Institutional and legal framework for drought management [Part 1. Components of drought planning. 1.2. Organizational component]

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Chapter 4. Institutional and legal framework for drought management

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The scope of the analysis and objectives

This work analyses the organizations and institutions involved in drought preparedness and mitigation and/or on water management, with special emphasis in agriculture and irrigation water supply. The Chapter includes a description of the current drought management plans and the explicit linkages and hierarchical relations among the institutions involved. The importance of identifying such relations among institutions lies on the need to design coherent drought management plans that mitigate the effects of such hazard on agriculture, water supply systems and economy.

This Chapter provides a common methodology for analysing the organizations and institutions relevant to water scarcity and drought management. The common methodology is adequate to provide information that will contribute to compare among and across countries and to promote the cooperation with the existing institutions, organizations, networks, and other stakeholders in the Mediterranean. The methodology proposed and described in this Chapter is supported by previous leading experiences synthesised by Wilhite *et al.* (2000), Rossi *et al.* (2003) and Vogt *et al.* (2000). Although the objectives of the Guidelines are not directly focused on the institutional Analysis per se, it is important to understand the conceptual bases, to identify the organisations and institutions and to map them to ensure the relevance of subsequent drought management analysis. The approach is intended to cover the following areas:

(i) Explicit description of institutions and organizations with competence in water policy and administration, planning, decision making, operation of water supply systems and in drought preparedness, and emergency action with particular emphasis in municipal and irrigation water supply.

(ii) Explicit description of the linkages and hierarchical relations among the organizations and institutions.

(iii) Information on existing drought preparedness and management plans.

(iv) Documentation of the institutional experience on the application of the existing drought preparedness and management plans.

(v) Description of the data collection system in each country, specifying the institutions responsible, the type of reporting and accessibility, and the primary uses of the data.

The analysis aims to provide insights to the following key questions:

(i) Do the set of organisations and institutions interact within a formal or an informal network?

(ii) Are there networks to provide communication and hierarchical flows of command?

(iii) Are the stakeholders included in the network?

(iv) What is the degree of influence and dependence of the stakeholders' decisions on the institutions' core themes?

The Chapter takes into account drought and water scarcity. The underlying rationale of this separation is based on two facts. First, artificial and natural reservoirs eliminate, alleviate and delay the effects of abnormally low precipitation and run-offs. Second, the conditions and the processes of drought (meteorological) evolve along temporal and spatial scales with little bearing on the processes that characterize water scarcity (hydrological droughts) situations. Resulting from this desegregation, the Chapter analyzes two institutional mappings pertaining to drought and water scarcity contexts. The analysis includes the stakeholders that ultimately benefit from drought preparedness and management (primary stakeholders) and the stakeholders that are intermediary in delivering aid to the first group (secondary stakeholders) and describes the participation of the stakeholders in the processes. The Chapter attempts to provide a dynamic analysis of the institutional frameworks of different Mediterranean countries with regards to drought risks and planning.

Drought risks

Ensuring water availability and protecting the environment are the main focus for coming years in order to address questions on drought management. Few countries have realistic policies, operational strategies or plans for integrating drought management plans into water policy, particularly in the southern Mediterranean Countries. In fact most of the strategies for drought management are typically based on ex-post approaches and address only part of the issue of social and environmental sustainability. Examining the experiences of a wide range of Mediterranean countries with the same methodology makes possible to define strategies that have proved environmentally and financially sustainable, with possibilities to be used in other areas.

Starting from the *institutional* setting of each country it is possible to define the characteristics of the particular policies that need to be modified in order to promote sustainable drought management plans. During the next years water management and spatial planning in European countries will be focused on the implementation of EU Water Framework Directive in the EU Member States with potential impact also in candidate countries as well as in other Mediterranean Area countries. The resulting new responsibilities in spatial planning and water management have to be clarified at the administrative level. Additionally, this requires a contribution of environmental sciences as "trans-border" water bodies (as Mediterranean Sea) will require integrated and coordinated tools and efforts for proper water management.

Communities must often give priority to water either for agriculture, industry, tourism or other users. Therefore there is the need to define a careful strategy for sustainable use of water resources, based on the principle that water is not a "worldwide good" but a "worldwide need". As a consequence, the only policy will have to apply correctly the "integrated water management", that is the management of water cycle according to technical – economical logics. Current drought management plans are not always effective because they rely too much on decision processes under stress situations.

The relations among organizations and institutions are essential for understanding current drought management plans and for improving future actions that mitigate the effects of drought on agriculture, water supply systems and the economy. To understand the national institutional regime is a key factor for establishing effective and integrated drought management plans that incorporate monitoring, public participation, and contingency planning (Iglesias and Moneo, 2005). Combating drought risks is viewed in most societies as a public good that justifies government action. Therefore societies must develop policies that deliver significant drought risks reduction and lesser social vulnerability.

Methodology

The methodology developed here comprises five main tasks:

(i) Elaborate a mental model of organisations and institutions in each country and describe the institutional and legal frameworks.

(ii) Collect additional information by interviews and/or other dialog methods. The interview should include "problem analysis" (i.e., what actions did your institution take during a historical drought in a specific year?) and identification of the stakeholders affected by the decisions of each institution.

(iii) Validate the model structure. Communicate back to the organizations and institutions the results of the previous two tasks and complete the analysis.

(iv) Analysis of the strengths and weaknesses of the system organizational processes to take decision within the institution and within the hierarchical structure in each country.

(v) Discussion of the challenges and opportunities to improve drought management.

The Legal Framework

Legislation and normative

Drought management policies should be based on integrated evaluation of all those measures required to implement the objectives of the water policy, together with those measures required under other policies and relevant legislation. This section reviews the existing legal initiatives and present legislation explicitly focussing on drought risks. The section provides a description, ordered hierarchically, of all laws, rules, norms, and statutes that are presently in force in each country with connection to water uses, management, conservation as well as land uses and the natural environment, as it concerns or are influenced by all types of drought. The water and drought legal framework includes all acts and regulations related to water resources management, wastewater management, non-conventional water resources and environment related issues. The legal framework includes all laws applicable at national, regional, district and local levels including international agreements or regulations in force.

Mediterranean countries have extensive legal provisions (legislation and normative) related to water management focusing on water scarcity. The existing legislation enables governments to develop specific drought mitigation plans, both of proactive and reactive nature. The legislation is an instrument that allows governments to implement drought mitigation plans and drought relief policies. Effective legal provisions need to include budget for implementation of the measures. In general, the laws focus on drought management strategies adopted under stress situations, providing conditions for emergency actions.

The United Nations Convention to Combat Desertification (UNCCD, 2000), provides the framework for implementing drought mitigation strategies. The convention is especially relevant to Southern Mediterranean countries.

In the MEDROPLAN countries, the legislation has evolved as a consequence of severe drought episodes, such as 1993-95, and 2001. An attempt has been made to identify the legal base in Mediterranean Countries that enables governments to develop specific drought mitigation plans, both of proactive and reactive nature. The current legislation offers opportunities to governments to use instruments to develop, and allocate budget, to mitigation plans and drought relief policies. Ultimately, the legislation is the instrument that provides the means to produce drought management plans.

The idea is to obtain an overview of the measures needed to achieve sustainable drought management in relation to a particular geographical area (e.g. a basin in a country). This approach allows a degree of rationalisation and co-ordination of the different existing measures taken by integrating politic decisions (e.g. economic incentives of fees) with technical analysis of the area.

The drought policy must be flexible to avoid imposition of inappropriate or unnecessarily strict requirements simply for the sake of harmonisation. Such flexibility would also ensure that, where a problem is regionally specific, measures appropriate to that particular area could be taken. The range of environmental conditions in the Mediterranean basin is very diverse and this must be taken into account.

A cost-effective strategy implies assessment from an economic perspective of advantages and disadvantages of the three basic sets of policy instruments: Regulations and standards, new technology and internalisation of external pollution costs through pricing and market-based incentives.

These sets of policy instruments are not mutually exclusive and can be used as complementary or alternative measures depending on their relative cost-effectiveness to address water pollution as well as water scarcity issues.

Drought policy is not to be seen in isolation, but as a contributory element in the wider search for a balanced and sustainable development. And such a sustainable approach can be neither planned nor implemented in a satisfactory and efficient way without providing for broad consultation and participatory procedures of all actors concerned.

Most of the Mediterranean countries recognize drought as a direct consequence of water resources availability and management, therefore the legal base related with drought is directly derived from the water code of each country. This is a legal body that is on the top of the hierarchy of laws which cover all issues and aspects related to water policies, organization, procedures, finance, civil work planning and public participation. Consequently this legal framework considers drought a hydrological phenomenon. There are no specific legal provisions that consider drought as a meteorological phenomenon.

Legal provisions in Mediterranean countries

Table 1 summarises the legal provisions related to water scarcity and drought contingency plans in Cyprus, Greece, Italy, Morocco, Spain, and Tunisia. Only Spain and Cyprus have developed an Agricultural Insurance Law that includes drought hazards. Italy conceives drought as a natural hazards or disaster, so it has developed a legislation to implement competencies and action of public institutions to face a natural disaster (Law 225/1992). Cyprus developed a General Disasters Law to provide for the definition of the scope of action, economic compensation for losses. Only Spain, Cyprus, Morocco and Tunisia have developed specific drought mitigation plans, both of proactive and reactive nature. In Spain, the Law of the National Hydrological Plan (Law 10/2001 Art. 27[1]) explicitly deals with drought and establishes the bases for a proactive and reactive response against hydrological and meteorological drought. The contingency plans include supply reliability and the future development of supply plans for large cities. The reactive responses include emergency works, decision on reservoir management and users strategies. The legal base to meteorological drought is based on the development of an agricultural insurance law.

Tunisia has developed a specific contingency plan (Operation Drought Management Plan Setting) but it not based on a specific legal provision. In this case the plan is implemented requiring a drought announcement and on the MARH (Ministère de l'Agriculture et des Ressources Hydrauliques) minister decision which establish a drought committee and design an operation program for drought mitigation instead its crisis management. Cyprus' approach is similar to Tunisia's and has developed a specific proactive plan but it is not envisaged by any law. The legislation related to drought in Morocco is very advanced but its control is not very well developed. The Water Law of 1994 included a lot of consideration related with water management in drought period at regional and local level. The Law introduces elements like Water Basin Agencies whose decision in must be submitted to the Superior Council for Water and Climate.

Italy has a great amount of laws related with water management, soil conservation, water quality, and civil protection. The 183/1989 Law aimed to solve water and land conservation problems by an integrated approach but actually has not been yet implemented. Also there are some specific legislative indications for coping with drought impacts but unfortunately none of these is currently operational, except for the measures funded by civil protection in the form of emergency actions that operate according to a specific program drafted after drought starts.

Proactive and reactive responses to drought include some actions plans in order to prepare for drought and to mitigate his effects. The performance of these action plans can and cannot be defined by a legal framework. Spain, Morocco and Italy have defined a specific legal provision for this actions plans but only in Spain and in Morocco are currently in force. Operational proactive plans designed ad-hoc to mitigate drought are in Tunisia and Cyprus, but they are not envisage by any law.

1. Although this law was repealed by Law 2/2005, the provisions concerning drought were kept intact. Based on former article 27, the government is finalising a drought plan and contigency strategy for all Spanish basins.

Table 1. Legal provisions related to water scarcity and drought contingency plans in Cyprus, Greece, Italy, Morocco, Spain, and Tunisia

Legal provisions	Contingency Plan	Institutions / Stakeholders	Focus / Funding
All countries			
International Convention (United Nations) 1994 Agreement, 2000 Enforced	Strategy to combat drought and desertification	United Nations and National Governments	Strategies to fight desertification and mitigate drought to be implemented by all the countries that signed the Convention
Cyprus			
General Disaster Law	Disaster relief; crisis based	Water development Department (Ministry of Agriculture, Natural Resources and Environment) Drought Management committee	Payments of losses Prepare an action plan based on the most probable scenario: water transfer, emergency scheme, water cuts, water reallocation, water saving campaign. Based on crisis management National budget
Agricultural Insurance Law (1978)	Agricultural drought	Agricultural Insurance Organization, Department of Agriculture, the Planning Bureau, Ministry of Finance, Council of Ministers. Council of Ministers and Parliament to approve the funds for remaining crops	Payments of losses National budget
Greece			
National Action Plans for Combating Desertification (2002)	Plans for Combating Desertification	Common Ministerial Decision (six Ministries) Central direction of waters River Basin Authorities: Regional direction of waters. Consultative committee of water (Ministry of Environment, Physical Planning and Public Works)	The development of the new law of water management will provide a plans for each basin containing drought mitigation measures Neither compensation policy nor insurance
No legal provisions, actions taken case-by-case in response to crisis	Drought mitigation	Same as above	No plan for drought mitigation In the past decisions concerning drought were taken in case to case basin Construction of dams and off-stream reservoirs Reactive measures: drilling, repairing irrigation networks, water transfer Neither compensation policy nor insurance
Italy			
Legislative Decree 152/1999 regulating the identifications areas vulnerable to drought and desertification	National program against drought and desertification	National Committee to combat drought and desertification	

Law 36/1994 identifying areas affected by water crisis	National program of prediction, prevention of contingency and assistance plans	Civil Protection Department Authority of optimal territory unit. Regional Government or Basin Authority National Committee to combat drought and desertification	Proactive: long term measures to reduce vulnerability, such as new water infrastructures Reactive: emergency measures such as transfer to urban use, aquifer over exploitation, restriction on irrigation National Funds for Natural Calamities
Law 225/1992 regulating civil protection service	Crisis management strategies	Civil Protection Department Authority of optimal territory unit. Regional Government or Basin Authority National Committee to combat drought and desertification	Reactive: emergency measures such as transfer to urban use, aquifer over exploitation, restriction on irrigation Reactive: subsidies to farmers for covering agricultural damage National Funds for Natural Calamities
Morocco			
Spain			
Basin Hydrological Plan (2001)		River Basin Authorities, (Ministry of Environment) Drought Permanent Committee Ministry of Agriculture, Agricultural Insurance Agency Finance Ministry, Reinsurance Public Agency Permanent Office for Drought (officials of the Ministry of Agriculture) reactive response	Reactive: new insurance products Proactive: taxation abatements or deferrals, drilling wells Proactive: Water supply reliability, urban priority Reactive: emergency works, decision on reservoir management and users strategies
1983, 1999	Crisis management plans	Civil Protection Permanent Office for Drought	Creation of committees that will define the action terms in case of drought Different performance environments, social or agricultural
1995-2000	Emergency measures	Most of them undertaken after the most severe drought periods as mitigation measures	Laws, Royal decrees and orders created to mitigate the impacts of drought Hydraulic supply measures Transfers of water between different river basins Measures for sub sectors of agriculture (apiculture, livestock, tree crops)
Definition of the areas where the emergency measures are applied; 1993, 2000, 2001	Crisis management		Definition of the criteria used to delimit areas affected by drought Establishment of criteria for aid supply Final criteria used Amount of rainfall Stocking rate

Agricultural Insurance Law (1978). 2001, 2002	Insurance	Agricultural Insurance Agency	Definition of the conditions, application areas and other characteristics of drought insurance
Albufeira Convention, 1998	Transboundary		Albufeira Convention between Spain and Portugal for transboundary basins under the framework of sustainable water resources management and common environmental protection
Tunisia			
Legal actions developed upon "Drought announcement", as established by the Ministry of Agriculture, Environment, and Water Resources (MAERH)	Operation Drought Management Plan Setting	National Commission (supervision of the execution of operation actions) Regional commission (inform about necessary measures Specialized commission (preparation of the drought indicators) Supervised by MAERH	Depends on the phase of drought plan: Preparation actions: insuring forage and seeds, preparing for eventual importation of forage and seeds, identifying drought farmers Drought management: identification of affected and sensitive zones, enhancing complementary irrigation State budget because the absence of insurance system Plan not implemented yet

Actions plans define different pro-active responses by means of programmes of measures. Some measures are specifically defined by water resources law, for example the definition of order of priorities of users during scarcity or the possibility to carry out of some economic instruments. The first is considered in most of water law evaluating here, establishing that urban use have priority over agricultural, industrial o recreation use. Economic instruments that allow water allocation mechanisms are included in the Spanish water code. In these sense, Spanish Water Law gives competencies to the River Basin Authorities to create Water Exchanging Centers (now called "Water Banks"), through which right holders can offer or demand use right in periods of drought or sever water scarcity situation. In other cases, the agency itself can offer right holders compensations for surrendering their rights and allocate the resources to alternative users or to environmental purposes. The rest of the countries have not considered this possibility, perhaps because water rights are not allways well defined. In Morocco there is a coexistence of the modern legal system based on public property and the inheritance of Islamic law, so the administration recognizes private appropriation and free transactions on water rights, forming a mixed system not yet fully solved. Italy legislation views water resources as a primary good that cannot be traded, but there is a general opinion against deregulation of water market.

In general terms in all countries the advisory authorities have competencies to allocate and reallocate water during drought periods. Legal framework in Cyprus gives competencies to the Council of Ministers to allocate and reallocate water resources according to the existing water availability and the priority of needs. Also the Council of Ministers has the right to expropriate private or other water rights for the public interest. Morocco, based on the 10/95 Water law, created the Superior Council of Water and Climate which constitutes a real forum of dialogue of the stakeholders group in the water sector. This Council formulates the general orientations of the national water and climate policy, water national plans and integrated management plans on water resources.

EU Water Framework Directive forces in the long term to the adoption of full cost recovery pricing criteria to ensure that tariffs charged to users cover all cost of the service. These criteria can be considered as economic instruments to save water by means of demand management. Currently, European countries have not yet implemented this kind of economic instruments, but in the near future this will be a clear possibility to develop a proactive response to drought improving the efficiency of water use.

Other demand management instruments like awareness campaigns for water conservation or adoption of water saving measures have a clear framework for implementation in Tunisia, Morocco or Cyprus where there are some specific contingency plans containing these kinds of mitigation measures. In Spain and Morocco, the National Hydrological Plans, regulated by law, include these kinds of measures. Cyprus also has specific contingency plan not regulated by law. In this case water transfers, emergency scheme, water cuts or water reallocations are examples of the measures considered. Operation Drought Management Plan setting of Tunisia is not based on a specific law. The Drought National Commission has the role of supervision of the execution of the operation actions. A Drought specialized commission establish drought indicators, which are the triggers of the preparation actions designed such as dams management plans according to climate condition or store water evaluation and demand identification. In Morocco the Superior Council of Water and Climate grants the distribution of water between user sectors, the transfer of water and the protection of water resources.

In Italy the National Program of prediction, prevention of contingency and assistance plans and the National Program against drought and desertification are the specific instruments to implement proactive measures in order to reduce vulnerability such as the construction of new water infrastructure. This plan has not been yet implemented. The situation of proactive legislation in Greece is similar to Italy. The future establishment of river basin plan opens the possibility to develop some proactive measures like construction of dams and off-stream reservoirs. But up to day the problems of drought are solved case to case.

Contingency plans based on legal provisions

Table 2 summarizes the legal provisions that support the contingency plans and Table 3 summarises the drought contingency plans in Cyprus, Greece, Italy, Morocco, Spain, and Tunisia.

Table 2. Summary of the drought contingency plans in Cyprus, Greece, Italy, Morocco, Spain, and Tunisia

Country	National strategy plans	Specific drought plans	Crisis and emergency measures	Insurance	Committee	Budget provisions
Cyprus	x	x	x	x	National	x
Greece	x	x	x			
Italy	x	x	x			x
Morocco	x	x	x	x	National, local	x
Spain	x	x	x	x	National, local, stakeholders	x
Tunisia	x	x	x		National, local	x

Table 3. Summary of the drought contingency plans in Cyprus, Greece, Italy, Morocco, Spain, and Tunisia

	Cyprus	Greece	Italy	Morocco	Spain	Tunisia
Specific reactive measures, economic compensations, such as taxation abatement, and emergency measures, such as drilling wells and water transfer	x	x	x	x	x	x
Water reallocations	x	x		x	x	
Demand management		x		x	x	x
Insurance scheme	x			x	x	
Long-term measures: New water infrastructure			x	x	x	
Reactive measures depend on the scenario of drought	x					x
Policy planning process				x	x	
Proactive plan that anticipate costs and effects	x			x	x	x
Operational drought management depends on the phase of drought: Combined methods of physical and socio-economic data					x	x
Proactive Action Plans based on most probable scenarios	x				x	
Hydrological National Plan: supply reliability and supply plans for cities					x	
Operational drought management depends on the phase and severity of drought (National Drought Plan), National Water Plan: water supply for drinking water and irrigation				x	x	

Coordination and cooperation with relevant EU policies: WFD and CAP

The Framework Legislation for European countries is the European Union Water Framework Directive (2000) (WFD). The European Parliament and Council Directive 2000/60/EC of 23 October 2000 establish a framework for Community action in the field of water policy (Official Journal L 327, 22/12/2000 P. 0001 – 0073). The WFD contains a series of principles that affect water policies in all EU Member States in areas such as water tariffs (Article 9); programmes of measures (Article 11); demarcation and description of basins' territories (Articles 3 and 5); monitoring of all waters' quality (Article 8); and hydrological plans (Article 13). The purpose of the WFD is to establish a framework for the protection of surface waters and groundwater. It aims at contributing to: (i) the provision of a sufficient supply of good quality surface water and groundwater, as needed for sustainable, balanced and equitable water use; (ii) a significant reduction in pollution of groundwater; and (iii) the protection of territorial and marine waters. The WFD introduces the following elements: (i) water management based on river basin approach; (ii) maintenance of the good water status where already exists; and (iii) cost recovery in accordance with the polluter-pays principle.

Agriculture is the most important economic sector in Spain in terms of land and water use, and irrigated agriculture contributes with more than 50% of the final agricultural production in many regions of the country. As the main water user, it seems logical to discuss and analyze the implications that new regulation on water might have for agriculture. There is a need to coordinate both policies in order to avoid confronted objectives that lead to the deterioration of such a vulnerable and at the same time key sector as agriculture.

There is actually an intense debate among the different stakeholders. While institutional representatives express their absolute support to the complete implementation of the WFD, with all the associated instruments (incentive pricing, cost recovery, and the application of the principle "the polluter pays"), there are some concerns coming from the farmer's unions and irrigators communities

who doubt about the future of the agricultural sector depending on the mechanisms adopted for the implementation of such instruments. As an example of this, many speakers expressed their concerns about the negative effects that water pricing might have on the farm's standards of living that the CAP is trying to protect from the other side.

One of the central issues agreed in general by all the speakers is the necessity of irrigation modernization in Spain. The OECD determines a global efficiency of 47% for Spanish irrigation system, what implies huge losses of usable water every year. Both the General Director of the AGUA Programme and the General Director of Rural Development agree on the important savings of water that could be reached trough this modernization process. In addition, other aspects such as environmental demands could be satisfied with a higher security level.

Irrigated agriculture is seen by farmer's unions and agricultural management institutions as a key promoter for rural development (through the creation of labour, stabilization of rural population, industrial development and environmental benefits) and they support the implementation of the WFD as long as their opinion and concerns are taken into account for the process, demanding a higher level of public participation and control in water management for the coming future.

Other speakers presented the calendars for the coming years of the two policies in parallel, underlining the opportunities for coordination and the necessity of regional implementation for the effectiveness of the measures.

The general conclusion is the importance of adopting the WFD as a horizontal directive that will have implications for every other sectoral policy and the actual uncertainty about the real implementation of the directive further than the programmes development by 2015, which is the deadline for implementation across the member states.

Drought contingency *vs* water resources planning

Droughts provide a good opportunity to implement water policy. Society claims that something should be done. Additional funds are made available. In political terms, we are "solving a problem created by others" (Fig. 1).

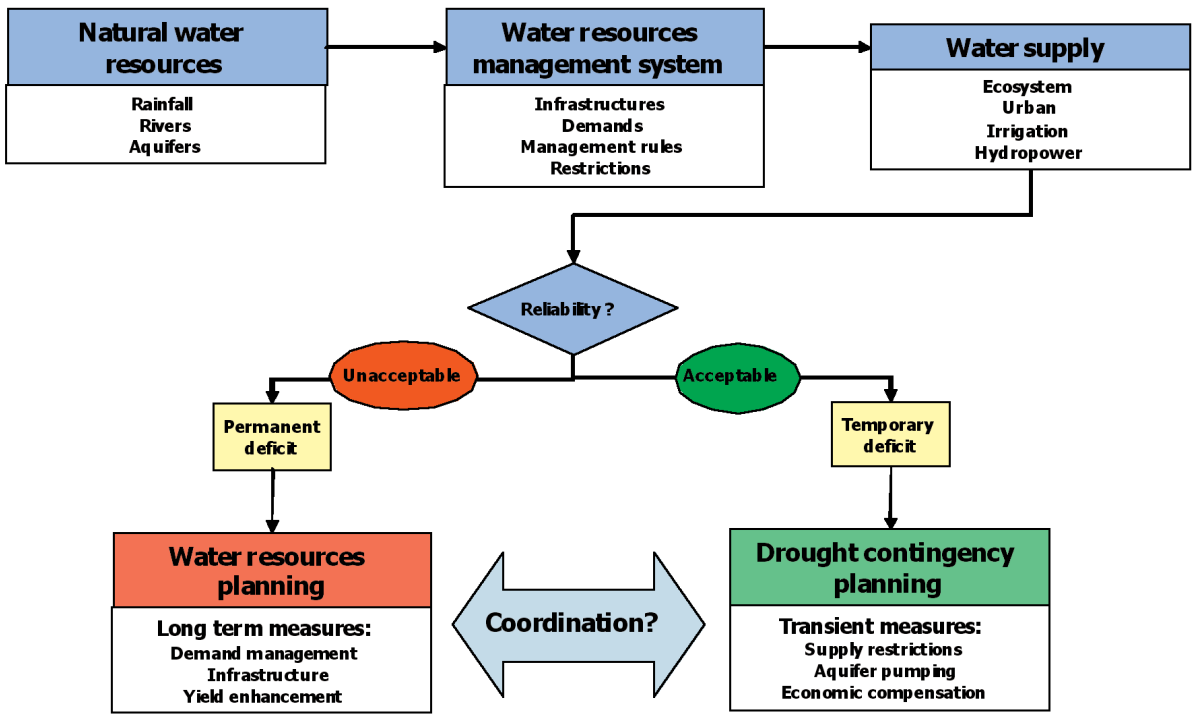

Fig. 1. Overview of the coordination between basin and drought policy to derive legislation.

The Institutional framework

Linkages between institutions and stakeholders

The objective of the research is to co-ordinate the knowledge and experiences of the Northern and Southern Mediterranean Countries in order to implement and apply an innovative management for droughts and water scarcity aiming to operate into the framework of integrated management of the water sources and provide instruments to manage droughts in a more effective way.

This mental model is applicable to basins. It is the result of the exchange of knowledge and experiences among Mediterranean Countries on policies and implemented proactive and reactive action plans. The results are analysed to assess the contribution to the sustainable management of water resources.

The mental model complies with the principles introduced by the EU Water Directive and aims at contributing to achieve the objectives of protection, enhance and restore all bodies of surface waters and groundwater, ensure a balance between suction and recharge of groundwater. It can be useful to target those cases where it may be feasible or reasonable to achieve effective drought management plans.

The mental model is developed on the basis of the assumption that in each basin a proper policy of drought management can be carried out when the privileged target is the safeguarding of stakeholders rights belonging to the same area. Applying this mental model to basins in the Northern and Southern Mediterranean Countries, assuming as the target is the minimisation of social risks derived form drought, it should be possible:

(i) To examine specific features of each country. The institutional profile, to evaluate the status of water management, the effectiveness of those plans in historical situations, and assess the level of improvement of drought management plans.

(ii) To define both the characteristics and the institutional changes necessary to improve current drought management plans.

The use of such a mental model may have a crucial role in creating positive outcomes in those situations detectable according to different scenarios. As examples four typical scenarios can be individuated: Proactive and reactive meteorological and hydrological droughts. These four scenarios are quite widespread in all countries of the Mediterranean basin. The proposed model promote an improvement of drought management plans oriented to increase of water availability in Mediterranean countries, minimising the social risk of drought as well taking in account the socio-cultural differences of the Mediterranean countries. The use of the proposed model to develop drought management plans can play a crucial role in contributing to ensure water supply in the area and socio/economic development. The mental model provides a methodology to analyse integrated drought management plans, to involve the stakeholders and users, and to define the possible incentives supporting proposed changes. As a result of this approach to drought management analysis, a better understanding of specific needs of different areas is promoted. The use of a common methodology for management evaluation promotes better trans-border integration and process learning.

An exact technical definition of the best solution for drought management for a certain area requires to rank the different possible alternatives, demonstrate actual needs for drought management improvement, and demonstrate that needs of extensive and expensive actions are based on rigorous analysis. The research contributes to define these elements by evaluating recognized standards for drought management intended as a part of environmentally and socially sustainable growth.

Water and drought institutional framework are all organizations and institutions related with the management of water resources. The institutions are classified into policy-level institutions, executive-level institutions, user-level institutions and the NGO's institutions, at national, regional, district and local levels. A correct definition of the roles of the different levels of government in planning and co-ordination is a primary need in the preparedness and management processes. This component of the mental model includes a topology-type graph and a written description. The organizations and institutions to be included are those within the formal framework of the political and government structures in each country (i.e., Ministries, General Directorates, Commissions, etc.) and the Official

Institutes and Offices with relevant roles in drought preparedness and management, including water management organisations (e.g. municipal supply agencies, irrigation district consortia), institutions responsible of disaster's defence and ad-hoc drought emergency Committees or Offices. Figure 2 provides an overview of the institutional framework within which meteorological and agricultural droughts may be faced, mitigated and alleviated. Figure 2 illustrates a general guide and road mapping that may be used as conceptual framework in the specific country analysis. In all cases, the analysis and evaluation of this institutional performance takes into account the reactive capacity, the scope, and the social learning process.

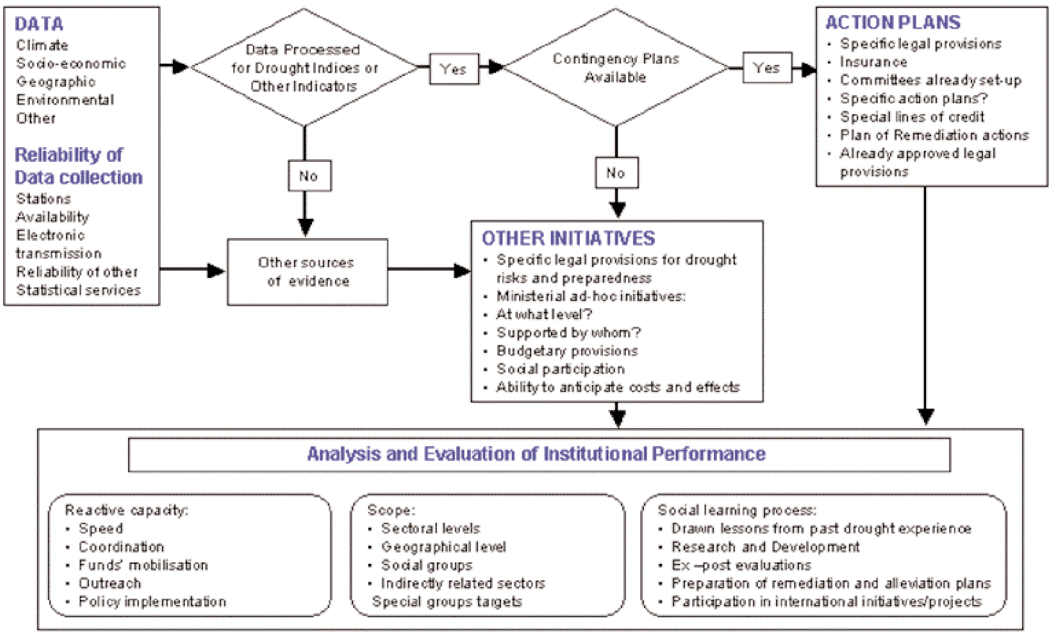

Fig. 2. Overview of the institutional framework within which meteorological and agricultural droughts may be faced, mitigated and alleviated.

Description of the roles of institutions and organizations

A complete detailed description of each of the following points:

(i) Description of the organizations and institutions included in the flow-chart.

(ii) Description of the formal and informal means of communication and hierarchical command among the organisations and institutions described above. This should include both regular, and ad-hoc modes of interaction, both at the pre-active and pro-active levels.

(iii) Description of the various governing boards, commissions and groups' actions that have direct responsibility in drought preparedness, planning, management and mitigation. Under pre-crises and crises situations, a very detailed description of these should be provided

(iv) List, description and location of each stakeholder that either influences drought preparedness and management or is directly affected by it. Description of the means of communication, interaction and dependency with the map of organisations and institutions.

(v) At the local and stakeholders level, it would be of special interest reporting on the customary rules and actions, and their dependence from upper organisations.

In the context of the MEDROPLAN Drought Management Guidelines we define Organization as a group of people who work together in a systematic way arranged in a structure. An Institution is an entity defined interactively by birth in a formal or an informal way, as well as at the macro and micro

level, that establish sets of rules, norms, and shared strategies for their operation in relation to law, policy, and administration. Network is a group that interacts or engages in informal communication for mutual assistance or support. The institutions relevant to drought management are those that are concerned with water law, water policy, and water administration in relation to water shortages, risks, and impacts. Institutions are not simply organisations and they transcend organizations. This complex broad definition implies the following ideas about institutions have regularised patterns of behaviour, informal and formal rules, explicit and implicit rules, kinds or/and levels of rules' and laws' enforcement, and formal and informal sanctioning rules.

Proactive and reactive plans and actions

This component of the mental model includes a description of the proactive and reactive drought preparedness and management plans that have been developed or are already developed and put in action in the past or are applied in the present, detailing the responsible organisation, and sources of funding for the plan or its actions. If no drought preparedness or management plan has been applied to the present time, focus on plans that are currently being developed. The analysis should be done at the country level and examples should be provided.

An example of a proactive plan may be an insurance policy for dry-land cereal and forage growers. An example of a reactive plan may be a list of water plants to be realized for increasing water resources (new wells, conduit for water transfer or desalination plants) or for reducing water losses in conveyance and distribution network. An example of a reactive plan may be a programme of water use restrictions for cities (prohibition to water public parks or to clean streets).

Each plan should at least include: objectives, list target groups, logic and rationale, attempt to judge and determine its performance, either proved or potential, budget and funding sources, and bodies and offices that are responsible in design, development and application.

The revision of the plans will contribute to the interview process by identifying the potential candidates for the interview, and by outlining the main themes and questions that may be of interest to them.

Model validation

The mapping models presented above are validated with the participation of the stakeholders interviewed. The process included four sequential steps. First, the theoretical involvement of the stakeholders was included in the mental model. Second, key stakeholders were interviewed to validate the model. Third, the participation of the stakeholders in the process was defined. Finally, the four mapping models were reviewed, identifying omissions, redundancies and other diverging elements. To do so, it is essential to follow the same structure developed to present the mappings.

The mental model structure validation includes the following steps:

(i) Final collection of information and data needed for the institutional analysis.

(ii) Ensure that the mental model components provide a realistic representation of each country's drought preparedness and management plans as well as the country's capacity to implement them.

(iii) Contrast the mental model with the interviews' insights and results.

(iv) Set the framework of reference for the analysis of the strengths and weaknesses of the institutions and the Conclusions.

Strengths and weaknesses of the model structure

This task should clearly identify the institutions strengths and weaknesses for implementing or developing drought preparedness and management plans. The analysis should consider all aspects of the model. Table 4 outlines the major issues to be evaluated.

Table 4. Summary of the major issues to be evaluated in the analysis of the model structure.

Topic	Relevant issues
Data and Information	Representation (spatial and temporal) Adequacy for risk analysis Appropriate for historical analysis Accuracy Handling Accessibility Legal data: Water right-holders records Updated registries Socio-economic data: Water users Sectorial distribution Demographics Other
Institutional Organization	Organisational set-up Legal set-up Personnel capacity and training Coordination among institutions Information flows and utilisation Units in charge of drought preparedness actions Bodies in charge of developing proactive and reactive management plans NGOs and stakeholders participation
Institutional Performance	Based on the most recent drought episode Based on the present state of approved contingency plans Based on the strategies developed as a response to recent drought episodes Based on the capacity to conduct risk analysis Based on the capacity to pool risks and ensure compensation mechanisms at the lowest cost
Conflict Resolution	Levels at which conflicts are faced and solved Means to solve conflicting issues Stakeholders and users participation Groups left unattended or disenfranchised

The analysis may consider the following aspects:

(i) Synthetic and comprehensive view of the current state of institutions in each country in relation to all issues related to drought preparedness and management.

(ii) Concise and specific conclusions about the institutions' performance (both based on past episodes and future contingencies) in relation to mitigation of drought impacts and anticipatory measures.

(iii) Discussion the major strengths and challenges (impediments and weaknesses) that stand against drought preparedness and the capacity to develop and carry out management plans. Following the analysis, tentative recommendations as to what specific institutional changes would be needed to improve the current preparedness plans can be made. In some cases, specific identified changes may take place within the current political and administrative context in each country.

Stakeholder participation

In relation to drought management, stakeholders can be individuals, organisations, institutions, decision-makers, or policy-makers, who determine or are affected by water use and exposure drought

and water scarcity. Stakeholders enact institutions - sets of rules, norms, shared strategies - and they are constrained by them in their responses to drought preparedness and management. Therefore a purposeful description of the map of legitimate actors, as well as an analysis of their interests, values and approaches to risk is a pre-requisite for the understanding of their link with institutional drought policy. The participation of the stakeholders serves two purposes: the validation of the mental model and the raise of awareness of the need to change drought management policies. Recognizing the importance that representative stakeholders are formally incorporated within the structure of the Guidelines, the stakeholders are interviewed and further engaged in model validation. As result, the models described in each country have been accepted by the stakeholders. This will contribute to the acceptance and trust of the science that feeds into the Guidelines for drought mitigation and preparedness planning that will result from the drought management plan.

The stakeholders considered are those actors who are directly or indirectly affected by drought and water scarcity and who could affect the outcome of a decision making process regarding that issue or are affected by it. Table 5 outlines the stakeholders considered and included. The stakeholder analysis is conducted by mean of interviews. The objectives of the interviews are to: confirm that the mental models described above provide an accurate representation about drought preparedness and management plans; complete the findings and fill the gaps that may exist in the mental models; and collect personal and subjective views of the country's level of preparedness and capacity for developing and carrying out management plans. The target individuals for the interviews are: policy makers/practitioners at the highest technical level and leading researchers with experience in drought's analyses and characterisation. The number of interviews should be six to eight. The interview's structure is described in Appendix 1, at the end of this document).

Table 5. Stakeholder identification and participation

Stakeholder	Characteristics and structure	Interests and expectations	Potential and deficiencies	Involvement and participation
1. Mediterranean rainfed farmers	Sometimes in collective organizations or Unions. Very interested in guidelines development	Plan and adopt practices adapted to drought. Anticipate drought effects on livestock. Avoid decreasing livestock capitals	Some with low financial margin to invest in new technologies. Some with insurance coverage Increasing experience in alternative sources of livestock feeding	Benefit from new insurance products R&D for insurance activities Alert in case of drought
2. Mediterranean irrigated area farmers	Frequently, in irrigators associations. Interested and positively involved	Same as above	Same as above	RB plan design and functioning Represented by irrigation Communities R&D insurance Alert in case of drought
3. Urban water consumers and water utilities	Directly affected by water shortages. Sometimes represented by consumers associations Aware of need to save water	To avoid water shortages, increase supply guarantee levels and water standards' reduction	High potential of saving water	RB plan design and functioning Represented in Assembly of Users
4. Tourism companies	Directly affected by water shortages Represented by tourist companies associations	To avoid water shortages and bad quality that limits sector development	Very influential in economic policies Sometimes the tourism model is water-wasting	RB plan design and functioning Represented in Assembly of Users

5. Industrial companies	Depend on national Directly affected by water shortages Represented by employers' organizations	To avoid water shortages and bad quality that limits sector development	Very influential in economic policies Sometimes the industry development model is not water-sustainable	RB plan design and functioning Represented in Assembly of Users
6. Water Basin Authorities	Depend on the State Government In charge of administration and distribution of water	Directly affected by water shortages Need to develop water policies based on risk analysis	Main actors in drought guidelines Need to take into account different and opposed interests	Pro-active: Design, management, decision-making, and implementation of RB plans Reactive: Permanent Committee, emergency works strategies
7. Local Water Authorities & Water Suppliers	Depend on the local authorities Also private companies in some cases	Directly affected by water shortages. Need to develop water policies based on risk analysis	Main actors in drought guidelines	RB plan design and functioning. Priority in water allocation Represented in Assembly of Users
8. Meteorological and Hydrographical Institutions	Depend on national and/or regional governments	Interested in the use of their data in risk analysis	Main actors in drought guidelines. In some countries, difficulties to provide data	Provide information for plan designing and monitoring
9. Ministries of Agriculture, Environment, Water, Tourism, Industry	Depend on national and/or regional governments	Directly concerned by water shortages In charge of the implementation of mitigation policies	Key actors In some countries, coordination between them is to be improved	Approval of Basin Plans. Funding of Insurance Premia Funding for subsidies, tax abatement. Create Permanent Office for Drought
10. Insurance companies	Depend on national and/or regional governments	Directly concerned with the reduction in agricultural production due to drought periods	Key source of data for risk analysis in some countries Main actors in drought preparedness guidelines	R&D New insurance products Approval of products
11. Agricultural banks and rural lending institutions	Depend on national and/or regional governments, or private	Directly concerned with the need of extraordinary financial resources due to drought periods	Key source of data for risk analysis in some countries Main actors in drought guidelines	Credits to farmers
12. Research, Training and Development Institutions	Depend on national and/or regional governments, or private	In charge of development, adaptation and adoption of technologies for efficient water use	Key human capital in some disciplines but limited financial resources	New insurance products Water planning Transfer of technology and knowledge
13. International Cooperation Organizations	Intergovernmental	Drought and water are key issues. Key actors in technology transfer and knowledge	Good network of contacts and human resources Limitation of financial resources	Networking. Facilitate International agreements Use common tools for water management Capacity building
14. NGO´s	Non-profit, non-governmental	Environmental and social improvements	Very active and sharp users of scientific results. Limitations resulting from their clear political standpoints	Indirect participation in RB plans. Link between society and institution. Press governments to include environmental topics in political agenda. Information

Discussion and conclusions

Current legislation on water and drought management show different development stages for the Mediterranean countries that lead to important differences in the way droughts can be faced. While some of the countries have a stable and long tradition legislative framework with functional river basin authorities and clearly defined responsibilities, others are still developing institutions and organizations that take care of water management issues. Drought preparedness requires adequate institutions and agencies with competences to develop and enforce plans. In the absence of them, governments must necessarily resort to emergency actions and alleviation programmes, but very little can be done to reduce the likelihood and severity of drought risks.

In general, decisions related to droughts are taken in the context of formal legal system. There are legal provisions for emergency actions in case of crisis situations, such as extreme drought. Informal customs may evolve into formal decisions. For example, historical users of groundwater without formal rights may be legalized. The legislation does not provide explicit regulations about how to calculate the ecological discharge during drought situations; this important question is being left to the discretion and responsibility of the various River Authorities. Tables 6 and 7 summarise drought management characteristics and the key aspects of drought management plans, respectively, in the MEDROPLAN project partners countries. Specific drought management plans have been developed at different administrative levels. A main advantage of the explicit linkage of legislation and management to the basin level is the opportunity to address directly the needs and problems of the natural hydrological system and the stakeholders represented in the Assembly of Users. For example, Basin Authorities in Spain can establish priority of users or right holders according to each situation, can approve works and projects needed to solve emergent scarcity problems, and can create Water

Table 6. Summary of the drought management characteristics in selected Mediterranean countries

Country	Summary of drought management
Cyprus	Current proactive action plans for drought management based on crisis management. Good approach to risk management
Greece	Centralised system of collecting and processing of data: National Bank of hydrological and meteorological information Modern GIS system for spatial analysis Large experience in drought preparedness and mitigation by institutions Good starting point to develop actions plans for drought management: New Water Law adapted to EU Water Framework Directive
Morocco	Good technology to monitor hydrological system (RIBASIM) Modern technology for remote sensing and GIS system for spatial analysis of drought Good performance basin agencies: Social participation and planning process Several years experience with drought agricultural insurance River basin agencies established: Regional water and drought management Good starting point to develop action plans for drought risk management; National Drought Observatory; new Water Law and National Drought Mitigation Plan
Spain	Modern technologies to monitor hydrological system Solid base insurance system: Knowledge of drought risk Good performance basin agencies: Social participation and planning process Drought adapted legal framework: Establish priorities, reallocations mechanism and legal mandate to develop contingency plans Insurance system for dryland agriculture Sound connection within river basin agencies between water planning and drought preparedness planning, in the context preparations for EU WFD's article 4
Tunisia	Drought is considered in the National Development Plans Latest data collecting and processing techniques: Interaction between data collection and drought mitigation process: SINEAU system Drought indices are considered in drought management process Adaptations of reactive and proactive measures to phases of drought Adequate start point: First Drought Mitigation Guideline

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.

Table 7. Summary of the drought management actions in selected Mediterranean countries

Concept	Cyprus	Greece	Italy	Morocco	Tunisia	Spain
Surface water ownership	Public	Public	Public	Public	Public	Public
Groundwater ownership	Partially private	Public	Public	Partially private	Public	Mixed
Water Law	Not include drought	Includes drought	Includes drought	Includes drought	Includes drought	Includes drought
River Basin Authorities	Not developed	Developed	Developed	In developed	Partially developed	Developed
Drought contingency plan	Not developed	In development	Regional	In development	National	At river basins and urban supply levels
Drought monitoring system	Partially developed	Partially developed	River basin	National	National	River basin
Agricultural insurance	Rainfed agriculture	Not developed	In development	In development	Not developed	For rainfed agriculture
Relation among institutions	Low	Low	Low		High	Medium
Public participation in water management	Low	Medium	High	Low	Low	High

In all cases, there is a clear and constant conflict between water uses during drought periods, however, in some countries agencies actions are generally accepted and perceived as legitimate. And yet in some other related regulations still need development and evaluation. Also the view on water use rights exchange varies dramatically from one institution to another, making more difficult the real application of approved plans and initiatives. There is also a conflict concerning emergency works. On the one hand some of these works are necessary for the normal functioning of the basin and the emergency situation accelerates the approval process, on the other hand these works result in larger costs and efforts than would have normally implied. The traditional treatment of drought has rarely incorporated environmental issues. The European Water Framework Directive highlights the importance of improving the "ecological status of the heavily modified water bodies", and mandates that the ecological water quality be integrated as an objective of the programmes of measures. However, it foresees derogations of quality targets if severe drought conditions prevail or social costs are high.

A common characteristic of the countries in the region is the weak cooperation among the different institutions related to water management. Another similarity is the fragmented roles of the State, the administrative Regions and the River Basin Authorities, which result in administrative conflicts that are an impediment for adequate water management. The key issue of transboundary water management is included in drought management plans. Spain shares a large amount of surface water resources among basins in the country and basins that extent to Portugal. The agreements on water transfer amounts between national basins (such as the Tagus-Segura) or between countries sharing a common basin (such as the Spanish and Portuguese portions of the Tagus Basin) include strategic regulations in the case of drought. The EU mandates that international basins which include EU

member states must approve agreed programmes of measures applicable for the entire demarcation. Other Mediterranean countries, especially in the southern basin, share a significant portion of groundwater, but the regulation during drought needs to be further developed.

No single management action, legislation or policy can respond to all the aspects and achieve all goals for the effective drought management. Multiple collaborative efforts are needed to integrate the multidimensional effects of drought on society. The United Nations Convention to Combat Desertification (UNCCD, 2000) provides the global framework for implementing drought mitigation strategies. The United Nations International Strategy for Disaster Reduction (UNISDR, 2002) establishes a protocol for drought risk analysis.

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Annex 1. Questionnaire for stakeholders

Introduction

Name, age, organisation, current position, previous position, profession.

Organisation (history)

How many years have you been working for/an activist in……?

How, when and why was the organisation created?

What type of public does it represent and how many members does it have? (not applicable for governmental organisations and media)

Approximately how many people work in the organisation? What kind of profiles and skills do they have?

What is the socio-professional profile of the members of the organisation? (not applicable for governmental organisations and media)

Perception of drought and uncertainty

What is drought in your opinion?

In your opinion, water scarcity in the region is chronic, cyclical or irregular? Give reasons for your answer. a) Chronic ☐; b) Cyclical ☐ How often? ……..; c) Irregular ☐

Do you think that mankind can ever control droughts? Why?

Do you think that mankind can ever control floods? Why?

What sector is mostly affected by droughts? Order them from 1 (most affected) to 7 (least affected). Give reasons for your first and last choice.

	No.	Reasons
Industries		
Tourism and services		
Irrigation		
Environment		
Recreational uses		
Dry farming		
Domestic users (households)		
Others		

What sector is with whom lies the main responsibility to cope with the effects of drought?

Order the following factors of uncertainty, which affect irrigation farmers from 1 (high level of uncertainty) to 5 (low level of uncertainty). Give reasons for your first and last choice.

Factors of uncertainty	No.	Reasons
Climate		
Level of guarantee in irrigation supply		
Agricultural policies		
Work market		
Others		

Legal arrangements on water allowances and water reserves

Do you think that the current legal framework defines clearly the rights of the water permit holders? Why?

Do you think that the compensations due to users affected by a reduction in water allowance during drought periods are clearly defined in the current legal framework?

Which groups participate in the definition of water allowances during drought periods?

In your opinion, do the sectors, which are affected by water allocation during drought periods, participate sufficiently and adequately in such organisations/committees? Why? If the answer is *no*, which actors should improve their participation?

Do you think there are groups with greater capacity to make or influence decisions concerning the definition of water allowances? Give reasons. If the answer is *yes*, which groups?

How are the droughts inceptions defined or established? Is there a formal procedure to declare a "drought situation"?

Stakeholders (relations and conflicts)

In the case of drought, to which activities would you (personal opinion) give priority for the supply of water? Order them from 1 (highest priority) to 6 (lowest priority). Give reasons for your first and last choice.

Sector	No.	Reasons
Domestic use		
Services and tourism		
Environmental uses		
Irrigation		
Recreational uses		
Industry		
Other		

Do you think that these priorities correspond to the priorities that the administration defends in situations of water scarcity? Give reasons.

Do you think that the administration adequately enforces the agreements reached on water allocations? If the answer is *no*, where does the main non-compliance lie? If the answer is *yes* or *do not know*, what are the main difficulties (both internal and external) that the administration faces in enforcing the agreements?

Do you think that irrigation farming is a very, little or not at all homogeneous sector? What factors give homogeneity to this sector? What features are responsible for internal diversity? Could you list any more clearly defined/differentiated groups?

Do you think that the arguments that were put forward during the past drought in favour and against the social distribution of water –i.e. water allocation according to farm unit rather than agricultural surface– were reasonable?

Do you think that the definition of irrigation water allowances during drought periods should take into account the different irrigation systems used?

Do you think that the definition of irrigation water allowances during drought periods should take into account the diversity of crop types, in terms of different water requirements and timing of irrigation?

Mechanisms of political and media pressure

Do you think there are measures of political and media pressure that can condition or modify the decisions taken on water allowances during drought periods? To what extent are they effective? For instance, to what extent specific groups of users obtain privilege positions in times of droughts at the expense of others that are less powerful or politically active?

List in the types of actions to exert political and media pressure and the actors that normally use them.

Drought mitigation measures

Which ones of the following measures do you think are most necessary? Order them from 1 (most necessary) to 13 (least necessary). Give reasons for the first and last choice.

Action	No.	Reasons
Increase in the regulation capacity for urban supply		
Improved efficiency of the urban water distribution networks		
Freeze the increase in the irrigation surfaces		
Water markets		
Increase in the regulation capacity for conjunctive uses		
Increase in the regulation capacity for irrigation purposes		
Substitution of high- with low water-demanding crops		
Water metering		
Reallocation of water from irrigation to urban uses		
Improved irrigation efficiency		
Inter-basin transfers		
Conversion of some irrigation surfaces to dry farming		
Remote control		
Reuse of waste water		
Full cost recovery		
Other		

In your opinion, which of these measures receive the highest social acceptance and which the lowest? Give reasons.

Which of the following activities are most socially and economically important for your region/ country? Order them from 1 (most important) to 6 (least important). Give reasons for your first and last choice.

Sector	No.	Reasons
Cattle-raising		
Building sector		
Tourism		
Irrigation farming		
Dry farming		
Industry		
Other		

In your opinion, which of these functions or effects of irrigated agriculture receives the highest social acceptance? Which the lowest? Give reasons.

	Highest	Lowest
It creates jobs		
It avoids emigration from the countryside		
It contributes to the economic development of less favoured regions		
It has negative impacts on the environment		
It contributes to the distribution of wealth		
It wastes water		
Other		

Economic instruments

Do you think that water can be traded in a way similar to other natural resources (e.g. oil, gas, etc.)? Why?

If the following measures were to be carried out, how and who should make the greatest contribution in terms of investment. Give reasons.

	Users (totally)	Users (majority)	50% users 50% public sector	Public sector (majority)	Public sector (totally)
Increase in the regulation capacity for urban supply					
Improved efficiency of the urban water distribution networks					
Increase in the regulation capacity for conjunctive uses					
Increase in the regulation capacity for irrigation purposes					
Substitution of high-with low water-demanding crops					
Reallocation of water from irrigation to urban uses					
Improved irrigation efficiency					
Inter-basin transfers					
Water metering					
Remote control					
Reuse of waste water					
Other					

List the advantages and disadvantages of the water pricing systems, based either on actual abstracted volume or irrigated surface.

	Advantages	Disadvantages
Irrigated surface		
Abstracted volume		

Do you think that water prices should adjust to the real costs of the resource? Do you think that this adjustment of water prices would entail a considerable reduction of irrigation water use? To what extent?

Do you think that the option to buy and sell water would involve a considerable number of users? Would it involve a considerable volume of water? What proportion?

What should be the role of the public administration in the process?

1. To get involved as little as possible, letting the water rights holders operate freely.

2. To supervise interchanges so that certain requirements are met.

3. To control the process, by acting as an intermediary, fixing the prices, etc.

4. Other.

What would be the major cultural obstacles for the application of this new framework?

What could be its possible negative effects?

Would it lead to an uneven distribution of benefits and prejudices for different actors? If the answer is *yes*, which ones?

Institutional scenarios

Do you think that the current proportion of water assigned to irrigated agriculture (about 80%) will be reduced in the future? No ☐; Yes ☐ If the answer is *yes,* fill in the next two tables:

	5	10	20	Longer
In what time span (years) would the reduction begin?				

	70%	60%	50%	Other
What percentage would it reach?				

What would be the main factors that could condition such redistribution of water between sectors?

How likely is it (high, medium, low probability) that agricultural policy measures with a significant effect on water use are approved? Low ☐; Medium ☐; High ☐ Why? To what extent would they affect water use?

Do you think that cultural changes are taking place, which could affect the volumes of water used and its distribution between sectors? Yes ☐……Which ones? No ☐

Climate change

With the hindsight of the past three drought periods (1970s, 1980s, 1990s), do you think that our capacity to face the effects of drought has improved? Yes ☐ To what extent?; No ☐ Why?

How do you define climate change? Do you think you have sufficient information on this issue?

How could climate change affect the water resources and demand?

Was the problem of climate change ever discussed at your work?

Given the impacts that climate change could entail, how would it affect the level of priority of the previously mentioned measures? Give brief reasons for your answer.

Action	No.	Reasons
Increase in the regulation capacity for urban supply		
Improved efficiency of the urban water distribution networks		
Freeze the increase in the irrigation surfaces		
Water markets		
Increase in the regulation capacity for conjunctive uses		
Increase in the regulation capacity for irrigation purposes		
Substitution of high- with low water-demanding crops		
Water metering		
Reallocation of water from irrigation to urban uses		
Improved irrigation efficiency		
Inter-basin transfers		
Conversion of some irrigation surfaces to dry farming		
Full cost recovery		
Remote control		
Use of waste water		
Other		

Annex 2. Data and information systems

This component refers to the collection, recording, manipulation, processing and accessibility of variables that provide a representation of natural processes and socio-economic patterns. Table 1 outlines the types and characteristics of the data relevant to drought management. The sources of data and the reliability have to be evaluated. In some cases, data are processed to create drought indices or other indicators, and in others, other sources of evidence are used to identify drought or its impacts.

Table 1. Types and characteristics of the data relevant to drought management

Type of information	Description and variables to be included in the analysis
Data Types	Biophysical data: climate, soils, water, land, agriculture Socio-economic data: water and land uses supplies and demands, economic indicators (i.e., GDP), demographic indicators
Data Suppliers	List the organisations and institutions that have the responsibility of data collection and processing, and describe the strategic mandates or policies that dictate the data collection policies
Data Acquisition	Description of the instrumental base for data collection, processing, and recording. For example for climatic data, the information should include the number of weather stations, variables collected, length of the data series, etc
Data Accessibility	Description of the accessibility conditions of data: costs, regularity, format Documentation of the metadata, location, and publications
Data Reporting	Mention the mandatory dependencies that exist with regards to data reporting among official organisations, stakeholders and NGOs
Data Users	List the organisations and institutions that receive data on a regular basis