

Xerochore Final Conference on  
**Supporting Drought Policies in Europe**  
Brussels, 23-24 February 2010



## European perspectives on drought preparedness and management: the Italian experience and proposed planning tools

Rossi G., Bonaccorso B., Nicolosi V.,  
Castiglione L., Cancelliere A.



*Department of Civil and Environmental Engineering  
University of Catania*

---

---

# Outline of the presentation

- Remarks on Proactive vs. Reactive approach
  - Limits of the WFD
  - Proposal of WS&DEN
  - Italian experiences in coping with droughts
  - Proposal for a drought planning framework
  - Conclusions
-

# Introduction

- The severity of drought impacts depends on the vulnerability of water supply systems and of the economical and social sectors, as well as on the effectiveness of the adopted mitigation measures
- A **reactive** approach, based on emergency measures selected after drought consequences are perceived, is inadequate and should be replaced by a **proactive** approach

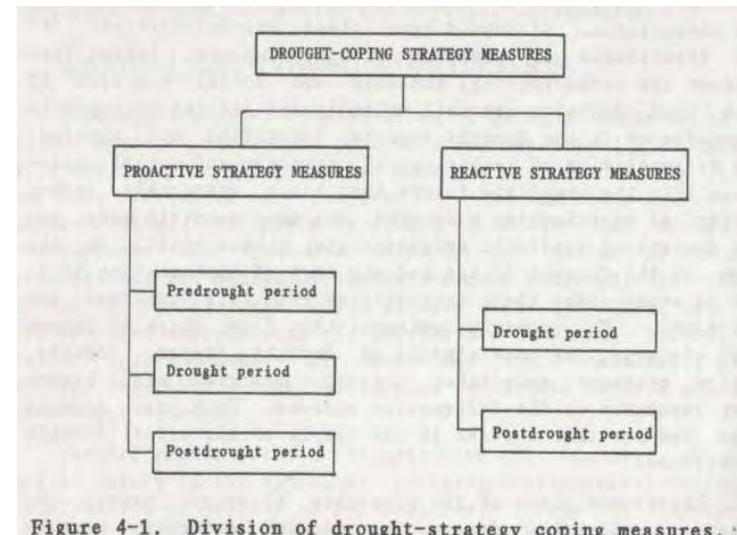
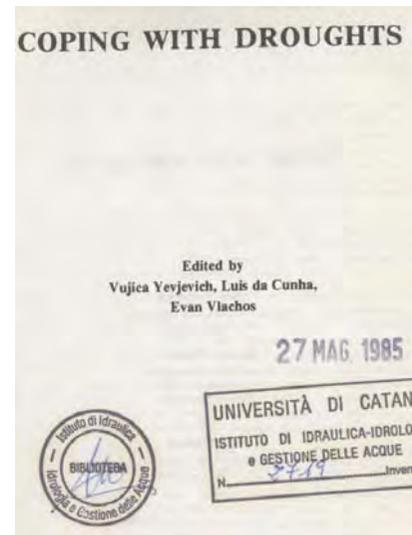


Figure 4-1. Division of drought-strategy coping measures.

---

# WFD and droughts

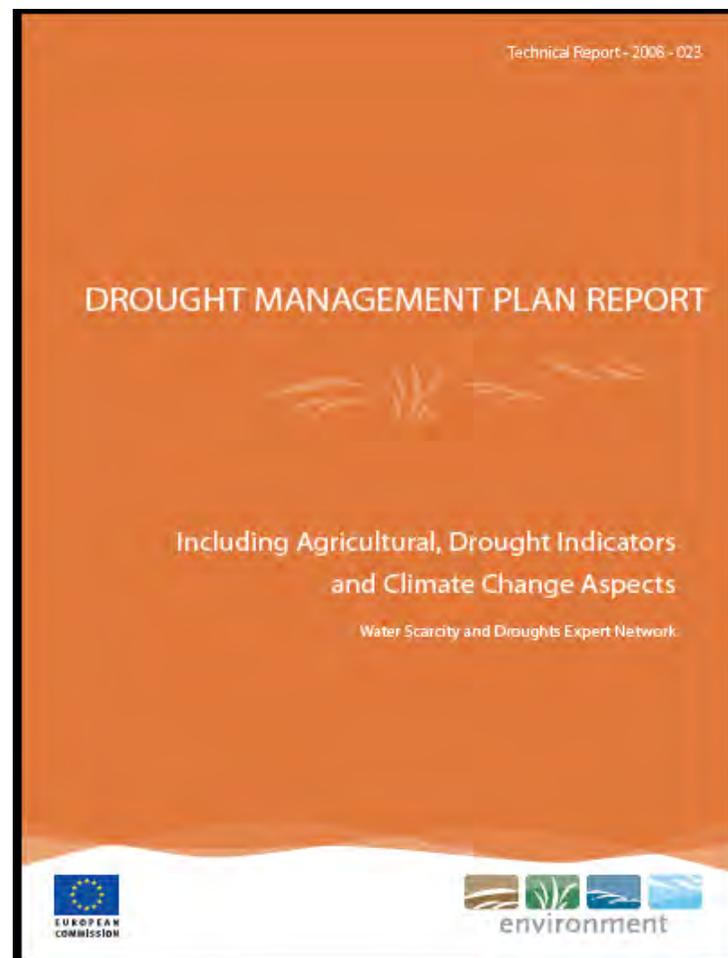
- WFD lists among its objectives mitigation of floods and droughts (art. 1) and lists **demand management measures** among the supplementary measures that can be adopted within the programme of measures of the RBMPs (Annex VI, Part B)
  - However, droughts are addressed only marginally
    - “prolonged droughts” are considered as “force majeure” events that enable temporary derogations to environmental prescriptions in terms of delay or less stringent quality objectives (article 4.6)
  - Risk of droughts is not addressed, water shortage definition is lacking and prevention measures for droughts and water scarcity are missing
-

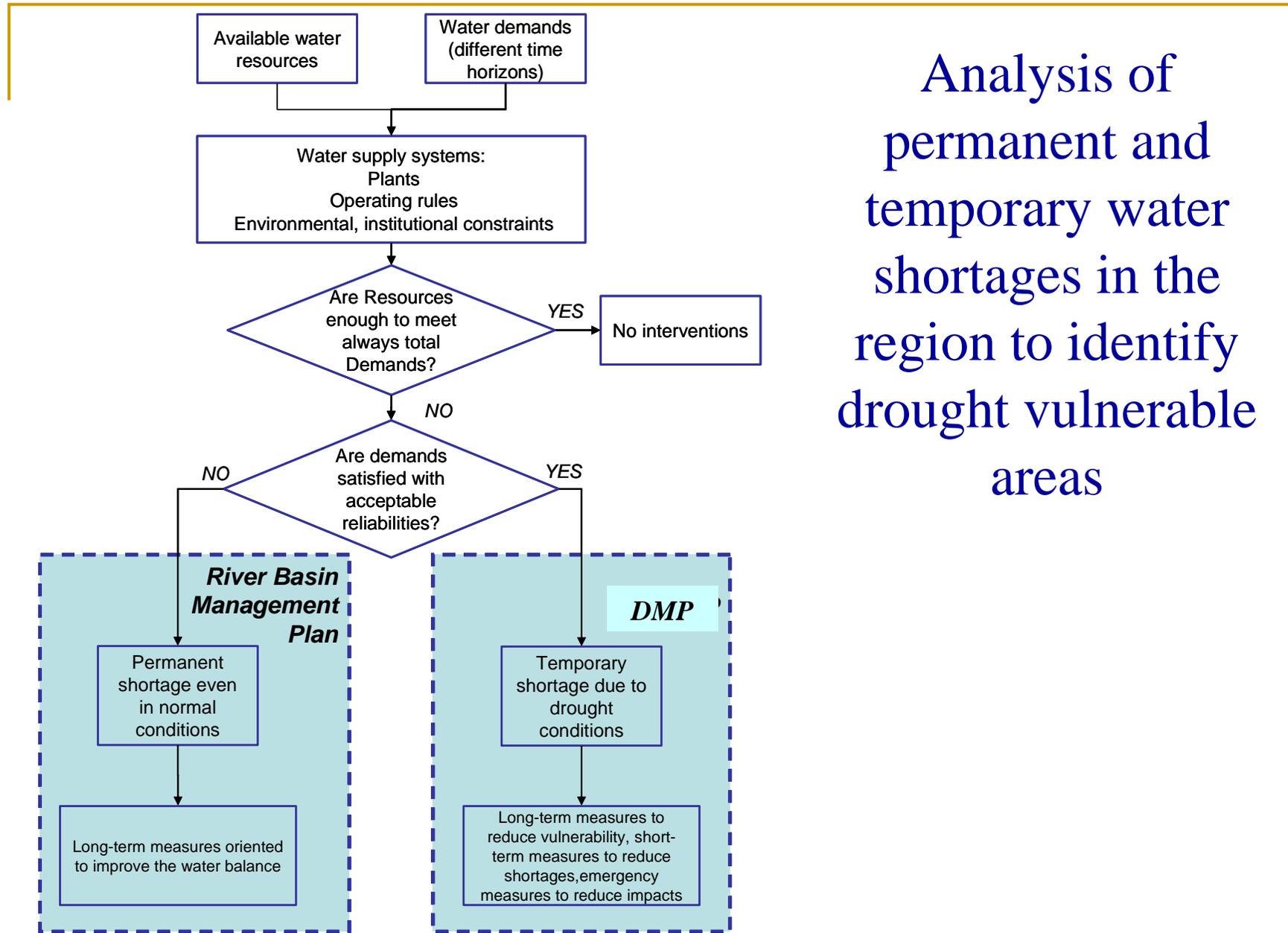
# Drought and water scarcity issues at European level

- Technical tools are missing with respect to:
  - Adequate water stress monitoring indices
  - Identification of areas at risk of drought and water scarcity
  - Assessment of the effect of measures (e.g. water saving, water reuse, desalination)
  - Organization of initiative to foster public awareness
  
- Financial tools are not adequate since:
  - Financial aids encourage water demanding crops in areas suffering water stress
  - Funds allocation is not at basin or district scale
  - Civil protection funds give more emphasis to flood damages
  
- At legislative level, tools are missing with reference to:
  - Standards for non conventional water use (e.g. treated wastewater)
  - Specific regulations for water resources management
  - Water saving for all water uses (municipal, irrigation, industrial)

# Water Scarcity and Droughts Expert Network

- The **Water Scarcity and Droughts Expert Network** has drafted a **Drought Management Plan Report** which recommends to include in the implementation process of WFD the preparation of a **drought management plan (DMP) as an annex to the River Basin Management Plan (RBMP)**
- The essential elements of such DMP should be:
  - Implementation of drought warning system
  - Drought characterization within the basin
  - Program of measures for preventing and mitigating droughts linked to indicators and thresholds
- DMPs should be developed according to a multi-level approach:
  - National level: strategic measures but also emergency measures that can be activated through a set of global indices and indicators, (e.g. to activate declaration of calamity)
  - River-basin level: tactical measures to delay and/or mitigate drought effects
  - Local level: tactical and response measures to guarantee essential public water supply as well as measures to increase awareness.
- A specific section should be dedicated to “prolonged droughts” (WFD, article 4.6), including indicators to be considered for the identification of PDs.





# Analysis of permanent and temporary water shortages in the region to identify drought vulnerable areas

# Italian experiences

- Although a specific legislative framework to cope with droughts is missing, drought and water shortages problems are addressed in several laws and decrees which, however, lack of homogeneity in terms of:
  - Territorial unit for implementation
  - Agency or authority in charge of implementation
- As a consequence, a reactive approach to drought is still prevailing, although recently a common awareness about the need to shift to a proactive approach is increasing as shown by some positive experiences



## Italian legislative indications for preventing and mitigating drought impacts

Legislative Act	Technical Tool	Measures	Territorial Unit	Status of implementation	L. Decree 152/06
L. 183/89	River basin plan (RBP)	Long-term measures to improve drought preparedness	River basin	Drought risk is not taken into account explicitly	RBP should indicate interventions against drought risk and measures against desertification (art. 65)
L. 225/92	Drought contingency plan (DCP)	Short-term measures to reduce drought impacts	Region or Province	Drought risk is not included	-
L. 36/94 and DPCM 4/3/96	OTU plan Identification of areas at risk of water crisis	Long-term and short-term measures	Optimal territorial unit (OTU) for integrated urban water service	Identification of areas at risk of water crisis is not included	-
L. Decree 152/99 and CIPE resolution 21.12.99	Water Quality Protection Plan (WQPP) Identification of areas vulnerable to drought and desertification	Long-term measures to combat drought and desertification	Region	Identification of areas vulnerable to drought and desertification is included in few Water Protection Plans	Drought mitigation (art. 73) and identification of drought and desertification prone areas within WQPP (art. 93)

Rossi et al. (2007)

# Recent droughts in Italy

- Severe droughts in the past (e.g. 1988-90 Sicily, 2001-2002 Apulia and Basilicata, 2002-2003 Sicily, 2005 Po River Basin)
- Prevalent approach → **reactive**
  - Sicily 1988-1990: **contingency measures implemented by Civil Protection to ensure municipal supply** (mainly structural measures)
  - Apulia and Basilicata 2005: **Appointment of Commissioners for Water Emergency** to draft a programme of actions to face water shortage situations, to foster the realization of hydraulic works for improving withdrawal, conveyance and distribution networks

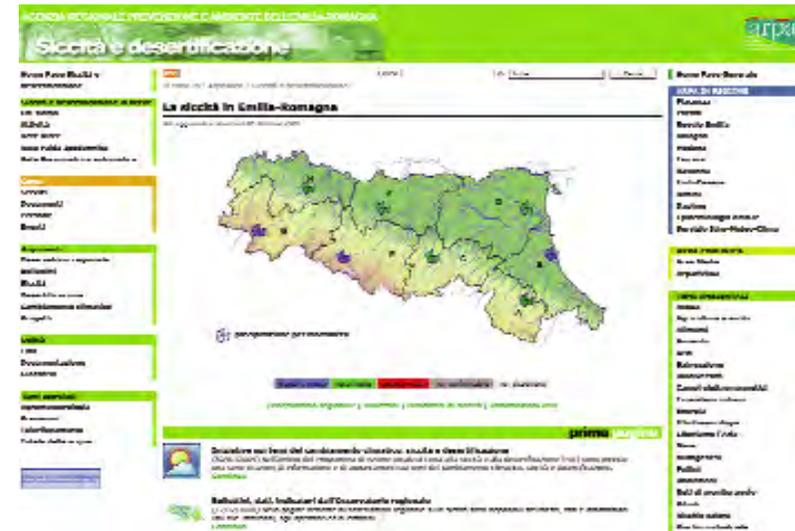
Table 8. Civil Protection Acts during 1987-90 period of water emergency in Sicily, Italy (from Barbagallo et al., 1994)

Type of intervention	Area of intervention	Amount (millions Euro)	% of amount
Surface reservoirs	Scanzano (Pa)	5.84	18.4
	Poma (Pa)	16.85	
	Blufi (PA)	92.96	
Links between surface reservoirs	Garcia-Poma (Pa)	11.88	3.0
	Piana Albanesi-Risalaimi (Pa)	7.02	
Desalination plants	Trapani	88.31	19.8
	Gela (5° modulo)	36.15	
Purification plants	Voltano (Ag)	1.55	0.8
	Leone, Voltano and Castello (Ag)	3.31	
Conveyance aqueducts	Municipalities of Palermo province	19.37	49.1
	Municipalities of Trapani province	25.53	
	Municipalities of Caltanissetta province	96.58	
	Municipalities of Agrigento province	39.56	
	Municipalities of Catania province	73.50	
	Municipalities of Enna, Caltanissetta, Catania	54.02	
Distribution networks	Municipalities of Palermo province	7.57	8.9
	Municipalities of Trapani province	2.47	
	Municipalities of Agrigento province	38.73	
	Municipalities of Caltanissetta province	5.76	
	Municipalities of Catania province	1.55	
Total		628.54	100



# Promising Italian experiences

- **Emilia Romagna region**
  - areas vulnerable to drought and desertification have been identified within the regional Water Quality Protection Plan, also based on the spatial distribution of a drought index, namely the Standardized Precipitation Index
  - Four categories of actions have been defined: a) Soil protection; b) Sustainable water resources management; c) Impact reduction of productive activities d) Improved territorial planning
  - The regional government is finalizing a “Drought Management Program”, covering aspects related to monitoring, risk evaluation and mitigation actions for areas threatened by drought
- **Po River Basin**
  - on June 2005 a formal preliminary agreement was signed with all the institutions involved in water resources issues, in order to:
    - define common indicators of water resources status
    - to assess the water balance



AUTORITÀ DI BACINO DEL FIUME PO  
P A R M A

## PROTOCOLLO D'INTESA

ATTIVITA' UNITARIA CONOSCITIVA E DI CONTROLLO DEL  
BILANCIO IDRICO VOLTA ALLA PREVENZIONE DEGLI  
EVENTI DI MAGRA ECCEZIONALE NEL BACINO  
IDROGRAFICO DEL FIUME PO

STIPULATO TRA

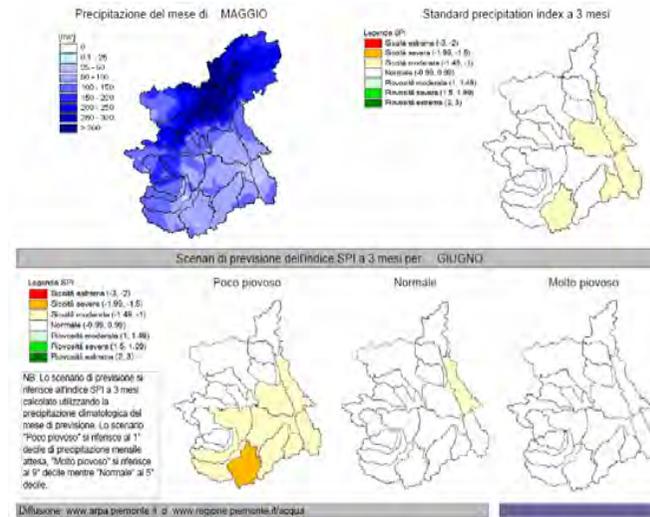
- AUTORITA' DI BACINO DEL FIUME PO
- REGISTRO ITALIANO DIGHE
- REGIONE EMILIA ROMAGNA
- REGIONE LIGURIA
- REGIONE LOMBARDIA
- REGIONE PIEMONTE
- REGIONE VALLE D'AOSTA
- REGIONE VENETO
- PROVINCIA AUTONOMA DI TRENTO
- GESTORE DELLA RETE DI TRASMISSIONE NAZIONALE (GRTN)
- ENTI REGOLATORI DEI LAGHI: CONSORZI E AGENZIA INTERREGIONALE PER IL PO
- ASSOCIAZIONE NAZIONALE BONIFICHE E IRRIGAZIONI (ANBI)
- AZIENDE DI PRODUZIONE DI ENERGIA IDROELETTRICA

# Example of drought bulletin: ISPRA (formerly APAT)

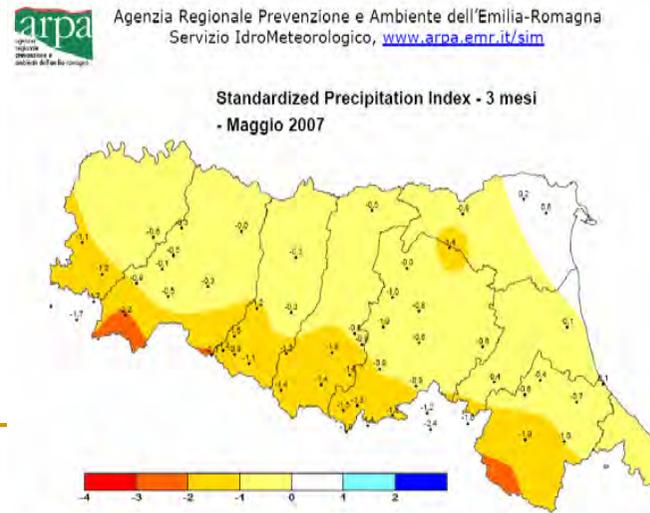
The image shows two screenshots of the APAT website. The top screenshot displays the main page for the 'Bollettino Siccità' (Drought Bulletin). The page features a navigation menu on the left with options like 'Previsioni QBOLAM', 'Metogrammi', 'ECHWF', 'Sistema Idro-Meteo-Mare', and 'Bollettino siccità'. The main content area includes a 'Seleziona l'anno' button and a paragraph explaining the bulletin's purpose: 'Questo bollettino si propone al pubblico come strumento per il monitoraggio quantitativo delle condizioni di siccità in Italia ed in Europa, visualizzate per mezzo di mappe, aggiornate mensilmente, dello Standardized Precipitation Index, un indice climatologico comunemente usato per la quantificazione della relativa scarsità o abbondanza di precipitazioni.' Below this, there is a section titled 'In sintesi...' and a list of four types of drought: meteorological, hydrological, agricultural, and socio-economic. The bottom screenshot shows a specific bulletin for August 2007, titled 'Bollettino Siccità - 08/2007'. It features four maps of Italy, each representing a different Standardized Precipitation Index (SPI) scale: SPI 3 mesi, SPI 6 mesi, SPI 12 mesi, and SPI 24 mesi. Each map uses a color scale from green (normal) to red (drought) to indicate the severity of the drought conditions across the country.

# Examples of Regional Drought Bullettins

## ARPA Piemonte (www.arpa.piemonte.it)



## ARPA Emilia Romagna (www.arpa.emr.it/ia\_siccita)



# Examples of Regional Drought Bulletins

## Water Observatory, Sicilian Agency for Waste and Water

**Agenzia Regionale per i Rifiuti e le Acque**  
**Osservatorio delle Acque**

Home | Progetti | Reti | Banche dati | Mappa sito | Contatti

**Banche dati**

- Annali idrologici
- Bollettino Siccità regionale <-
- Bollettino Siccità MEDOCC
- Archivio fotografico

**Bollettino regionale**

- Consultazione

**BANCHE DATI**

### Bollettino regionale di siccità

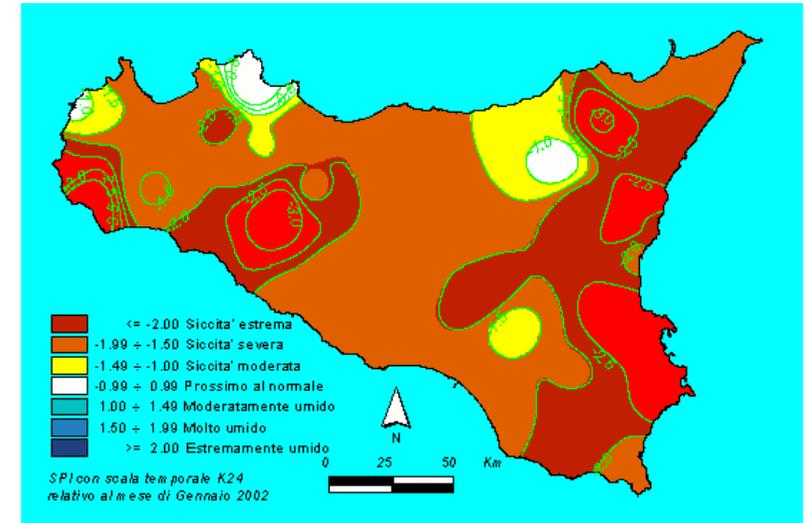
Nell'ambito del progetto SEDEMED, tramite un'apposita convenzione con il DICA avente per oggetto "Studi e ricerche per l'aggiornamento e l'applicazione del bollettino siccità in Sicilia e per la definizione di misure di mitigazione degli impatti della siccità", è stato realizzato l'ampliamento del prototipo di bollettino per il monitoraggio delle siccità, già sviluppato grazie al Programma Interreg II C "Assetto del territorio e lotta contro la siccità". In particolare è stata ampliata la base dati mediante il potenziamento del sistema di acquisizione ed elaborazione dei dati rilevati in telemisura, al fine di includere nel bollettino le informazioni relative ai livelli freaticometri misurati dagli impianti installati dall'Ufficio. Tali informazioni, insieme ai dati di precipitazione, temperatura, volumi invasati nei serbatoi e agli indicatori di siccità sviluppati (Palmer e SPI), forniscono un quadro di riferimento sullo stato delle risorse idriche in Sicilia.

Il bollettino per il monitoraggio delle siccità, riporta per ciascun mese le mappe della distribuzione sulla Sicilia delle grandezze idrometeorologiche di base, quali precipitazioni e temperature (con isolinee dei valori assoluti e dei rapporti rispetto alle medie di periodi precedenti) e degli indici scelti per la descrizione della siccità (deficit di precipitazione, SPI, indice di Palmer). Inoltre contiene le mappe con l'indicazione dei volumi d'invaso (in m3) presenti nei serbatoi all'inizio del mese, espressi anche come rapporto rispetto alla capacità del serbatoio, al volume medio degli ultimi 5 anni, al volume medio dell'intera serie storica disponibile e al volume presente nell'anno precedente nello stesso mese.

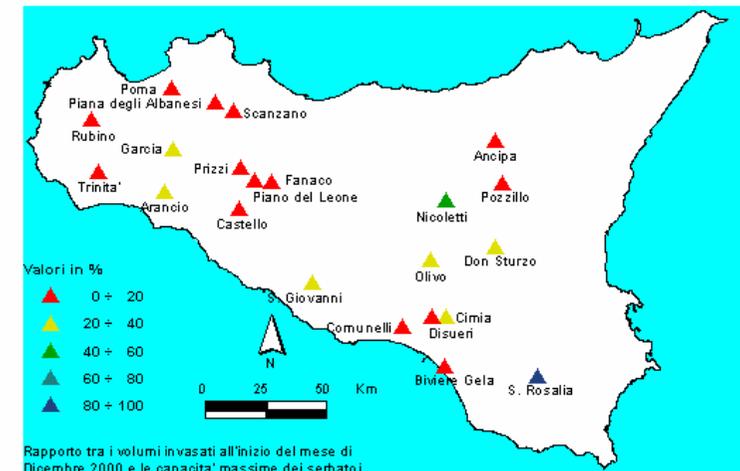
L'attività di potenziamento del Bollettino realizzata nell'ambito del progetto SEDEMED ha riguardato tre aspetti:

- l'ampliamento delle informazioni disponibili, con l'introduzione dei livelli freaticometrici, misurati dai sensori della rete dell'UIR, recentemente installati;
- il miglioramento delle modalità di generazione delle mappe, tramite il software ArcView 3.2;
- la facilitazione dell'accesso da parte dei potenziali utilizzatori, mediante la consultazione delle mappe attraverso un sito Web.

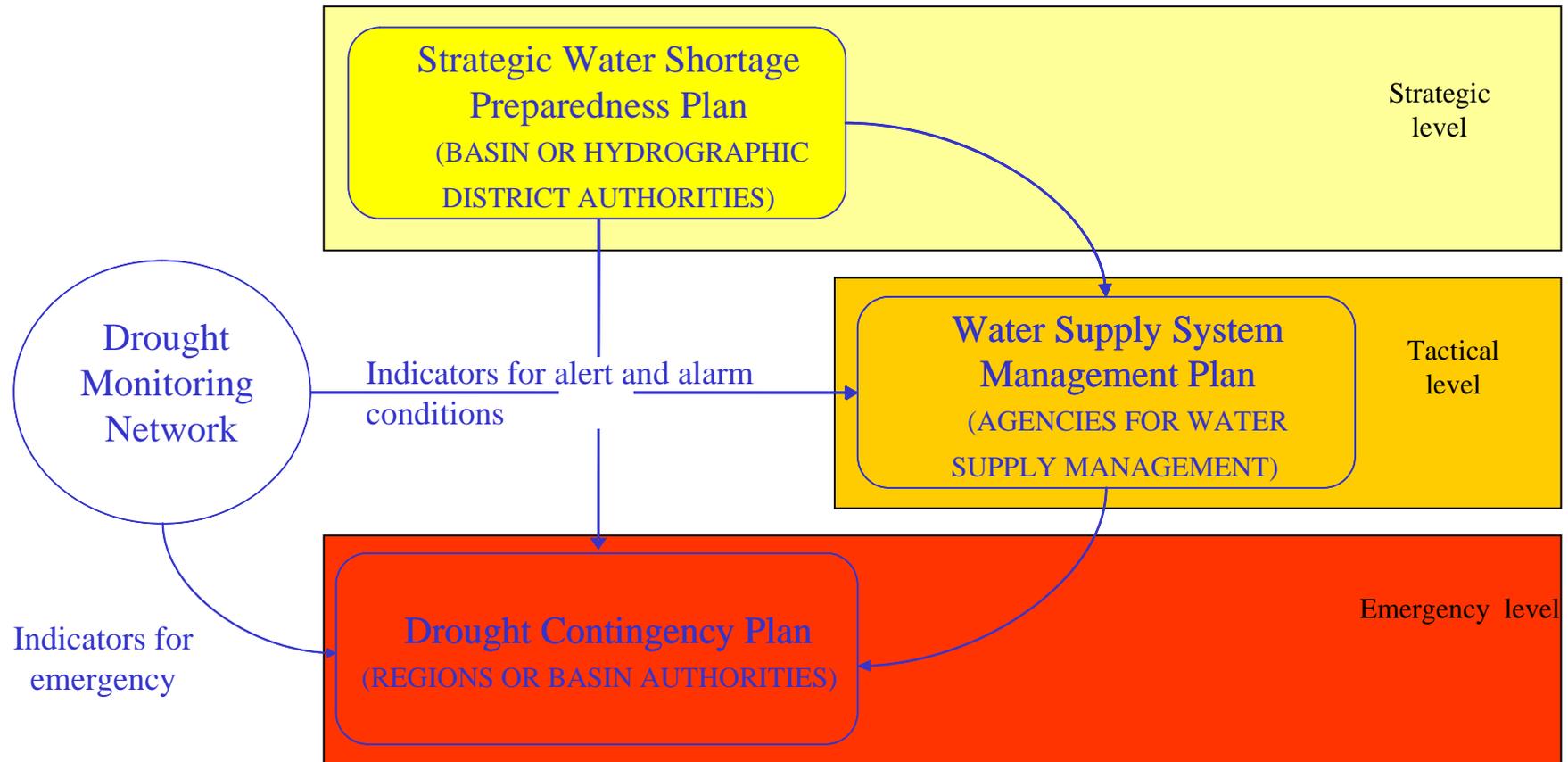
SPI at k=24 months (August 2005)



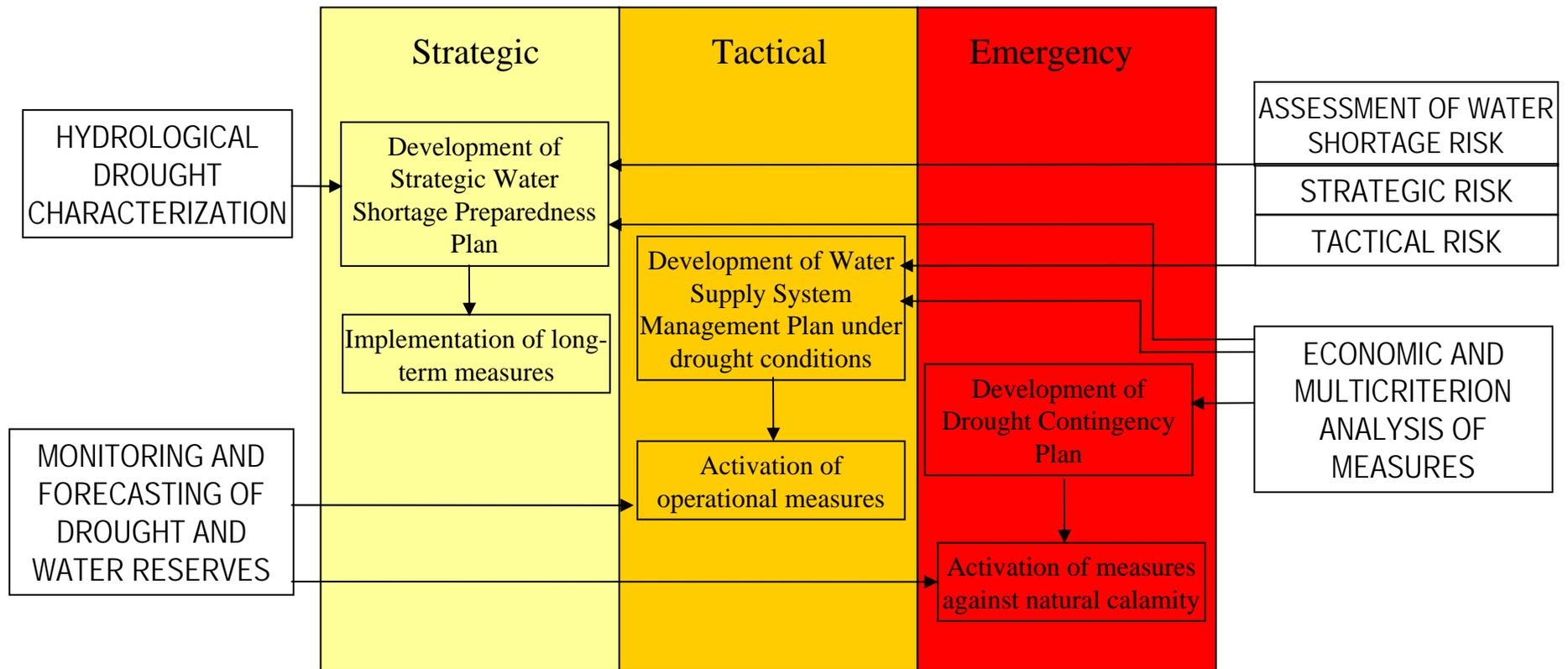
Stored volumes in reservoirs (December 2000)



# PROJECT ARCHIMED-PRODIM: Proposed planning framework for drought management

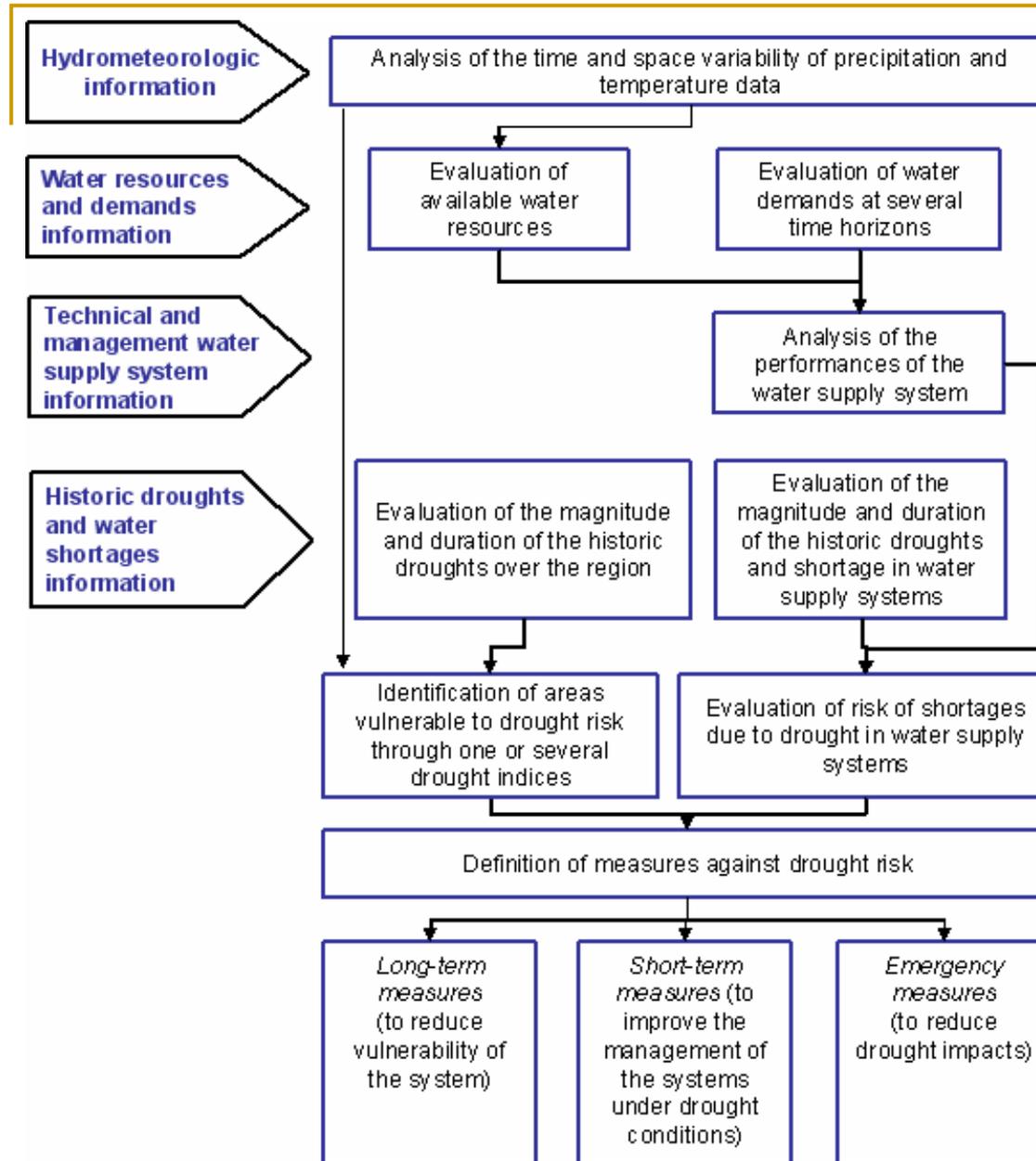


# Planning framework of drought risk management



# Responsible authorities and main contents of proposed drought management plans

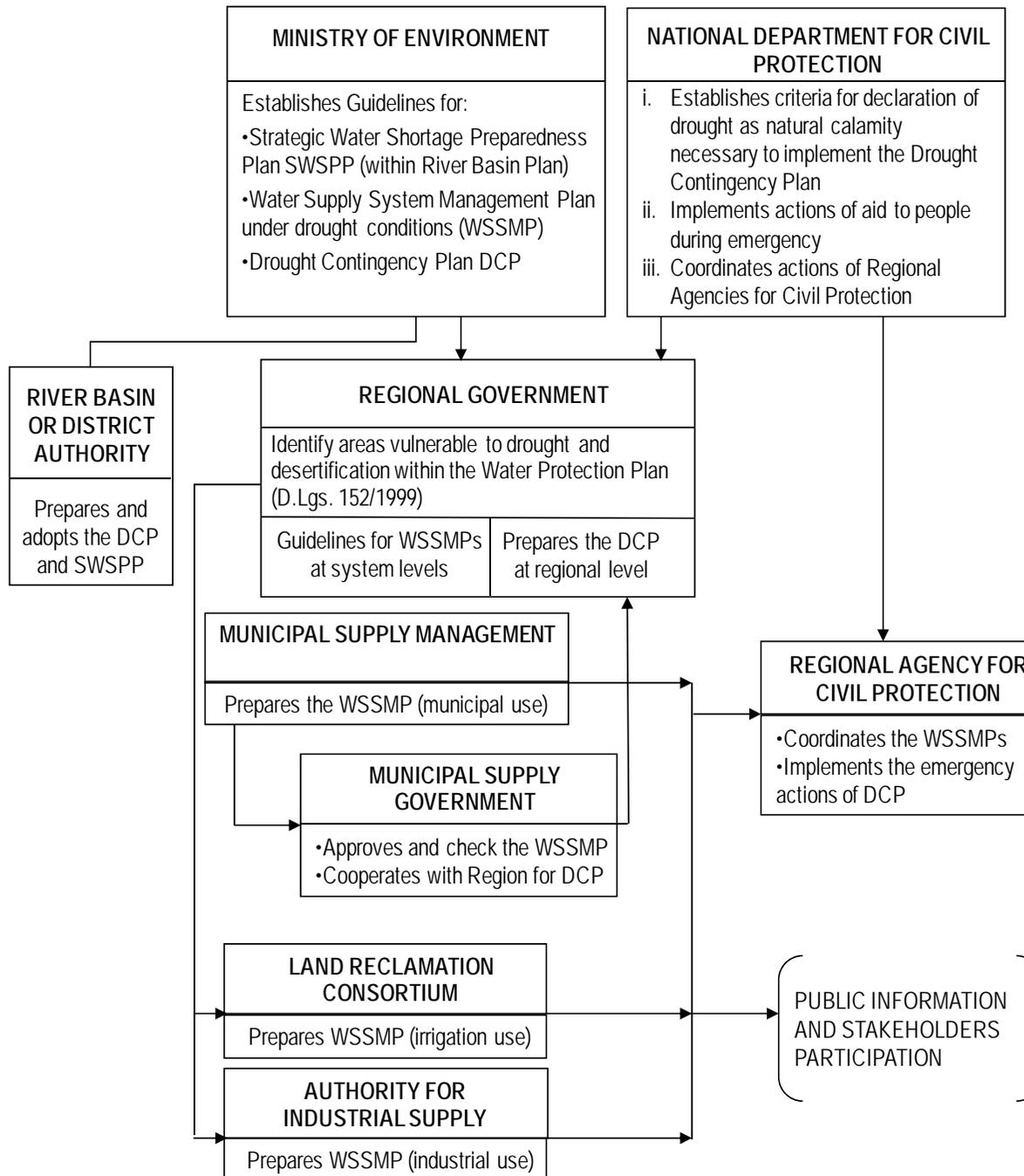
Plan	Responsible Authority	Contents
Strategic Water shortage Preparedness Plan (SWSPP) to be annexed to the River Basin Management Plan	Basin Hydrographic District Authority	<ul style="list-style-type: none"> <li>• Identification of drought vulnerable areas, through the analysis of past drought events and their impacts</li> <li>• Estimation of water shortage risk in water supply systems taking into account:               <ul style="list-style-type: none"> <li>- definition of the priority in water allocation under shortage conditions among different uses</li> <li>- definition of guarantee levels for different uses (expressed as time reliability and volumetric reliability)</li> </ul> </li> <li>• Definition of appropriate long term actions to reduce water shortage risk;</li> <li>• Comparison and selection of alternative drought mitigation measures;</li> <li>• Procedures to ensure the transparency of information on drought situation and planning process and to allow public participation to the decisions</li> <li>• General indications for the drafting of Water Supply System Management Plan (WSSMP)</li> <li>• General indications for the drafting of Drought Contingency Plan (DCP)</li> </ul>
Water Supply System Management Plan	Agencies for Water Supply Management	<ul style="list-style-type: none"> <li>• Definition of indicators and their values to define Normal, Alert and Alarm conditions with respect to drought for a given water supply system</li> <li>• Definition of the best mix of long term and short term measures to avoid emergency</li> <li>• Estimation of costs and financing sources for the chosen mitigation measures</li> <li>• Tools for fostering the stakeholder participation and exchanges</li> </ul>
Drought Contingency Plan	Regions or Basin Authorities (with the contribution of Civil Protection)	<ul style="list-style-type: none"> <li>• Definition of indicators and their values for declaration of a drought as natural calamity</li> <li>• Tools for an institutional participation through a devoted task force on drought</li> <li>• Definition of short term mitigation measures and their costs</li> <li>• Indications for the coordination of state, regional and local interventions during emergency</li> <li>• Tools to ensure the transparency of information on drought situation</li> <li>• Possible recovery from drought damages</li> </ul>



## Information needed to draft SWSP against drought



Rossi et al. (2008)



**Proposal of competence sharing for drought management**  
(adapted from Rossi, 2004)

---

# Conclusions

- Reactive approach is still prevailing, while proactive approach is lagging behind
  - Positive experiences
    - At EU level: WS&DEN report, but also research efforts (MEDROPLAN, PRODIM, XEROCHORE, etc.)
    - At Italian level: planning tools taking into account drought risk, drought monitoring systems
  - WS&DEN proposal may require some adaptations according to the specific national institutional and legislative framework
    - At Italian level a three level planning framework could be adopted
-

---

## References

- Rossi, G. (2004). Prevenzione e mitigazione delle carenze idriche dovute a siccità. *L'Acqua*. 4: pp. 9–22.
  - Rossi, R., Castiglione, L., Bonaccorso, B. (2007). Guidelines for planning and implementing drought mitigation measures in *Methods and Tools for Drought Analysis and Management*, Rossi, G., Vega, T. and Bonaccorso, B. (Eds.), ISBN: 978-1-4020-5923-0. Springer, Dordrecht, The Netherlands, 62, pp. 325-347.
  - Rossi, G., Nicolosi, V., and Cancelliere, A., (2008). Strategic water shortage preparedness plan for complex water supply systems. In: *Proceedings of the International Symposium Water Shortage Management*. Athens, Greece: NTUA.
  - Yevjevich, V., Da Cunha, L. and Valochos, E. (1983). *Coping with Droughts*, Water Resources Publications, Littleton, Colorado.
  - WS&DEN (Water Scarcity and Droughts Expert Network), (2007). Drought management plan report. Including agricultural, drought indicators and climate change aspects. Technical Report, 2008-023 Luxembourg, November 2007.
-