clear compulsory end point: the water status has to be good after WFD implementation. However, Mediterranean Partner Countries (MPC) are not bound to any international duty to achieve certain objectives in their watersheds.

In the majority of countries involved in NOSTRUM-DSS, a rather centralised system is the responsible for the governance of water resources. However, in the last 10-15 years the governments of the countries involved made strong efforts to restructure and improve water management institutions, as a means to achieve better performances in managing this scarce natural resource. Nevertheless, in some countries, a normative system split by numerous laws is still present, driving to significant overlapping of functions and jurisdictions which are responsible of several competence conflicts.

NOSTRUM-DSS identifies the UN Millennium Declaration (MD), the Plan of Implementation of the World Summit on Sustainable Development (WSSD), the EU Water Initiative, and the Millennium Development Goals (MDGs), as focal references for the work that has been carried out in the frame of the Coordination Action implementation. Therefore the main recommendations are related with the contribution for the achievement of the targets agreed at the World Summit on Sustainable

Development in Johannesburg (2002), and the achievements of the Millennium Development Goals for water, as set out by the *EU Water Initiative: Water for Life*. Key objectives of the Water Initiative are, amongst others (EC, 2003):

- the reinforcement of political commitment towards action and innovation oriented partnership;
- the promotion of improved water governance, capacity building and awareness;
- improved efficiency and effectiveness of water management through multi-stakeholders dialogue and coordination.

More specifically:

- Improving the integration of local networks of stakeholders in the decision-making processes;
- Reinforcing the linkages between policy-makers and decision-makers, stakeholders and scientists;
- Disseminating the interest of DSS tools to support decision-making processes ground in sound knowledge of the impacts of each decision;
- Improving awareness and capacity building of technical personnel to face the new realities of managing a scarce resource such as water.

References

- Ahmed, M. (1993). Land and Water Policies in the Arab Region, UNESCWA.
- Bartelmus, P., 1999, Economic Growth and Patterns of Sustainability. Wupertal Papers, N° 98, Wupertal Institute for Climate, Wupertal: Environment and Energy, 16 p.
- Beaumont, P. (2000). The quest for water efficiency: Restructuring of water use in the Middle East., Water, Air and Soil Pollution.
- Benoit, G. & Comeau, A. (eds.) (2005). *A Sustainable Future for the Mediterranean. The Blue Plan's Environment and Development Outlook*. London: Earthscan. 640p.
- Bianchi, R. R. and Kossoudij, S.A. (2001), "Interest Groups and Organizations as Stakeholders", *World Bank Paper 35*.
- Braga, M. I. H. (1999). Integrating Freshwater Ecosystem Function and Services with Water Development Projects. Inter-American Development Bank, Washington, 40p.
- CEC (2001). European Governance: A White Paper; Commission of the European Communities, Brussels.
- Cerneia, M. M., ed. (1985). Putting People First: Sociological Variables in Rural Development, New York: Oxford University Press, 444 p. Cater, E. & Goodall, B. (1992). Must Tourism Destroy its Resource Base? In *Environmental Issues in the 1990s*. Edited by A.M. Mannion and S.R. Bowlby. Chichester: Wiley. pp.309-324
- Ching, L. M. (2002) Sustainable Agriculture Pushing Back the Desert. Institute of Science in Society. London
- Degenne A. Forsé, H.B.(1994). Les réseaux sociaux. Ed. Armand Colin, Paris, 288p.
- Denich, M.; Schroth, G. (2002). Concepts and Paradigms for the Management of Ecosystem Resources. in Lieberei, R. et al. (editors) *Neotropical Ecosystems*, Hamburg.
- Dourojeanni, A. (2001). Water Management at the River Basin Level: Challenges in Latin America. report LC/L.1583-P. Serie Recursos Naturales e Infraestructura n°29.
- EC (2003). Water for Life. European Communities, Office for Official Publications of the European Communities, Luxembourg.
- Falkenmark, M. & Widstrand, C. (1992). Population and Water Resources: A Delicate Balance, *Population Bulletin*, vol. 47, no. 3, pp. 1-36.
- Freeman, L. (1979). Centrality in social networks: Conceptual clarification. *Social Networks*, 1 , 215-39.
- Global Water Partnership (2000). Integrated Water Resources Management, TAC Background Papers No. 4, GWP, Stockholm.
- Gonsalves, J., T. Becker, A. Braun, D. Campilan, H. De Chavez, E. Fajber, M. Kapiriri, J. Rivaca-Caminade and R. Vernoooy (eds). (2005). Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook. Volume 2: Enabling Participatory Research and Development. International Potato Center-Users' Perspectives With Agricultural Research and Development, Laguna, Philippines and

International Development Research Centre, Ottawa, Canada.
(<http://web.idrc.ca/openebooks/182-5/>)

- Hoekstra, A.Y. (2003). Virtual water trade. Proceedings of the International Expert Meeting on Virtual Water Trade. Value of Water Research Report Series No. 12. IHE Delft.
- INAG (2001). Plano Nacional da Água. Versão para consulta pública. INAG. Lisboa.
- Khor, M. (2004) Sustainable Agriculture: Critical Ecological, Social & Economic Issues. Institute of Science in Society. London
- Lemieux, V. (1999). Les réseaux d'acteurs sociaux. PUF, Paris, 146p.
- Lourenço, N. (2001). Equity, Human Security and Environment: Key Elements of Sustainable Development. *Coastin. A Coastal Policy Research Newsletter*, 5, pp. 2-5.
- Lourenço, N.; Jorge, R.; Machado, C.R.; Rodrigues, L. (2002). *An Integrated approach to understand territory dynamics. The coastal alentejo (Portugal)*. Nota di Lavoro 84.2002. Fondazione Eni Enrico Mattei, Milan.
- Lourenço, N.; Rodrigues, L.; Machado, C.R. (2004). *Social networks and water management decision-making: a methodological approach to local case studies*. Annex to the final report of the MULINO Project.
- Lundqvist, J. (ed.) (2000). New dimensions in water security. Water, society and ecosystem services in the 21st century. Rome: FAO. 82p.
- Machado, C. R.; Lourenço, N.; Jorge, M. R.; Rodrigues, L. (2002). Sustainability: Importance of social networks in the decision-making processes. *In Proceedings of the Conference Policies and Tools for Sustainable Water Management in the EU*.
- Margat, J. & Vallée, D. (2000). *Mediterranean vision on water, population and the environment for the 21st Century*. Sophia-Antipolis: Blue Plan for the Global Water Partnership/Medtac. 62p.
- Morna, C. L. (2000) Mainstreaming gender in water and sanitation: Literature review for the SA department of water and sanitation. Gender Links, Johannesburg.
- Narayan, D. (1993) Participatory Evaluation: Tools for managing Change in Water and Sanitation, World Bank, Washington.
- Noronha, L. (2004). Ecosystem approaches to human health and well-being: reflections from use in a mining context. *Ecohealth Special Supplement*. Dec. 2004.
- Ostrom, E. (1993). Design principles in long-enduring irrigation institutions, Water Resources Research.
- Paelke, R. (1999), Towards Defining, Measuring and Achieving Sustainability: Tools and strategies for environmental valuation, in Egon Becker and Thomas Jahn editors, Sustainability and Social Sciences. A cross-disciplinary approach to integrating environmental considerations into theoretical reorientation, London, Zed Books.
- Pearce, D. W. & Warford, J. J. (1993). World Without End. Economics, Environment, and Sustainable Development. Washington: World Bank, 440 p.
- PNUE/PAM/PLAN BLEU (2004). L'eau des Méditerranéens : situation et perspectives. No. 158 de la Série des rapports techniques du PAM, Athènes : PNUE/PAM. 366p.

- Risse, T. (2002). Transnational actors and world politics. In Handbook of International Relations. ed. W. Carlsnaes, T. pp. 255–74. Sage, London.
- Rogers, P.; Hall, A. W. (2003). Effective Water Governance. TAC Background Papers No. 7, GWP, Stockholm.
- Sachs, W. (2000) *Development. The rise and decline of an ideal*. Wupertal Papers, N° 108, Wupertal Institute for Climate, Wupertal: Environment and Energy, Wupertal.
- Sherbinin, A.; and V. Dompka (eds.). 1998 Water and Population Dynamics: Case Studies and Policy Implications, Washington, DC: American Association for the Advancement of Science.
- Solanes, M.; Gonzalez-Villarreal, F. (1999). The Dublin Principles for Water as Reflected in a Comparative Assessment of Institutional and Legal Arrangements for Integrated Water Resources Management. TAC Background Papers No. 3, GWP, Stockholm.
- Teodosiu, C.; Barjoveanu, G.; Teleman, D. (2003). Sustainable Water Resources Management. River Basin Management and the EC Water Framework Directive. *Environmental Engineering and Management Journal*, 2 (4), pp. 377-394
- UN (2005). *World Population Prospects: The 2004 Revision*. Population Database. Available at: <http://esa.un.org/unpp/index.asp?panel=1>. Last Accessed February 2006.
- UN/WWAP (2003). UN World Water Development Report: Water for People, Water for Life. World Water Assessment Programme. UNESCO and Berghahn Books, Paris, New York and Oxford.
- UNDP (2005). *Human Development Report 2005. International cooperation at a crossroads: Aid, trade and security in an unequal world*. Oxford: Oxford University Press. 260p.
- UNDP, 2001, Human Development Report 2001. Millennium Development Goals: A compact among nations to end human poverty. United Nations Development Program, New York, 367 p.
- UNDP/UNSO (1997). *Aridity zones and Dryland populations: An Assessment of Population Levels in the World's Drylands*. United
- UNDP/UNSO (1997). *Aridity zones and Dryland populations: An Assessment of Population Levels in the World's Drylands*. United Nations Development Programme/ United Nations Student Organization, New York.
- UNEP (2005). Millennium Ecosystem Assessment Synthesis Report. United Nations Environment Programme, New York.
- Vallée, D. & Margat, J. (2003). *Review of world water resources by country*. Rome: FAO. 123p.
- Wasserman, S. and Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge. Cambridge University Press.
- White, R. P.; Tunstall, D.; Henninger, N. (2002). An Ecosystem Approach to Drylands: Building Support for New Development Policies. Information Policy Brief No. 1, World Resources Institute, Washington.
- WORLD BANK (2005). *World Development Indicators 2005*. Washington: International Bank for Reconstruction and Development/THE WORLD BANK Available at: <http://devdata.worldbank.org/wdi2005/home.htm>. Last Accessed February 2006.

World Resources Institute (WRI) in collaboration with United Nations Development Programme, United Nations Environment Programme, and World Bank (2005). *World Resources 2005: The Wealth of the Poor—Managing Ecosystems to Fight Poverty*. Washington, DC: WRI. 200p.

Yasser, N. (2004). Virtual Water Trade as a Policy Instrument for Achieving Water Security in Palestine. Proceedings of the Second Israel-Palestinian-International Conference On Water for life in the Middle East, October 10 - 14, 2004, Antalya.