# Spain

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**SUMMARY –** Map of the organizations and institutions involved in drought – with special emphasis in urban and irrigation water supply – that work on: (i) the collection, processing, storing and disposing of meteorological and hydrological data; (ii) drought preparedness and mitigation; and/or (iii) on water management. This chapter contains a description of the legal Spanish framework related to drought situations, a revision of the institutions and governing bodies involved in the drought management processes and the interactions between them. Finally, the mapping of these institutions provides a useful basis for the evaluation of the strengths and weaknesses of the drought management system in Spain. In order to complete the analysis there is also a description of case studies where the decision making processes are explained, and another section of interviews with stakeholders of the water management environment that are used to validate this mapping.

**Key words:** Drought management, institutional analysis, drought legislation.

***RESUME –*** *"Espagne". Cartographie des organisations et institutions intervenant en matière de sécheresse – en particulier dans l'approvisionnement en eau des villes et l'irrigation – et s'occupant de : (i) collecte, traitement, stockage et mise à disposition de données météorologiques et hydrologiques ; (ii) prévention et atténuation de la sécheresse ; et/ou (iii) gestion de l'eau. Ce chapitre présente une description du cadre juridique espagnol en rapport avec les situations de sécheresse, passe en revue les institutions et instances concernées par les processus de gestion de la sécheresse ainsi que les interactions entre ces dernières. Finalement, la cartographie de ces institutions constitue une base d'utilité pour l'évaluation des points forts et points faibles du système de gestion de la sécheresse en Espagne. Afin de compléter l'analyse, des cas d'étude sont également décrits avec explication des processus de prise de décisions et il y figure une autre section présentant des entretiens avec les acteurs concernés par l'environnement de la gestion de l'eau, ce qui a permis de valider cette cartographie.*

***Mots-clés :*** *Gestion de la sécheresse, analyse institutionnelle, législation en matière de sécheresse.*

## Introduction

The objective of the institutional analysis is to identify and map national, regional and local organizations and institutions in Spain that work on: (i) the collection, processing, storing and disposing of meteorological and hydrological data; and (ii) drought preparedness and mitigation and/or on water management. This work describes:

(i) Explicit description of institutions and organizations with competence in water policy and administration, in 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) Document the institutional experience on the application of the existing drought preparedness and management plans.

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

(vi) Proposal of a structure to promote the cooperation of Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN) project with the existing institutions, organizations, networks, and other stakeholders.

## Data and information systems

Table 1 outlines the institutions that collect, record, and process data that provide a representation of natural processes and socio-economic patterns.

Table 1. Summary of institutions that collect and process data related to drought in Spain

| Type of data | Institution† | Data characteristics | URL |
|---|---|---|---|
| Agriculture | INE | Agricultural census per province 1999: land area, type of farms, labour, production data 1998-99 | http://www.ine.es |
| Agriculture | MAPA | Agriculture and forest production and areas, inputs, prices, 1950-present | http://www.mapya.es |
| Climate | INM | Stations data | http://www.inm.es |
| Industry and energy | INE | Industries by activity and energy consumption. Community. Survey, yearly. 1998-2001 | http://www.ine.es |
| Land | IGN | Land use/cover, 1:100,000. Since 2000 | http://www.ign.es |
| Land | MAPA | Land use, digital, 1:50,000, 2000, province level | http://www.mapya.es/sig |
| Land | MIMAM | Land cover, cartography, 1:25,000 | http://www.mma.es |
| Socio-economic indicators | INE | GDP, unemployment, consumer prices index (IPC). Monthly. Population and migration. 1990-present | http://www.ine.es |
| Water: groundwater | CHs | Groundwater control network. (Until 2003 they used data from IGME) | http://www.mma.es |
| Water: groundwater | IGME (previously ITGE) | Quantity and quality, monthly, 1966-present | http://www.igme.es |
| Water: quality | CHs | SAICA†† network. Since 1999 | http://www.mma.es |
| Water: quality | INE | 1996-2001. Autonomous Community level | http://www.ine.es |
| Water: supply and demand | AEAS | Survey (1987-present) of urban supply companies | http://www.aeas.es |
| Water: supply and demand | Canal Isabel II | Madrid: demand, supply, components of the supply system (reservoir level, water treatment). Real time | http://www.cyii.es |
| Water: supply and demand | INE | Annual survey (1996-2001). Autonomous Community level | http://www.ine.es |
| Water: surface water | CHs | Gauging stations, reservoir levels, real time data (SAIH††† system) | http://www.mma.es |
| Water: surface water | INE | Water use, indicators of water reuse, prices. Autonomic Community level, annual survey (1996-2001) | http://www.ine.es |

†INE: National Institute of Statistics; MAPA: Ministry of Agriculture, Fisheries and Food; INM: National Institute of Meteorology; IGN: National Institute of Geography; MIMAM: Ministry of the Environment; CHs: Water Basin Authorities; IGME: Geological and Mining Institute of Spain, Ministry of the Environment; ITGE: Technical and Geomining Institute of Spain; AEAS: Spanish Association of Water Supply Companies.
††SAICA: Automatic System of Information on Water Quality.
†††SAIH: Automatic System of Hydrologic Information.

## Legal framework

### Framework legislation

Embid Irujo (2003) recognizes two main legal sources of the Spanish water codes and statutes: derived from the Spanish Constitution and from the European Union Water Framework Directive. These two legal bodies are on top of the hierarchy of laws and statutes pertained to water and droughts.

*Spanish Constitution (1978)*

The Spanish Constitution of 1978 foresees:

(i) The revaluation of the public property on all water resources (Article 132).

(ii) The explicit concern for the environment (Article 45).

(iii) The structural and territorial organization of water administration competences, under which the State (National Government) takes on all administrative and management tasks of all interregional basins (Article 149.1.22).

*European Union Water Framework Directive (2000)*

The European Parliament and Council Directive 2000/60/EC of October 23 contains a series of principles that will 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).

### Instrumental laws

Three instrumental laws are identified as the main precursors of drought preparedness and planning: the Water Law (WL), the Law of the National Hydrological Plan (NHP) and the Agricultural Insurance Law.

*The 2001 Water Law*

The WL was approved in 1985, reformed in 1999, and consolidated in 2001 in a Royal Decree (1/2001, 20 July 2001) with slight amendments with respect to the 1999 version. The Spanish WL can be considered a modern and comprehensive water code, covering all issues and aspects related to water policies, organization, procedures, finance, civil works, planning and public participation. This report focuses only in issues with direct implications on drought preparedness and planning. Next section of the document describes in detail the various organizations that are recognized in the WL and play a role in droughts preparedness or planning.

Among the key WL provisions that pertain to droughts are:

(i) Water-rights holders can make use of their rights insofar basin authorities approve them and issue concrete management plans detailing all possible uses for the current hydrological year (Articles 55 and 58). Droughts are considered exceptional circumstances. The formal declaration of a "drought" allows the Government to initiate any project, work, or action under fast track approval procedures.

(ii) For planning purposes, users or right holders are ordered according to priorities explicitly established in each basin hydrological plan (approved as decrees, Article 60). 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.

(iii) Works and projects needed to solve emergent scarcity problems are considered works that promote the general interest (Article 46), and as such, their approval procedures and financing enjoy preferential treatment.

(iv) Water use plans and reservoir release decisions are taken by the basin authorities, as proposed by the Reservoir Release Commissions and Management Boards (Articles 32 and 33).

(v) Right-holders are allowed to freely exchange their water use rights, but the transfer requires approval of the basin authority and is subject to various regulatory provisions (Articles 67-70).

(vi) 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). The initiative to create these centres must be proposed by the Environment Ministry and be approved by the Ministerial Cabinet. If the exchanges centres or the water rights transfers involve two different basins they must be explicitly approved by the Environment Ministry.

### *The Law of the National Hydrological Plan*

This Law (10/2001, of July 5th, "de Plan Hidrológico Nacional") consolidates all planning decrees pertained to each of the inter-regional basins, and lays down the basic principles of the water planning at the national level. Droughts are explicitly mentioned in Article 27 establishing:

(i) The Environment Ministry will establish a system of hydrological indicators to support the formal declaration of alert situation and droughts by basin authorities.

(ii) Basin authorities should develop special action plans for alert situation and droughts, including the management rules and the programme of measures to be applied on the water public domain under these situations.

(iii) 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 and take into account the special action plans mentioned in the previous point.

### *Hydrological Basin Planning Royal Decree*

All Spanish Hydrological Basin Plans were approved by the Royal Decree 1664/1998 of July 24th. In compliance with Article 60 of the WL, reliability criteria were established that guarantee minimum allowances for the irrigation and urban sectors for the medium and long term. The criteria are specified by a range of probabilities of supply failure during one, two or ten consecutive drought years.

### *Agricultural Insurance Law*

The Agricultural Insurance Law (Law 87/1978, 28 December 1978, "de Seguros Agrarios Combinados") lays the framework and institutional organization of the Spanish system of agricultural insurance policy. Droughts are mentioned among the risks recognized in the law to be covered by the insurance policies (Article 3). The specific development of various insurance policies covering yield losses caused by droughts (and other abnormal natural events) has given rise to a menu of options that are currently available to most crops grown under dry-land regimes. Some of these will be described below.

## Specific drought legislation

In Spain, the legislation and normative related to water management and water policy is extensive. Table 2 outlines the laws related to drought that are not mentioned explicitly in the following sections. Table 3 lists the main laws, statues, and norms. In general the laws focus on reactive drought

management, providing conditions for emergency actions. In the case of the insurance normative, the laws from 2001 to present have a pro-active character.

Table 2. Summary of the laws related to water scarcity and drought management in Spain

| Category | Date | Contents |
|---|---|---|
| International Convention (United Nations) | 1994 agreement, 2000 enforced | Strategies to fight desertification and mitigate drought to be implemented by countries all around the world |
| Special plans: Civil Protection, Permanent Office for Drought | 1983, 1999 | Creation of committees that will define the action terms in case of drought.<br>Different performance environments, social or agricultural |
| Emergency measures. Most of them undertaken after the most severe drought periods as mitigation measures | 1995-2000 | Laws, royal decrees and orders created to mitigate the impacts of drought.<br>Hydraulic supply measures.<br>Transfers of water between different river basins.<br>Measures for sub sectors of agriculture (apiculture, livestock, tree crops) |
| Scope definition. Definition of the areas where the emergency measures are applied | 1993, 2000, 2001 | Definition of the criteria used to delimit areas affected by drought.<br>Establishment of criteria for aid supply.<br>Final criteria used.<br>Amount of rainfall.<br>Stocking rate |
| Insurance | 2001, 2002 | Definition of the conditions, application areas and other characteristics of drought insurance |

Table 3. Spanish legislation related to drought and water scarcity

| Year | Area | Law/normative |
|---|---|---|
| International | | |
| 1994 | Drought | United Nations Convention to Combat Desertification in countries affected by serious drought or desertification, particularly in Africa. Paris, 17th June 1994. (BOE No. 36, 11-Feb-1997) |
| 2000 | Drought | Annex V (for regional application for Central and Eastern Europe) of the United Nations Convention to Combat Desertification in countries affected by serious drought or desertification, particularly in Africa. Bonn, 22nd December 2000. (BOE No. 257, 26-Oct-2001) |
| 2000 | Water management | European Directive 2000/60/EC of the European Parliament and of the Council, 23 October 2000. EU Water Framework Directive: Establishment of a framework for the Community action in the field of water policy. (Official Journal L 327, 22-Dec-2000) |
| National | | |
| 1978 | Agriculture | Law 87/1978, 28 December 1978. Combined agricultural insurance |
| 1983 | Drought | Order of 27th June 1983. Approval of the Drought Special Plan of coordinated actions with Civil Protection. (BOE No. 161, 7-Jul-1983) |
| 1985 | Water management | Water Law, 2 August 1985. It established the basic legal framework on water. I: Hydraulic public domain of the State. II: Public water management. III: Hydrological planning. IV: Public hydraulic domain use. V: Protection of hydraulic public domain and quality of freshwater. VI: Economic-financial system of the hydraulic public domain use. VII: Transgression, sanctions and court of justice competencies |
| 1993 | Drought | Resolution of 12 July 1993 of the Public Works Ministry. Declaration of irrigated areas affected by drought and adoption of emergency measures to mitigate drought effects |

Table 3 (cont.). Spanish legislation related to drought and water scarcity

| Year | Area | Law/normative |
|---|---|---|
| 1993 | Drought | Royal Decree Law 8/1993, 21 May. Adoption of emergency measures to mitigate drought effects |
| 1995 | Drought | Royal Decree Law 7/1995, 4 August. Approval of the transfer of 55 $hm^3$ to the Segura Basin and of the financing of emergency works to face drought situation. (BOE No. 188, 8-Aug-1995) |
| 1996 | Drought | Law 8/1996, 15 January. Adoption of emergency measures to mitigate drought effects. (BOE No. 15, 17-Jan-1996) |
| 1996 | Drought | Law 9/1996, 15 January. Adoption of extraordinary and exceptional measures in hydraulic supply systems to mitigate drought effects. (BOE No. 15, 17-Jan-1996) |
| 1998 | Water management | Royal Decree 1664/1998, 11 August 1998. Approval of the Basin Hydrological Plans |
| 1999 | Drought | Order of 25 October 1999 that states the increase of the unitary module of loans granted in apiculture to mitigate the effects of drought. (BOE No. 257, 27-Oct-1999) |
| 1999 | Drought | Royal Decree Law 11/1999, 11 June. Application of emergency measures to mitigate the effects of drought. (BOE No. 140, 12-Jun-1999) |
| 1999 | Drought | Order of 23 November 1999. Settles down the application rules of the content of article 4 in Royal Decree Law 11/1999. (BOE No. 290, 4-Dec-1999). |
| 1999 | Drought | Royal Decree Law 20/1999, 3 December, adopting new measures to mitigate the effects of drought on woody crops (BOE No. 290, 4-Dec-1999) |
| 1999 | Drought | Order of 17 December 1999. Delimitation of areas that are subject to the emergency measures proposed in Royal Decree Law 20/1999. (BOE No. 304, 21-Dec-1999) |
| 1999 | Drought | Order of 6 September 1999. Constitution of the Permanent Office for Drought. (BOE No. 215, 8-Sep-1999) |
| 1999 | Water management | Law 46/1999, 13 December. Modification of Law 29/1985, 2 August, Water Law |
| 2000 | Drought | Order 15 December 2000. Determines the territorial scope affected by drought and other climatic situations and establishes criteria for the application of the new measures stated in Royal Decree Law 8/2000, 4 August (valid until 2 February 2001) (BOE No. 301, 16-Dec-2000) |
| 2000 | Drought | Order 1 February 2000, sets down the application rules of the content of article 5 in R.D.L 20/1999, 3 December, (BOE No. 38, 14-Feb-2000) |
| 2000 | Drought | Royal Decree Law 8/2000, 4 August. Application of emergency measures to mitigate the effects of drought and other climatic situations. (BOE No. 194, 14-Aug-2000) |
| 2000 | Drought | Order of 26 December 2000. Regulations for the development of Royal Decree Law 8/2000. (BOE No. 3, 3-Jan-2001) |
| 2001 | Drought | Order of 18 January 2001. Sets down the application rules of the content of article 8 Royal Decree Law 8/2000. (BOE No. 26, 30-Jan-2001) |

## Institutions involved in water and drought management

### Ministry of the Environment

The Ministry of the Environment includes two – Water and Coasts, and Environment – that have potential competences for drought issues. In practice, the Secretariat of Water and Coasts is directly responsible for water management, through the Direction General of Hydraulic Works, the administrative body that encloses, among others, the river basin authorities (see below).

### River Basin Authorities

Headed by a Chairman selected form the Central Government, it includes users groups and representatives of different central and regional government bodies. 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). The composition is outline below:

(i) *Chairman*. Appointed by the Council of Ministers at the proposal of Ministry of Environment, for inter-regional basins, and at the proposal of the Autonomic Communities the when is an intra-regional basin.

(ii) *Management Board ("Junta de Gobierno")*. Headed by the Chairman, includes representatives of the Ministries of Environment, Agriculture and Energy, regional governments whose territories are part of the basin and users (at least 33% of the board members). It is in charge of: financial matters, general action plan, definition of aquifer depletion and groundwater protection and drought by creating an *ad hoc* permanent committee.

(iii) *Operation Boards ("Juntas de Explotación")*. Several by basin. They co-ordinate the management of hydraulic works and water resources in specific areas, where water uses are especially interlinked. The Waters Act establishes composition of the Board according to the importance of each user group in the basin, but it includes the administration, public and private water supply companies, irrigation associations, hydroelectric companies, and industrial users.

(iv) *Assembly of Users ("Asamblea de Usuarios")*. Headed by the Chairman, includes all users, that are part of the Operation Boards. Co-ordinates the management of hydraulic works and water resources throughout the basin.

(v) *Dam Water Releases Commission ("Comisión de Desembalse"*). Headed by the Chairman, and members selected by the Assembly of Users. Responsible for proposing the system for releasing water from reservoirs, and flood measures (through the creation of a special permanent committee).

(vi) *Water Basin Council ("Consejo del Agua de Cuenca")*. Headed by the Chairman, it includes representatives of the central and regional governments, technical services and users including NGOs and professionals (at least 33%). It approves the Basin Hydrological Plan, which is then referred to the Central Government.

(vii) *Hydrological Planning Office ("Oficina de Planificación")*. Defines, monitors, and reviews the Hydrological Basin Plan, and provides technical support to the Water Basin Council.

## Ministry of Agriculture, Fisheries and Food

The Ministry of Agriculture is responsible for irrigation planning, the implementation of publicly funded water schemes and the development of irrigation improvement schemes.

### *Agricultural Insurance Agency*

This institution, with the characteristic an autonomous agency, dependent on the Ministry of Agriculture, Fisheries and Food through the Undersecretariat of the Department, acts like a coordination organization and link on behalf of the Administration for the development of agricultural insurances. The institution is headed by the Undersecretary of the Ministry of Agriculture, Fisheries and Food and has a Director that is designated by the Minister of Agriculture, Fisheries and Food.

### *Insurance Compensation Consortium*

During its activities, this state company is subject to the private legal system, and acts as an essential re-insurer of the system and has been entrusted the monitoring of the consultancies and taking on the percentage of co-insurance not covered by the insurance institutions.

### *Permanent Office for Adverse Climate and Environmental Situations*

Depends on the Ministry of Agriculture, Fishing and Food, General Secretariat of Agriculture and Food. Directed to an agricultural environment for the generation, execution and monitoring of measures undertaken to mitigate drought effects.

## Map linking the institutions, organizations and stakeholders related to drought and water scarcity

The mapping of the Spanish institutions involved in drought preparedness and planning is presented disaggregated in two independent spheres. One pertains to meteorological droughts, and the other to hydrological droughts and water scarcity. The underlying rationale of this separation is based on facts. First, because artificial and natural reservoirs eliminate, alleviate and delay the effects of abnormally low precipitation and runoff. Secondly, because the conditions and the processes of meteorological droughts evolve along time and space frames with little bearing on the processes that characterize hydrological droughts and water scarcity situations. Resulting from this disaggregation, the following sections take on two institutional mappings pertaining to meteorological droughts, and hydrological droughts and water scarcity contexts.

### Meteorological and agricultural drought

#### *Pro-active responses*

The degree of development of the Spanish agricultural insurance, as it covers most climate risks, stands out as the main pro-active response to droughts. Being a major drought policy in Spain, and one that complements other types of policies, it deserves specific attention. Therefore, we first concentrate on the institutional landscape of the agricultural insurance policies, since this is a guide for describing the institutional framework of the reactive responses. The institutional mapping of meteorological and agricultural droughts is completed with the description of the reactive responses to drought risks.

Figure 1 describes the institutional process of the agricultural insurance system to illustrate a key pro-active response to drought in Spain. The figure illustrates the framework for developing new agricultural insurance premiums as a result of emerging risks. This process includes seven key stages (1 to 7 in Fig. 1).

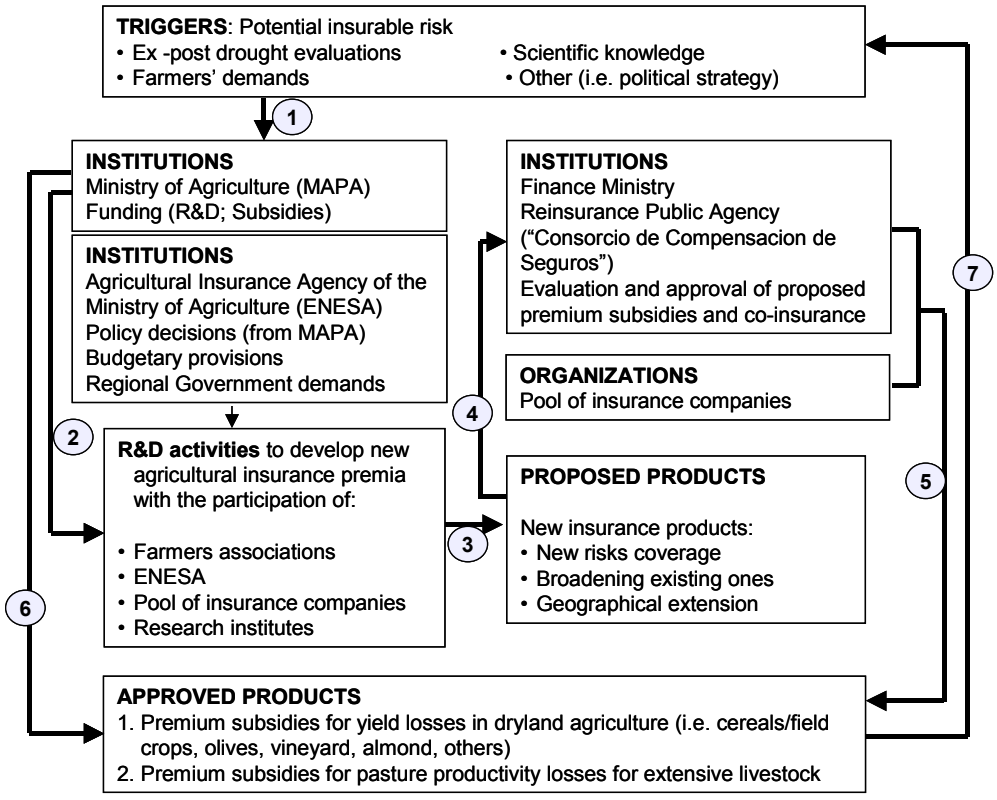


Fig. 1. Processes and institutional linkages in the pro-active responses to drought in the agricultural sector in Spain.

The trigger (Stage 1) is the realization that a new potential insurable risk(s) is sufficiently concrete and specific, so that demand to develop new premiums to cover it is expressed by formal and informal means. In some cases, the result is coverage expansion of premiums already in the market based on past and accumulated experience for increased risk. In others cases, farmers associations demand that certain risks should be covered. Occasionally, local and regional political pressures take on sufficient strength so that the Ministry of Agriculture elects to initialize new studies, and provide the required research and development (R&D) funds.

Under Stage 2 budget is allocated and approved for concrete research and development activities to analyse the new product. A research team is formed, which tentatively includes officials from ENESA (the Spanish State Insurance Agency), representatives of farmer associations, insurance companies, and external research institutes. If the research and development results recommend to generate marketable premiums, all its details are defined in Stage 3, including rates, geographical scope and other technical characteristics. Under Stage 4, the Finance Ministry, and the Reinsurance Public Agency will review the proposed new premiums, and approve or reject them. In this process, the pool of insurance companies is consulted. Their approval is necessary to continue the process.

Stage 5 gives rise to final marketable policies that are added to the menu of insurance premiums and are commercially offered to eligible farmers. In addition, the level of rate subsidization requires the approval of the Ministry of Agriculture, which also makes budgetary allocations (Stage 6). The process ends in a standard feed-back relation, described by Stage 7. New and old premiums are permanently evaluated, giving rise to amendments, removals, or impulse to broaden existent insurance lines.

In conclusion, the institutional framework encompasses all sectors – from farmers to insurance companies – and various administrative branches. In the past 25 years (i.e. from the declaration of the Agricultural Insurance Law mentioned above) this process has given rise to a wide and broad set of insurance policies, being the ones covering drought risks the most important from the point of view of farmers' responses and agricultural areas covered.

*Reactive responses*

Figure 2 illustrates the reactive responses to meteorological and agricultural drought, outlining the organizations and institutions involved in the processes, their hierarchical linkages, and the sequential time stages of the process. This process complements the pro-active responses described above. In general, the triggers of the reactive responses are dispersed and diffused social tensions, social unrest, or warning signals that originate from regional and local governments (Stage 1). These triggers originate primarily from the agricultural sector, particularly from dry-land agriculturalists and extensive livestock farms.

In Stage 2, the Ministry of Agriculture calls for a meeting of the Permanent Office for Drought (entirely composed by officials serving in the Ministry). In Stage 3 the Permanent Office analyses the situation focusing almost exclusively on the risks for which no insurance was available. Among the most vulnerable sub-sectors subject to non-insurable risks are a few marginal crops, such as saffron or nuts orchards, and animals raised under extensive husbandry threatened by drinking water scarcity.

Under Stage 4, the Permanent Office will table specific proposals to alleviate the drought effects on the identified vulnerable sectors. These proposals are translated into the final programme measures to be developed and approved (Stage 6). The programme includes taxation abatements or deferrals and requires the approval of the Ministry of Finance (Stage 5), agricultural policy, agricultural insurance and water policy. The European Commission may also take measures to help farmers hit hard by droughts, bringing forward direct Common Agricultural Policy (CAP) payments or permitting cattle to graze on set-aside land. The most common response in water policy is a reactive response related to the authorization for drilling wells for animal drinking and it has to be approved and financed by the river basin authorities with urgent character (Stage 7).

The most salient characteristics of this mapping are: (i) that it focuses explicitly in the agricultural sector; (ii) that the executive committee is formed only by officials of the Ministry of Agriculture; and (iii) that its scope and concerns are limited to the vulnerable sectors or sub-sectors whose risks are not insured.

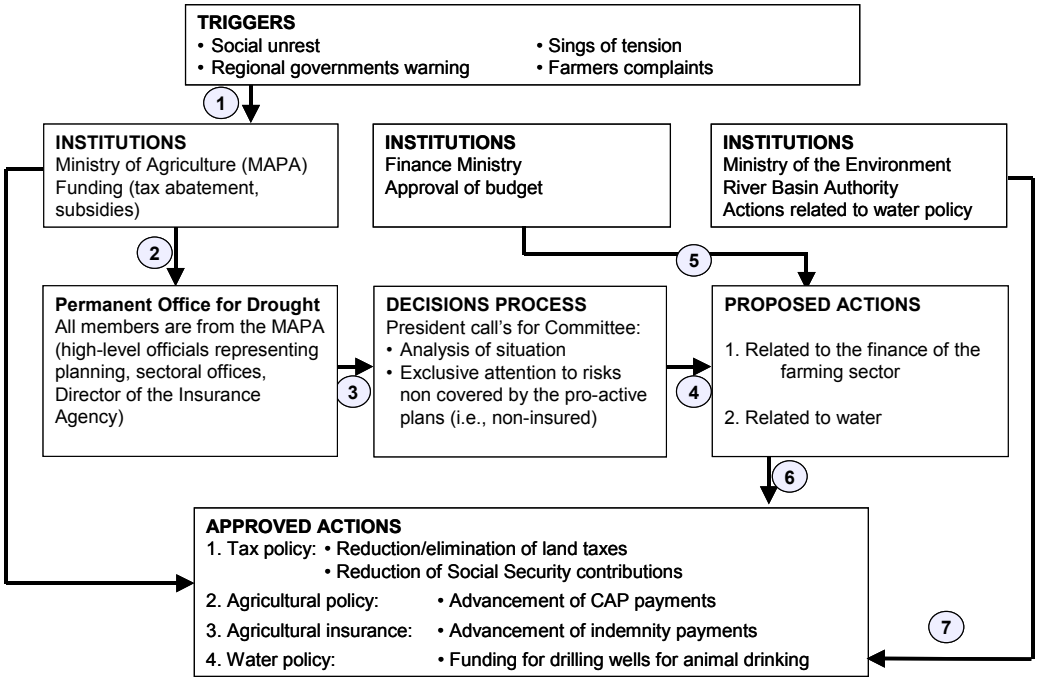


Fig. 2. Processes and institutional linkages in the reactive responses to drought in the agricultural sector in Spain.

## Hydrological droughts and water scarcity

To gain insight into the institutional nuances that differentiate pro-active and reactive drought and water scarcity responses, we offer two mappings as they pertain to pro-active and reactive responses. In all cases, the key institution responsible for the decisions is the Basin Authority. According to Article 23 of the WL, Basin Authorities are conceived as the entities responsible for the administration and management of all water resources within the basin territorial boundaries. Figure 3 provides a general description of the structural organization of the Tagus Basin Authority, the selected study basin in Spain, as illustration of the three-tier structure of the decision-making bodies within the basin: Governing Bodies, Management Bodies and Planning Bodies.

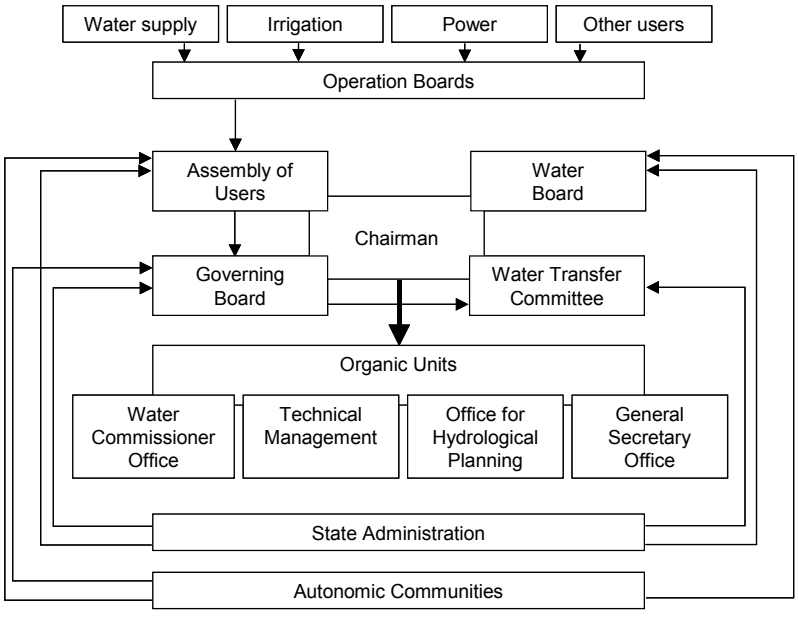


Fig. 3. General structure of the Tagus River Basin Authority, Spain.

*Pro-active responses*

The institutional process and the context of the pro-active responses to hydrological and water scarcity drought is mapped in Fig. 4. Triggers and motivations include general trends of the economy, demographics, environment, or land planning policies. Pro-active responses may also be motivated by force of complying with national and European Union legislation. In this situation the river basin authorities operate at three levels: Governing Bodies, Management Bodies and Planning Bodies (Stage 1), who draft the Basin Hydrological Plan (Stage 2). The decision process follows the phases of proposal, consultation, revision and submission to the Ministry of the Environment (Stage 3). The Ministry of the Environment can approve or reject the proposed Basin Hydrological Plan. If the Plan is rejected, the decision process is reinitiated (Stages 4 and 5).

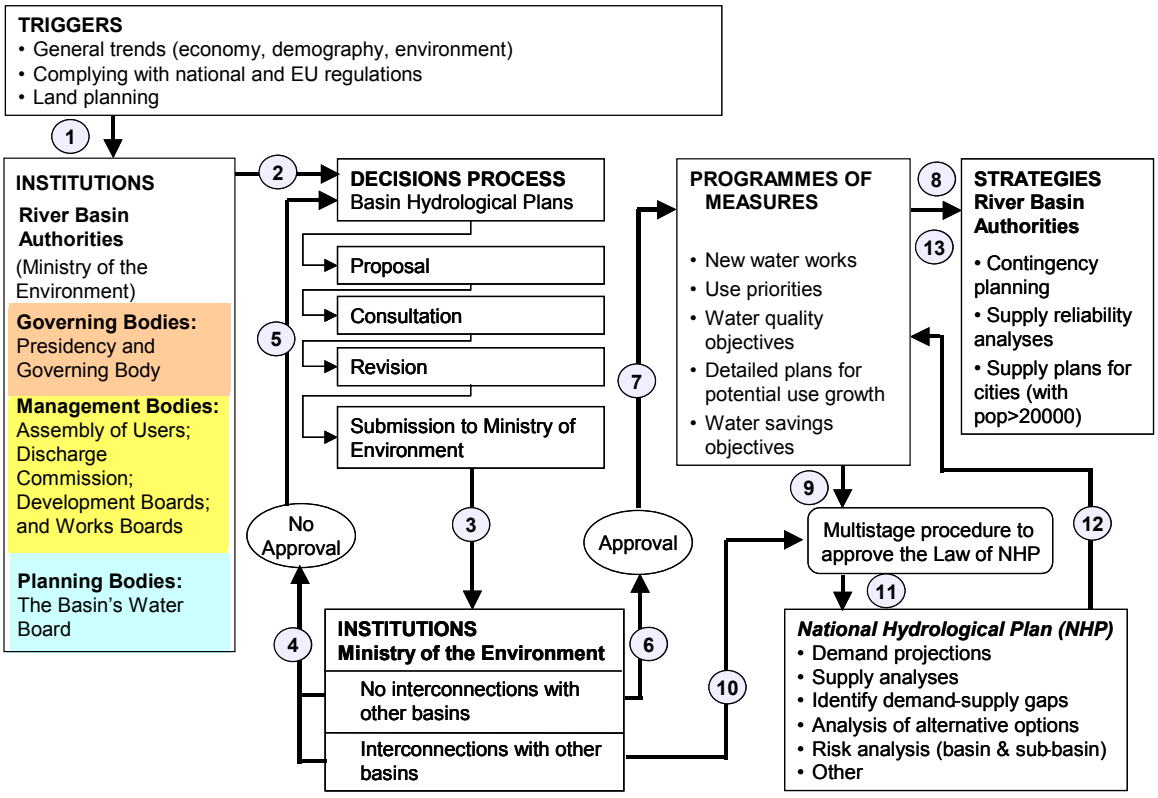


Fig. 4. Processes and institutional linkages in the pro-active responses to hydrological drought and water scarcity in Spain.

If the Plan is approved, two alternative roadmaps follow, depending on whether or not the Plan envisions any inter-basin transfer, according to the following structure:

(i) If the Plan does not foresee connections with other basins, it is approved (Stage 6). In this case, a few of the included measures can be qualified as pro-active, such as new water works, defining use priorities, water quality objectives, programmes of measures to solve scarcity issues, setting water conservation targets, and detailed plans for potential use growth (Stage 7). From this action some strategies to mitigate drought are derived which are related to contingency plans, supply plans for cities or supply reliability analyses (Stage 8). Finally, these actions and strategies are included in a multistage (Stage 9) that will likely integrate some of the proposed actions, measures, works and policies included in the Basin Plan (Stage 11).

(ii) If the Plan envisions inter-basin transfers (from or towards other basins), strategies are designed and drafted within the multistage procedure to approve the Law of NHP (see section "Instrumental laws"). (Stage 10). These plans take into account some outcomes from the NHP like demand projections, supply analyses, identify demand-supply gaps, and analysis of alternative

options and risk analysis (basin and sub-basin) (Stage 11). From this procedure final actions and strategies return to the Basin Plan for development and execution (Stages 12 and 13).

*Reactive responses*

Figure 5 depicts the institutional reactive responses to hydrological drought or water scarcity. As a result of permanent monitoring, some indicators of scarcity such as reservoir levels, low water tables in groundwater or, low runoffs may be warning signs to river basin authorities (Stage 1), whose response will depend on the relative severity of the perceived risks. Under non-emergency conditions, the reservoir release commission will meet in ordinary session (Stage 2) and will define some actions relative to reserve management, onset of right exchanging centres, revision of ecological flows and ground water abstraction and definition of precautionary water allocation schemes (Stage 3). All these measures affect farmers, hydropower units, environment, urban users and others.

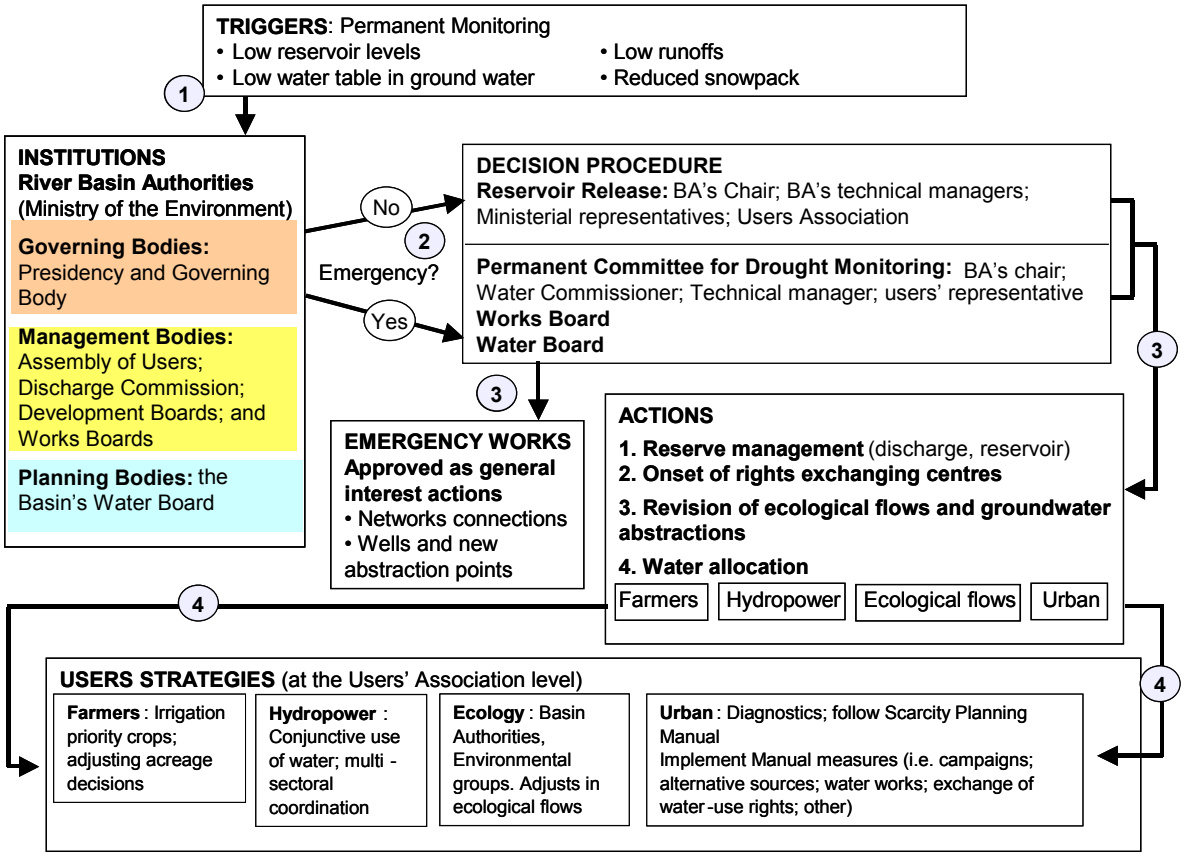


Fig. 5. Processes and institutional linkages in the reactive responses to hydrological drought and water scarcity in Spain.

If the monitored indices worsen, entering a pre-emergency stage, a Permanent Committee is established within the Basin Authority for drought monitoring. This committee can adopt exceptional measures such as extraordinary releases or establishing special strategic reserves in the basin's reservoirs. In this situation the Works Board and the Water Board, in addition, can file applications to have emergency works approved as "initiatives of general interest action" (networks connections, wells and new abstraction points) (also Stage 3).

Based on these River Basin Authority initiatives and in coordination with them, users strategies will be planned and carried out. These responses are usually drafted and decided by water users associations. For instance, irrigators can consider priority crops to be irrigated or perform exchanges of water use (Stage 4). Urban users in turn will follow their water scarcity planning manuals or protocols, implementing measures like saving campaigns, alternative uses, water works, exchanges of water use, demand management provisions and so on. In general, these reactive responses will be

applied only during drought periods. Examples of these are the revision of ecological flows and a better coordination of releases for hydropower generation with the timely demands for consumptive uses, such as irrigators.

## Historical examples of pro-active and reactive action plans

### Pro-active plans: Insurance policies for winter crops

Upon the approval of the Law of Agricultural Insurance in Spain in 1978, the initial policies offered to farmers for winter crops covered only fire and hailstorm risks. Since then, these crop producers have been given an increasingly broad choice to cover all natural risks in a broad range of crops, including droughts. For the fiscal year 2003-04, growers of rainfed winter crops can select one insurance premiums listed in Table 4.

During the period 1993-2001, insurance uptake has ranged from a low of 59% of all eligible land to a maximum of 78%. Presently, about 75% of the eligible land is covered by an insurance policy. In 2001, 42% of the total insured production was covered by integral, 18% under the combined premiums and 12% with yield premiums. Purchasing insurance represents a small cost percentage for the growers. The most expensive premiums represent about 4% of all direct production costs, whereas the least expensive policies represent about 0.5% of direct crop production costs.

Table 4. Summary of the insurance premiums for winter crops (2003-2004) in Spain

| Premiums | Hailstorm | Fire | Freeze | Drought | Wind | Rain | Floods | Pests and diseases | Climatic adversities |
|---|---|---|---|---|---|---|---|---|---|
| Integral | x | x | x | x | x | x | x | x | |
| Combined | x | x | | | | x | x | | |
| Yield | x | x | x | x | x | x | x | | x |

Total premiums subsidies of insurance lines applicable to winter crops amount to € 18 million in year 2001, which represents about 1.4% of the value of the insured crops. Subsidies range from 35 to 42 percent of the market rates for integral insurance and yield insurance respectively. These extremely large values data demonstrate that the Government policy aims to induce farmers to purchase insurance with the largest risk coverage.

Yield insurance is the latest addition to the choices – it was offered for the first time in 2000. Individual risk premiums for yield was developed by using historical records of individual farmers' yields. During drought years, the individual yields are adjusted according to the records of yield loss caused by drought (other hazards are also included in the database). Individual risk premiums and loss adjusting is possible because ENESA has kept and updated a database of 160,057 individual farmers, with 12 years of yield data.

The 20-year experience of insuring rainfed extensive crops has made a significant progress in facing drought risks in about 45% of all Spanish agricultural land. In addition, the cumulative results of years of R&D, ex-post evaluation and data collection and analysis, ensures that each farmer idiosyncratic risks can be evaluated, so that premiums can be tailored to each farmer at actuarially fair prices.

An indirect by-product of the insurance process is the research opportunities that ENESA's databases and experience offer to carry out risks analyses. Unfortunately, very little academic work has been conducted in this area. The evaluations carried out so far indicate that:

(i) Farmers tend to develop habits regarding their insurance strategies. The ones at greater risk tend to insure more often than those characterized as being expose to lesser risks.

(ii) Yields respond positively to higher than expected prices and to lower than expected price variance. As a result of this and the previous findings, price support mechanisms seem to provide clearer incentives to increase cereal yields than the various insurance policies available for Spanish cereal growers during the 1990 to 1998 seasons.

## Reactive plans: Actions at the Tagus Basin Authority

All relevant pro-active responses fall within the planning and administrative institutions. There are several examples that document the reactive actions taken during critical drought conditions with the aim of increasing water resources availability, such as new wells, conduit for water transfer, and desalination plants, or for reducing water losses in conveyance and distribution network. Here we document, as example, the actions taken in the Tagus River Basin that involved the agreement of four key stakeholders – two partners in MEDROPLAN project, the Canal de Isabel II (CYII) and the Tagus Basin Authority, a hydropower company (Unión Fenosa) and an association of irrigation farmers (Comunidad de Regantes del Alberche).

During 1991 to 1993, prolonged meteorological drought resulted in hydrological drought, and the regulated water storage systems that serve Madrid metropolitan area (over 5 million people) were under critical conditions. As response to the situation a number of emergency measures were taken. One of the actions was to establish an agreement to use water from the river Alberche for water supply in Madrid. An emergency work was constructed to link the source (San Juan Dam in the Alberche River) to the urban distribution system in Madrid. The water supply service provider for Madrid, CYII, did not hold a permit to use water from the Alberche for urban water supply in Madrid at that time. Water use priorities in the San Juan Dam were and continue to be, recreation and ecological services, and water in the Alberche River was legally allocated to hydropower and irrigation. The hydropower company was entitled to turbine freely while the water level at the San Juan reservoir was above a certain minimum required to satisfy the irrigation demand. Since there was a drought situation, water in the San Juan reservoir was below the minimum level for hydropower operation. The irrigation association of the Alberche River was affected by the decision to derive water for Madrid. The agreement among the irrigation association and CYII was reached after legally changing the priorities of water use in the San Juan Dam to allow for urban use in Madrid. In exchange for the loss of water rights, the irrigation association was given the right to irrigate with water from the nearby Tagus River. A pumping station was built to pump water from the Tagus River to the Alberche irrigation canal. The State Administration Tagus Basin Authority (CHT) paid for the facility, and CYII paid for the energy costs of the action. As a side effect, irrigators complained that water from the Tagus River had worse quality than that from the Alberche River and could contaminate the aquifer that was used for urban water supply to several municipalities. An existing water supply line, used for the nearby city Talavera, was used to supply water for three municipalities at risk of contamination. Eventually, all problems were solved, and water from the Alberche could finally reach Madrid, although the critical drought conditions were already over.

It is remarkable to note that, although this infrastructure was built under pressure due to the emergency conditions, it has been used ever since to supply water for Madrid. A legal action had to be taken to concede a permanent water use permit to CYII to divert the Alberche water. The negotiations involved the agreement with the hydropower company to establish an economic compensation for the loss of hydropower production, to be paid by CYII. This action highlights the implicit value of some of the emergency works during severe drought in the cases that drought is the detonating point to undertake a structural work that was necessary for the system. Nevertheless, structural works undertaken under emergency conditions often result in a higher total cost than if they were planned with sufficient time.

## Combination of reactive and pro-active plans: Programme for improving urban water use efficiency in Zaragoza

*Background.* The impact of drought in 1991-1995 in Spain stimulated Fundación Ecología y Desarrollo (FED), to develop a pilot project focused on improving urban water use efficiency. Spanish water use efficiency in cities has large possibilities for improvement as documented by the World

Water Council. FED launched a program of actions in Zaragoza (Zaragoza: The Water Saving City) that is outlined in Fig. 6.

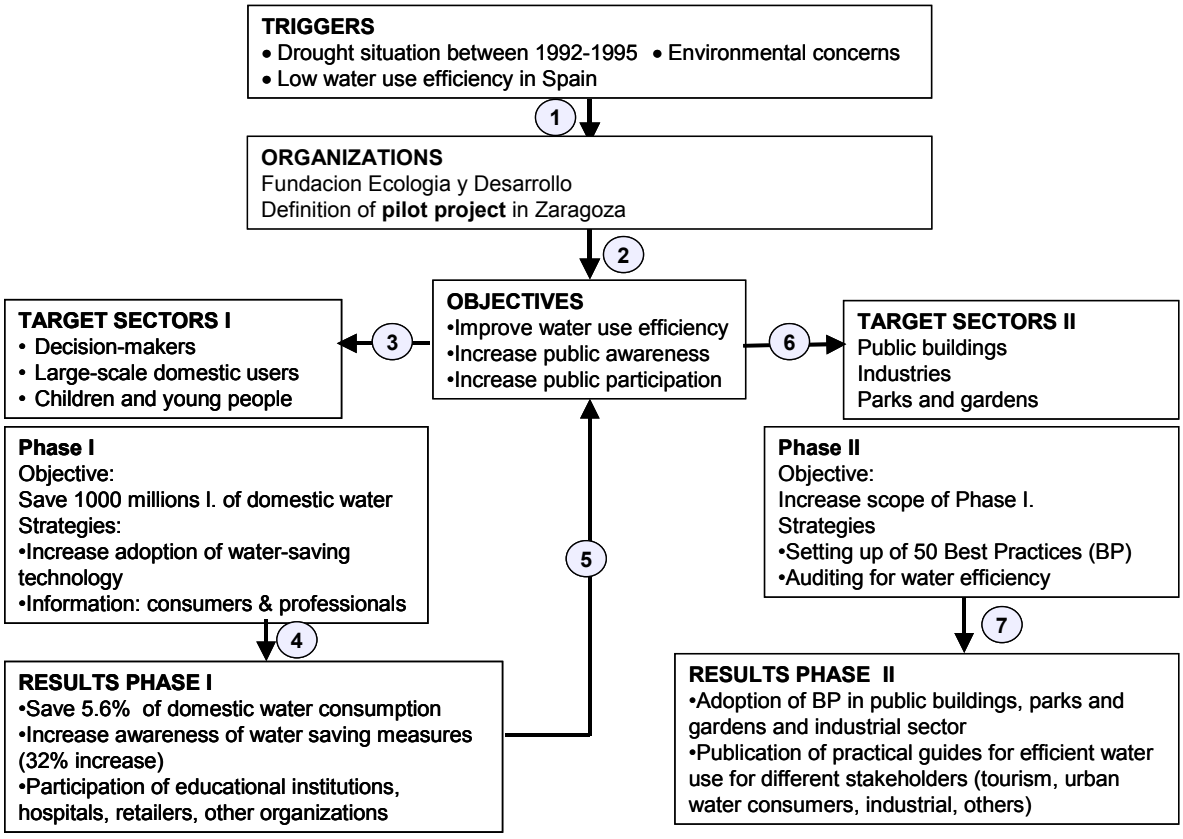


Fig. 6. Summary of the NGO Fundación Ecología y Desarrollo (FED) program to save water in the city of Zaragoza, Spain.

*Objective and strategies.* The main strategy was to save 1 million $m^3$ of domestic water per year. This objective was met by: (i) promoting demand for water-saving technology among consumers; (ii) stimulating water-saving technology markets; and (iii) training and informing professionals in this sector. Specific actions were directed to: (i) professionals linked to domestic water use (i.e. manufacturers, distributors, retailers, plumbers); (ii) large-scale domestic users (i.e. hotels, restaurants, gymnasiums, etc.); (iii) young people; and (iv) the general public. The program took place in parallel to other initiatives taken by the city, the Regional Government, the River Basin Authority, and the National Government.

*Results.* The results were positive and 1.176 million $m^3$ of water were saved (5.6% of annual domestic consumption). Water consumption decreased by 7 litres/person/day from 1996 to 1999 (106 to 99). The number of people aware of water-saving measures increased (from 40% to 72%). The participation in the project was large: 69% of educational centres; 65% of health care centres; and 150 diverse organizations that collaborated by disseminating information about water savings.

Although the results were positive, it was considered necessary to extend the scope of action of the project. A new objective was the development of 50 best practices for efficient water use in public buildings, industries, and parks and gardens. A program of free audits was created and implemented in voluntary centres willing to adopt the best practices guides. These pilot centres served and continue to serve as role model for others in the city.

In this second phase, the main results of the project include: (i) participation by 100% of the city's nurseries and garden centres; (ii) adoption of best practices in public buildings, in parks and gardens

and in the industrial sector; and (iii) publication of practical guides for efficient water use. These guides include: practical eco-audit guides for hotels, offices, industry, hospitals and educational institutions; practical guide to dryland gardening; and practical guide to water-saving technology for households and public services.

## Interviews to key stakeholders

Six key stakeholders have been interviewed to validate the mental model and to enhance the understanding of droughts and water scarcity problems in the country. This section includes an outline of the information provided by them relevant to model validation.

### Agricultural insurance

*Senior official of the National Entity of Agricultural Insurance (ENESA).*

ENESA is an autonomous body under the umbrella of the Ministry of Agriculture. The General Director of ENESA is also a member of the Permanent Office for Drought.

The interviewed expressed that meteorological and agricultural drought risks are perceived as identical. The Permanent Office for Drought meets when the signs of stress or difficulties arisen from meteorological droughts are perceived by affected groups. No particular index or set of indices of droughts are used to set off alarm signs or justified a call for a Permanent Office meeting. All members are senior officials of the Ministry of Agriculture.

In crisis situations, attention is focused on the agricultural sub-sectors with no agricultural insurance available that experience difficulties related to crop water stress or unavailability of animal drinking water. Alleviation measures include tax reductions or subsidies for wells construction for animal drinking.

The Permanent Office is also concerned with insurable production inasmuch financial support can be secured by advancing insurance indemnities payments, CAP subsides, and occasionally filing applications to the Finance Ministry to condone land taxes or social securities contributions.

### National Association of the Water Supply Companies

*Senior official of the National Association of Water Supply Companies (AEAS).*

The interviewed believes that water supply companies are to a great extent passive actors for most possible pro-active responses since they are severely constrained. A main constraint is that the companies are not responsible for reservoir management, therefore it is difficult, if not impossible, to take an active role in reducing water scarcity risks. An exception is the water company of Madrid (CYII, a partner in MEDROPLAN project), which has a protocol for both reactive and pro-active responses to water scarcity risks.

An additional constraint is the regulatory regime for local governments (Royal Decree 781/1986, of April 18) that limits the water companies in the scope of actions to obtain new tariffs approval based on the costs of implementing future contingency plans. A final constraint is the non-accumulative nature of technical efficiency improvements, from the abstraction point to the customer connection. As a result, improvements on the leakage ratio or the unaccounted losses have an incremental effect that cannot be accounted for in long-term planning, unless the reduced demands can be maintained and projected in the future. Therefore improvement of technical efficiencies, demand management and other measures taken by water companies, may not be as effective to reduce water scarcity risks.

In contrast, the interviewed expressed that water companies have a role in reactive planning and must also coordinate actions and initiatives with the basin authorities and local governments. Contingency plans and stable agreements (i.e. for water allowances exchange) are perceived as

critical elements for effective performance in case of drought. Nonetheless, market arrangements for sharing water use rights must be agreed through negotiations, with the mediation of the basin authority.

## Water supply system

*Senior official of the Canal de Isabel II (CYII, Madrid).*

The CYII is responsible for water supply to 5 million people and is the most important user of the water in the Tagus River Basin. The company has a comprehensive Manual of Water Supply. The manual has had significant public relevance and its aim is to provide rational arguments and rigorous risk analysis of actions before, during or after water scarcity situations. By rationalizing all processes and strategies, the company seeks to shelter itself from mismanaged allegations and uninformed public scrutiny.

*Drought versus water scarcity.* The main concern of CYII is the frequency or probability associated with each level of insufficient supply to meet water demands. In the view of the interviewed, droughts cannot be controlled, but water scarcity can be controlled to a certain extent. The CYII does not establish priorities among users during water scarcity, reflecting a political choice of free decision of the users. The Manual provides a special water levy for water scarcity situations, and it is systematically used in operations with preventive character. In real situations, water scarcity affects the environment and agriculture in the first place.

*Integration in the decision process at the basin level.* The water company has a prevalent position within the River Basin Authority (Tagus) and an influential role among other competing users.

*Short and long term planning and management.* Drought policies are included in long term planning, but are also dependent of the short term (i.e. operational) planning. In the long term, planning for scarcity consists of defining scenarios, evaluating probabilities and identifying effects and strategies, and in general these actions are not influenced by political or media pressures. Sources of uncertainty for future planning arise from the uncertainty of the climate patterns, land and urban development and changing demand factors, such as seasonality or consumption patterns. The main challenge is to maintain current reliability levels, despite the significant changes appearing from demographic and socio-cultural change (i.e. expansion to the peri-urban space, and single family homes).

*Water scarcity prevention measures.* The measures include: (i) water metering; (ii) full cost recovery rates; (iii) demand management; and (iv) water right exchanges with irrigators, making use of the provisions of the 1999 WL amendment. The CYII considers that the water rights are sufficiently clear and envisions purchasing water rights currently in the hands of irrigators, as one possible strategy to meet moderate risks of water scarcity.

*Economic instruments.* Economic instruments are viewed as a main tool for implementing measures. Reasonable expectations are based on market allocation mechanisms, by which water companies can acquire permanently or temporarily use rights currently in the hand of the farmers. If these measures result in cost increases, the company would pass them on to its final consumer.

## Tagus River Basin Authority

*Senior official of the Tagus River Basin Authority.*

The River Tagus 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).

*Drought and water scarcity.* Drought is viewed as a situation in which available resources are insufficient to meet regular demands, or when tensions arise attempting to meet the system's demands. Meteorological droughts are considered secondary events, as they affect soil moisture and runoff coefficients. As a result meteorological droughts increase the left tails of the probability distribution of runoffs as they feed the systems reservoirs.

*Planning process.* Basin authorities take decisions in collective bodies, although the executive responsibility is held by the Chairman of the Basin's Authority. Reservoir Release Commissions are responsible for the continuous management of reservoirs. Under severe scarcity conditions, a Permanent Committee is appointed to manage the situation. As in any other river basin authority, the planning process is exposed to public scrutiny. Concerned individuals and social or political groups can make allegations that affect the planners' decisions.

*Drought mitigation measures.* The measures considered take into account all economic and social costs, at the regional and local levels. At the present time, the exchange of water rights may not be the most adequate strategy in many areas of the Basin. The main impediment is that some water right holders do not exhaust their current rights, and therefore if they are offered an interesting price, they will sell their rights to buyers who would put the purchased waters into use, deteriorating the Basin's water balance. Some of the current water concessions could be revised and reduced if evidence of under-utilization is found.

*Data for risk analysis.* A fundamental issue that determines the actions related to risk management in a large basin arises from the available data series. In general data series are too short to consider accurately extreme events, such as droughts or floods. This may partially solved by the use of synthetic series.

*Analysis of reliability.* At the planning level, the Basin Authority is developing reliability indices that result from simulation models that impose alternative constraints and find optimal solutions at minimum costs. This work is challenged by: (i) changing definitions of ecological flows; (ii) new evidences on runoff trends; and (iii) political pressures that pose limiting constraints on water plans.

*Current pressures and sources of uncertainty for the future.*

(i) Urban growth in the metropolitan area of Madrid is perhaps the most challenging issue for the basin. A resulting effect of this growth is that regulated return flows have increased significantly and many basin tributaries are dependent on the treated effluents of the city.

(ii) Water quality deterioration as a result of reservoir eutrophication.

(iii) Hydropower and cooling services are important demands in the Basin that must harmonize with the remaining uses.

(iv) Groundwater use is not fully controlled. For instance, the CYII's plans to tap aquifers in times of moderate scarcity situations have not been endorsed by the Basin Authority.

## Ebro River Basin Authority

*Senior official of the Ebro River Basin.*

The Ebro Basin provides in general sufficient water for its users, although conflicts are manifested in certain years and/or locations. Nevertheless, the basin includes several areas of endemic drought where supply is not enough and others where there is a recurrent problem but not endemic. Eighty percent of the water use is for irrigation and the future of it is linked to the future water scenarios and CAP of the European Union.

*Planning process.* The legal framework is complete. However, the Basin Authority may benefit from a fuller capacity of decision during crisis situations. At the present time the basin authorities depend on the Council of Ministries for drought declaration and water rights revisions.

*Drought and drought planning.* It is important to highlight that planning for drought should be performed during non-crisis times. Drought impacts appear in the Basin under certain conditions. When irrigation supply is below 90%, conflict among users in the Basin arises. This may even give rise to additional conflicts between users of other basins if inter-basin water exchanges occur. Full cost recovery in the farming community cannot assume the cost of improved irrigation structures, part of these costs may have to be assumed by the State if they are recognized as positive for Basin's conditions and for other users along the Basin.

*Water scarcity management.* Information, water allocation and allocation of priorities are essential components of adequate management.

(i) Information. The data provided by the extensive data system SAIH (Automatic System of Hydrological Information) in real time and water extractions metering are an essential tool in the planning process. Spain is a pilot experiment for the use of these data. Agricultural water use data are provided by farmers willing to collaborate; at the moment 15 irrigation districts already engaged in an experiment that monitors real time data on agricultural water use. The Ebro River Basin Authority provides these data on-line.

(ii) Participation. Participation is consolidated in the Management Board. The meetings of the Board have incorporated a large number of stakeholders to conciliate interests. The pilot projects with farmers have shown positive results.

(iii) Priorities in water allocation. These priorities should be, as established in the WL, for domestic water supply. In many cases conflicts arise with water permits of the farmers. In case of crisis, it is necessary to agree on economic compensations to the water rights holders in exchange for their rights. In general this was not necessary in the Ebro Basin as stakeholders reach agreement without compensations. In the agricultural sector the priority is irrigation of orchards since the lack of water causes long term effects.

## Non Governmental Organization

*Representative of the Fundación Ecología y Desarrollo (FED, Zaragoza).*

The interviewed considers drought a recurrent process that depends mainly on management actions. In his view, man can anticipate drought and be prepared to minimize its impacts. The identified roles of NGO's in water management are: (i) to mobilize and rise awareness; and (ii) to force Public Administrations to introduce some topics in the political agenda that otherwise will not be attended. Through these actions, the FED has contributed to raise awareness in society of the need of rational water use together with implementation of actions targeted to reduce consumption using best available technology. The program started in a pilot experience in households, and has expanded to the commercial sector. At present, the actions include "eco-auditing".

The FED has introduced and developed a set of ideas for improving water management, including:

(i) Demand management versus supply management.

(ii) Modifications in the current legal framework to increase flexibility at crisis time (i.e. revision of water permits) and establishment of different crisis levels with measures target to each level.

(iii) Increased participation in the River Basin Authority, since environmentalists, consumers, neighbourhood associations are currently under-represented.

(iv) Include better water management in the political agenda by increasing efficiency in the system

(i.e. reforms in the sewage system, water metering, etc.), and by incorporating anticipatory measures (i.e. pro-active management).

(v) Promote cultural changes that will result in water use reductions (i.e. Mediterranean gardens with lower water consumption plants).

## Model structure validation

### Stakeholder participation

The results of the interviews with the stakeholders were used to validate and revise the mental model. The project partners in Spain are stakeholders directly affected and involved, such as the Tagus Water Basin Authority, that is a local water authority, the CYII, a water supplier, the Polytechnic University of Madrid, a research and training institution, and the FED, a NGO.

### Meteorological and agricultural droughts

The mapping for reactive responses shows that triggers originate from widespread and diffused signs that reach the Ministry of Agriculture. The call of a meeting of the Permanent Office for Drought is the origin of all reactive responses for drought alleviation. However, the types of signs and collected evidence are based on costs, damages, and difficulties, as they are already occurring across the agricultural regions.

By limiting their attention to non-insured risks, the Permanent Office assumes that insured risks do not deserve concern. The implication is that the drought effects that go beyond the farm gate are properly handled by agricultural markets, both of inputs and outputs. As a result of this, the spanning chain of effects that droughts create in related industries and perhaps in the urban areas is mostly disregarded. As a result, the whole family of indirect effects beyond the farm gate is left unattended in the institutional mappings.

Consider of a severe drought, and the supply reductions of many basic commodities. Eventually, consumer prices will start rising, affecting the Consumer Prices Index and the economy as a whole. This example, and many others that could be thought of, illustrates the reductionist concerns of the competences of the Permanent Office.

Some of the consequences resulting from this view are:

(i) That drought indirect effects are not considered, nor corrected.

(ii) Many vulnerable farms do not purchase insurance.

(iii) Risks associated with water supply could also be insured against, provided they are based on natural and objectively measurable indices, such as runoffs or precipitation indices.

(iv) While the agricultural insurance system is quite complete and innovative, some of the policies that are based on satellites images, such as the pastures drought insurance, are purchased by a very limited number of farmers.

The above points indicate that there are significant gaps both in terms of geographical scope and in the number drought vulnerable sectors and productive activities that may not receive sufficient attention.

### Hydrological droughts and water scarcity

Groundwater resources, as a strategic supply source, is not sufficiently controlled and valued. It is

also a source of conflicting views among basin agencies and water suppliers that rely on them for very specific situations.

At the basin levels, contingency planning is still in very early and immature stages.

The development and revision of basin hydrological plans are slow processes, constrained by legal formalities, and some data or results may become outdated in the process. In addition, the plans will have to be amended to comply with the EU Water Framework Directive, especially with the new notions enshrined in this European legislation.

Water quality deterioration is threatening the regulation capacity of eutrophic reservoirs to service urban customers. This reflects that proactive measures should include water quality issues in order to preserve the adequacy of current water supply sources.

Although users' and public participation is secured within the various bodies of the basin authorities, risk analyses performed by executive bodies may encroach the rights of the lowest value users.

Public awareness of the value of secure water sources at the basin level is extremely limited. While most users across the basin are largely dependent on the basin authority reactive and pro-active plans, the general public may disregard this fact and assume that their water supply security is managed by the retailer that service the water. This is the most uncommon case, except for the urban water supply to Madrid.

The water market and exchanging options, as envisioned in the WL, is perhaps too naïve to facilitate the kinds of agreements that water companies are interested in reaching with the irrigation sector. In particular, sharing mechanisms that are based on objectively measurable conditions may have a more promising future than the rights lease-out contracts that are defined in the law.

With reference to the previous point, water companies are demanding legal security and enforceable long-term contracts with irrigators. These will significantly reduce the negotiation costs that impede and retard lease-out contracts sometimes needed urgently.

## Strengths and weaknesses of the institutions

In this section we identify the strengths and weaknesses of the institutional mappings that have been described in the section "Institutions involved in water and drought management", contrasted by personal interviews and validated in our discussion in the section on map linking the institutions. The section is organized in coherence with our previous structure, focusing first on agricultural and meteorological droughts, and then on hydrological droughts and water scarcity risks.

### Meteorological and agricultural droughts

The main *strengths* of the Spanish institutional framework that stand out from the above analyses are:

(i) The Spanish agricultural insurance system has solid bases, and grows year by year expanding its coverage and new premiums specifically targeted to cover drought risks. This has given rise to an important capital of knowledge regarding site-specific drought risks and the development of premiums individually tailored to all eligible farmers.

(ii) In some rainfed crops, such as cereals, olive trees and other field crops grown, farmers can elect from a wide menu of insurance premiums, that cover an increasingly range of risks from fire and hailstorms all the way to yield losses caused by any natural event.

(iii) In addition to the well-developed and dynamic agricultural insurance system, there exists a Permanent Office with clear missions and means to address stressful situations caused by droughts and other climatic and environmental hazards. The Permanent Office members are appointed in

advance, and its president can call for a meeting whenever signs of stress are received. All Permanent Office members are senior officials of the Ministry of Agriculture, and are likely to be especially receptive to agricultural strains. The Office's attention is primarily focused on the agricultural sub-sectors and farmers which are not eligible for any of the agricultural insurance premiums.

The main *weaknesses* are the following:

(i) The combination of all eligible productions for insurance and the non-insurable areas or production is far from complete. In some products and production systems, the subscription rates are below 20%. This includes premiums for pastures, olive trees and vineyards which in total make up more than 4 million hectares. The fact the Permanent Office does not address drought hazards as they affect insurable production results in significant area and sector gaps, which the present institutional framework does not cover.

(ii) Fundamental problems hinder the prospects for higher subscription insurance rates. This is because many agricultural areas are subject to significant risks, which the insurance system can cover only with unaffordable premium rates for the farmers. This is not going to be solved by the insurance system, and does not seem to be properly addressed either by the Permanent Office's services.

(iii) The Permanent Office's primary attentions do not go beyond the agricultural sectors, nor does it pay attention to indirect effects of the vulnerable agricultural sectors. This implies that non-agricultural effects are basically disregarded and left to be attended by other income-smoothing and counter-cyclical instruments such as the tax and social security systems.

(iv) The Permanent Office does not use currently drought indicators or any other scientific objective indices to call for crisis situations.

(v) As a risk reducing strategy, insuring irrigated crops is presently disregarded on the basis of potential moral hazard and adverse selection problems. While there are unquestionable difficulties in developing insurance premiums that are based on human-made decisions, such as water allocation among sectors and crops, index rates could be developed that are based on runoffs or other fully natural events/variables. This possibility is fully disregarded, though does not differ dramatically from other policies that are already in the market, such as pastures insurance based on indices computed from satellite images.

## Hydrological droughts and water scarcity risks

The main *strengths* of the Spanish institutional setting are:

(i) Basin agencies are experienced organizations in managing basins' water resources. They have adopted modern technologies to monitor all systems in real time and are capable of collecting and processing hydrological data and analyse it for risk analyses and projects' evaluations.

(ii) Basin agencies, albeit public institutions, encompass by statute all users, governmental branches and stakeholders in all decision bodies both for pro-active and reactive responses. It is customary to favour their active participation and influence most decisions in planning and managing tasks.

(iii) Entities responsible of retailing water to final customers participate actively in the basin agencies' decisions and have seats in their planning and executive bodies. In times of scarcity, water is assigned through collective decisions taking into account the priorities enshrined in the approved hydrological plans or, by default, as the WL dictates. The allocation process is transparent, at least with regards to the most immediate consequences as they result in costs and benefits accruing on water right holders.

(iv) The Spanish WL is modern, well adapted to the country's water conditions, and fairly well

enforced in most basins for surface resources. The 1999 Law Amendment foresees water rights lease-out contracts and water banking schemes, as a means to mobilize valuable resources to be made available for demanding agents through voluntary responses.

(v) Planning documents both at basins' and national levels are legally approved, detailing priorities, specific plans, works and actions. These plans have gone through multi-layered consultation processes, and been subject to very thorough scrutiny by the political parties, various administrations, the general public, the media and the scientific community.

(vi) As a legal mandate, basin agencies must develop contingency plans for drought situations and develop strategic plans for cities with 20,000 population or larger.

(vii) Lessons drawn during recent drought experiences have been incorporated and used to shift the focus on pro-active responses and preparedness capacity. The Madrid water company is currently in its second generation "strategic contingent planning" and has specific staff devoted to these tasks working on risk analyses.

Some of the main *weaknesses* of the institutional framework to face hydrological droughts and water scarcity are the following:

(i) Although the planning documents described above result from intense consultations, scrutiny and analyses, they may lack the flexibility to be amended to accommodate social, environmental and economic trends. In particular, the planning concept and the programmes of measures as they are conceived in the EU Water Framework Directive represent a significant departure from the traditional planning techniques as they have been practiced by basin agencies in the past. Among the most significant difference is perhaps the focus on the 'ecological status of the heavily modified water bodies', and how restoring the ecological water quality is integrated in the planning strategies.

(ii) While basin agencies, in coordination with the Environment Ministry, are adapting their methodologies, objectives and constraints at a reasonable speed, the needed changes are far from simple and direct. So it remains to be seen how Spanish basins manage to comply with these new challenges.

(iii) The WL enforcement levels show a number of grey areas, particularly in the area of groundwater resources. Although key water suppliers internalize them as key strategic supply sources, the basin agencies are in charge of managing and controlling its use and exploitation regimes. Inconsistencies in these areas have been identified, showing that much more is needed to protect these key resources and secure accessibility when they are urgently needed.

(iv) The steps taken to let economic incentives allocate scarce resources during stressful situations are laid down in the Law, yet they have to be put into practice under real conditions. In particular, while these market arrangements to mobilize water resources and transfer them to highly valued uses are recognized by urban suppliers as promising, at the basin agencies level there is much more scepticism. This gives rise to some inconsistencies between the drafters of the 1999 Law Amendment, the expectations of some of the active parts of these market agreements, and the reluctance and reserves expressed by those basin agencies' officials, who act as notaries and controllers of such agreements.

(v) Water quality problems endanger strategic resources and threaten the quality of high water quality sources. These problems evolve slowly and silently, but are not properly framed in the menu of pro-active measures.

(vi) Emergency actions, mainly in the form of works approved and built under urgent conditions, often take much larger costs and efforts than would be the case had they been planned for regular time frames. Occasionally, these works become operative when scarcity is no longer a problem, although they are certainly available for subsequent drought periods.

## Conclusions

Drought is a recurrent characteristic of Spanish climate and drought impacts and conflicts derived

from water scarcity, are considered by all relevant stakeholders. Historically, the urban, cultural, and agricultural development in Spain has demonstrated a profound knowledge of adaptation strategies to drought, water scarcity, and precipitation variability. It is difficult to know how efficient are the institutions for incorporating drought preparedness in the cases that drought did not cause major negative impacts due to institutional planning strategies. In contrast it is easy to document the environmental and social costs of impacts of drought periods that could not be avoided by planning strategies. The overall conclusion is that the Spanish institutions and organizations have the instruments, legislation, and structures to manage drought.

Despite the adequate framework of the Spanish institutions to manage drought, the system has not completely internalized drought risks or water scarcity in a scientific and rigorous way. This prevents from presenting risks objectively, dealing with them in more systematic and scientific manners, considering pro-active and reactive ways. It is significant, that one of the aims for CYII for developing the Drought Manual (1st generation) and Supply Manual (2nd generation) is to provide objective and scientific guidelines to avoid controversy during drought situations (Cubillo and Ibáñez, 2003).

The scientific consideration of drought risks has been established in the Law of the NHP, within the realm of agricultural and hydrological droughts. Nevertheless, there is room for improvement on the risk analysis within the contingency plans of the hydrological basins. Future adaptation options of the basin institutional framework to the requirements of planning based on risks analysis and strategies design, rather than work based plans, remain a challenge for the future.

The systems for right-use exchanges acknowledged in the Law present possibilities for improving water and risks reallocation. However, the law does not fully exploit all the current possibilities to manage water resources allocation under uncertainty. This would require a greater flexibility in rights transmission by allowing a segmentation of such rights, which would enable only the transmission of some use-related attributes, especially those with an impact on the risk assumed by the users.

Although agricultural insurance systems are quite universal and mature, there are still large gaps of land and productive orientations that will hardly be insured due to the high risks they face, and the consequently high premiums costs. The Permanent Office for Drought does not have diagnosis capacity or competences to study risks associated to these specific territories and groups and develop pro-active policies. In the current situation, reactive responses only exist for non-insurable groups. However, the existing pro-active responses are not completely successful as many insurable farmers do not submit to insurance, and somehow responsibility of drought impacts tend to be delegated on farmers in this case. Thus, neither pro-active nor reactive responses are complete in territory and vulnerability coverage.

## References

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