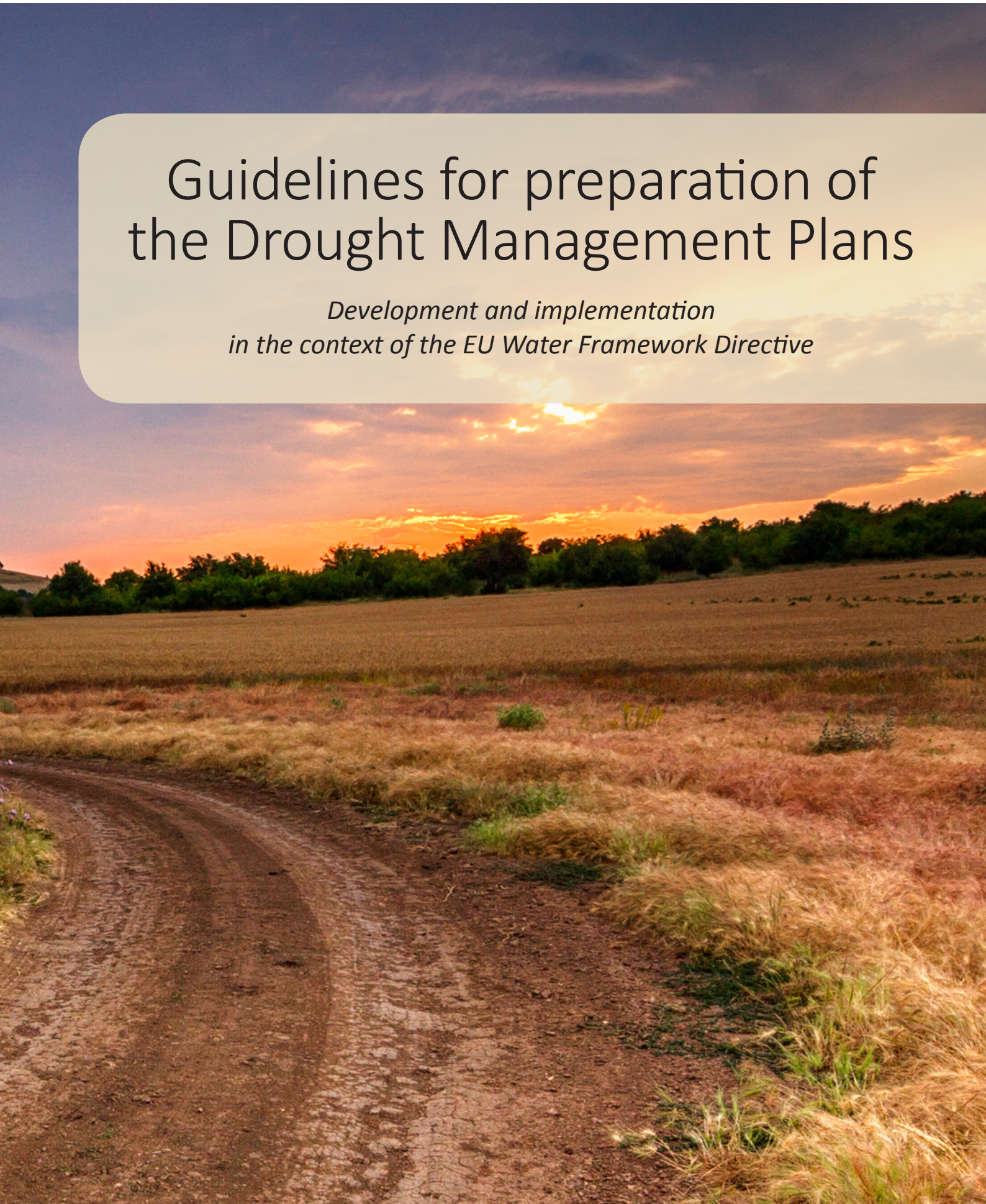
Global Water Partnership
Central and Eastern Europe

# Guidelines for preparation of the Drought Management Plans

*Development and implementation*
*in the context of the EU Water Framework Directive*



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# Guidelines for preparation of the Drought Management Plans

*Development and implementation of risk-based Drought Management Plans In the context of the EU Water Framework Directive – as part of the River Basin Management Plans*

Global Water Partnership
Central and Eastern Europe

**The Global Water Partnership Central and Eastern Europe (GWP CEE),** is an international network, which comprises 12 Country Water Partnerships in Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia and Ukraine and more than 160 partners located in 15 countries. Its mission is to advance governance and management of water resources for sustainable and equitable development. GWP CEE is a part of global network that consists of thirteen regions across the world.

www.gwpcee.org

Integrated Drought Management Programme

**Integrated Drought Management Programme for Central and Eastern Europe (IDMP CEE)** supports the governments of Bulgaria, the Czech Republic, Hungary, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia and Ukraine in the development of drought management policies and plans. It also builds capacity of stakeholders at different levels for proactive integrated drought management approach and tests innovative approaches for future drought management plans. It is part of the Integrated Drought Management Programme (IDMP), which was launched by WMO and GWP at the High-level Meeting on National Drought Policy in March 2013. Further information on the IDMP is available at *www.droughtmanagement.info*

www.gwpcee.org



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# ACRONYMS

| | |
|---|---|
| **CEE** | Central and Eastern Europe |
| **CIS** | Comn Implementation Strategy for the Water Framework Directive |
| **CAP** | Common Agricultural Policy |
| **DMP** | Drought Management Plan |
| **DWG** | Drought Working Group |
| **EC** | European Commission |
| **EU** | European Union |
| **FRMPs** | Flood Risk Management Plans |
| **GWP** | Global Water Partnership |
| **GWP CEE** | Global Water Partnership for Central and Eastern Europe |
| **ICPDR** | International Commission for the Protection of the Danube River |
| **IDMP** | Integrated Drought Management Programme |
| **IDMP CEE** | Integrated Drought Management Programme in Central and Eastern Europe |
| **IKSE-MKOL** | International Commission for the Protection of the Elbe River |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **NAP** | National Action Programme |
| **NWRM** | Natural water retention measures |
| **RBMPs** | River Basin Management Plans |
| **SEA** | Strategic environmental assessment |
| **WS&D** | Water scarcity and drought |
| **WFD** | Water Framework Directive |
| **UNCCD** | United Nations Convention to Combat Desertification |
| **WMO** | World Meteorological Organization |

# Countries

| | |
|---|---|
| **BG** | Bulgaria |
| **CZ** | Czech Republic |
| **HU** | Hungary |
| **LT** | Lithuania |
| **MD** | Moldova |
| **PL** | Poland |
| **RO** | Romania |
| **SK** | Slovakia |
| **SI** | Slovenia |
| **UA** | Ukraine |



# Content

# 1. Introduction

## 1.1. Background

Over the past decade, concerns and wide recognition about drought events and water scarcity have grown across the EU. In 2007, the European Commission issued a Communication from the Commission to the European Parliament and the Council - Addressing the challenge of water scarcity and droughts in the European Union (COM (2007) 414 final). In this document, Drought Management Plans (hereinafter DMP) were identified as one of the main policy instruments to combat the problem.

In 2012, the Commission carried out an overall evaluation of the policy on water scarcity and droughts introduced in the 2007 Communication. The evaluation focused on the integration of water scarcity and drought issues in the first (2009) River Basin Management Plans (RBMPs) with the aim of identifying gaps in EU drought policy and improving its implementation (the EU Water Framework Directive (WFD) requires RMBPs but not DMPs). The results revealed that the development and implementation of DMPs, and their inclusion within RBMPs, remains limited, and that countries should therefore try to integrate DMPs into the second versions of their RBMPs for 2015. Evaluation results were embedded in the Commission document, A Blueprint to Safeguard Europe's Water (hereinafter Blueprint), adopted in 2012 (COM (2012) 673 final).

Regarding water scarcity and drought in the Central and Eastern European (CEE) region, the United Nations Convention to Combat Desertification (UNCCD, 1994) found that the region suffers from "soil degradation and desertification". Although both processes vary considerably from country to country, the vulnerability of the region to this hazard is evident and estimated to be increasing (UNCCD).

In 2013, the Global Water Partnership (GWP) and World Meteorological Organization (WMO) launched a joint Integrated Drought Management Programme (IDMP) to improve the monitoring and prevention of droughts. In the same year, the Global Water Partnership (GWP) for CEE launched the IDMP at the CEE regional level (IDMP CEE). The aim of the IDMP CEE is "to support stakeholders at all levels by providing them with policy and management guidance through globally coordinated generation of scientific information and sharing best practices and knowledge for integrated drought management". During Phase 1 of the IDMP CEE, the overall drought situation in the 10 CEE countries of Bulgaria, Czech Republic, Hungary, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia, and Ukraine was analysed. The results confirmed that drought and water scarcity issues were widely recognized as a relevant phenomenon in the CEE region. (See Inception report for the GWP CEE part of the WMO/GWP Integrated Drought Management Programme, J. Kindler, D. Thalmeinerova, 2012)

Following up on this first phase, Activity 1.2 of the IDMP CEE assessed the integration of drought issues into the first RBMPs. The results of a questionnaire survey, completed by the ten CEE countries listed above, and summarised in the Report on review of the current status of implementation of the drought management plans and measures (Fatulova, 2014), showed that the actual situation for DMP development within the region is unsatisfactory. The majority of the countries had not produced a DMP in accordance with the general WFD guidelines provided in the WFD Technical report Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change Aspects (hereinafter the Report 2007). Furthermore, substantial shortcomings were found in the implementation of all key elements of the DMPs, namely, indicators and thresholds establishing different drought stages, measures to be taken in each drought stage, and the organizational framework for drought management. (Note that while neither Moldova nor Ukraine are part of the EU, both are part of the GWP CEE region and are EU accession countries, and both expressed their interest to join this programme and prepare DMPs according to the WFD.)

**In response, these Guidelines for the preparation of Drought Management Plans (hereinafter the Guidelines), tailor-made to the CEE's regional conditions, were created by the IDMP CEE to contribute to substantial progress in the development of CEE national DMPs.**

## 1.2. General objectives and scope

The general objective of the IDMP CEE is to develop practical Guidelines to support the timely production of CEE national DMPs within the development of the RBMPs. The Guidelines are targeted primarily at public bodies and competent authorities responsible for national drought planning. Furthermore, efforts were made to make the Guidelines clear and simple to increase understanding by stakeholders and the broad public.



The general objective was supplemented by specific objectives:

- Encourage broader commitments to integrated water management systems, according to the Water Framework Directive (WFD), that provide for a better understanding of how to integrate drought management into the planning and development of RBMPs.
- Use a step-by-step approach to develop DMPs in accordance with WMO/GWP Guidelines and EU Guidelines.
- Provide information on other issues related to drought that are included in the WFD: quantitative status, prolonged drought, and climate change.

In line with these specific objectives, the Guidelines were structured into three core chapters as illustrated in Figure 1:

| | |
|---|---|
| **Chapter 2: General aframework** | • Policy framework<br>• Drought management concept<br>• Legislative framework |
| **Chapter 3: Drought planning process** | • National drought management policy development and planning process - step by step approach comprised of 7 steps |
| **Chapter 4: Related issues - interactions with WFD** | • Groundwater quantitative aspects<br>• Prologed droughts<br>• Climate change aspects |

**Figure 1: Content of the Guidelines**

The Guidelines also include a number of experiences of the countries that were involved in earlier phases of the IDMP CEE (presented in brown boxes).

## 1.3. Elaboration process

The elaboration of the Guidelines was based on a participative process that involved experts from the CEE region. The process was divided into two phases.

**First phase**

During Phase 1, a case study was carried out in Slovakia as a practical example of how to develop the key elements of the DMP. The overall intention was to integrate the drought planning process into the integrated water management system within the development of RBMPs. The general objective of the study was to provide methodologies for drought assessment and suggest all necessary steps for the development of the DMP at the national level. One historical drought event (2011/2012) was chosen for drought assessment using available data from Slovakia's existing monitoring system. The key elements of a DMP (i.e. drought indicators, thresholds, early warning system, programme of measures, and organizational structure) were proposed for the whole country. The professional experiences gained during the case study were used for the development of the Draft Guidelines for the DMP. The Slovak Study Report is available at the IDMP CEE website.

Two rounds of National Consultation Dialogues (NCDs) were organised as a part of the IDMP CEE. Their aim was to open a discussion among key actors in each country dealing with drought issues at multiple levels including: policy (ministries, state agencies); professional (hydrometeorological services, universities); and stakeholders (farmers, households, energy companies, fisheries, and others). The first round of the NCDs, organized in 10 CEE countries, was focused on analysing the current state of drought policy in the individual countries.

The main output of the first phase was the Draft Guidelines for Drought Management Plans, developed on the basis of Slovak national experiences and taking into account information and recommendations gathered from other countries during the first NCDs.

**Second phase**

During Phase 2, the second round of NCDs, consisting of dialogues in nine CEE countries, aimed at:

- Gathering national practical experiences and other information relevant to drought planning, through short reports
- Elaborating comments, corrections, suggestions, and amendments to the draft Guidelines according to the specific conditions and drought planning experiences of countries
- Contributing to the development of a final version of the Guidelines that is tailor-made to the conditions of the CEE region

# 2. General framework

## 2.1. Policy framework

In 2000, the European Parliament and Council adopted Directive 2000/60/EC establishing a framework for Community action in the field of water policy: namely, the **Water Framework Directive (WFD).** The purpose of the WFD is to provide a common framework for the protection and enhancement of all surface waters (rivers, lakes, transitional waters and coastal waters) and groundwater. The WFD is the most important legislative tool for water protection across the EU, obliging Member States to implement new EU water policy based on the principles of integrated water management. Its fundamental objective is to achieve "good status" for all waters by 2015. This objective implies the duty to maintain a "good surface water status" where both its ecological and chemical status are at least "good", and "good groundwater status" where both its quantitative and chemical status are "good".

One of the important concepts of the WFD is the organisation and regulation of water management at the level of river basins. The central administrative tools are the **River Basin Management Plans (RBMPs),** which Member States are required to produce for each river basin district to achieve "good water status". The RBMPs must be produced on the national level and, at the same time, at the river basin scale. The development of planning documents for river basin districts falls under the coordination of river basin commissions (e.g. ICPDR, IKSE-MKOL, Sava Commission).

The deadlines for the development of RBMPs for the first, second, and third six-year planning cycles under the WFD are December 2009, 2015, and 2021, respectively (see Figure 2).

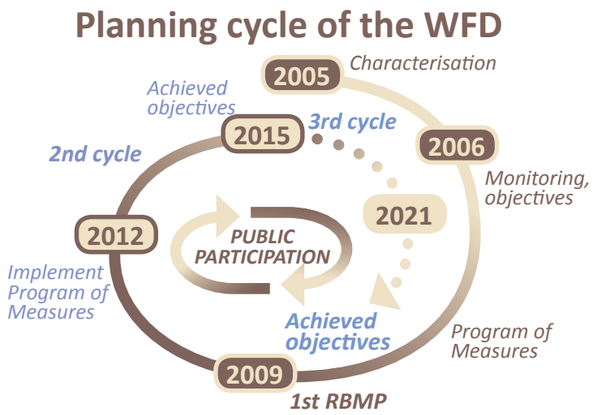


**Figure 2: Key elements and deadlines of planning cycles according to the Water Framework Directive**

**Source: http://www.ecrr.org/Portals/27/Events/ERRC2014/Presentations/27%20october%202014/Plenary/Beate_Werner_ERRC2014_WFD_RBD.pdf**



Among its many aims, the WFD also contributes to mitigating the effects of **droughts**, although the development of a DMP is not required under the WFD.

Regarding **floods**, reducing flood risk is not a principal objective of the WFD. Therefore, in 2007, the Directive 2007/60/EC on the assessment and management of flood risks (Flood Directive) was adopted. Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage, and economic activity. The Flood Directive shall be carried out in coordination with the WFD. Development of RBMPs under the WFD and of Flood risk management plans (FRMPs) under the Flood Directive are the main elements of integrated river basin management. The first FRMPs shall be developed by 2015 together with the second RBMPs, and shall be subsequently updated in six-year cycles. The FRMPs shall be produced at the national and river basin level. An assessment of climate change impacts on the occurrence of droughts and floods shall be included in both planning documents: RBMPs and FRMPs. The interconnection between the two planning processes allows for common synergies and benefits (see Figure 3)

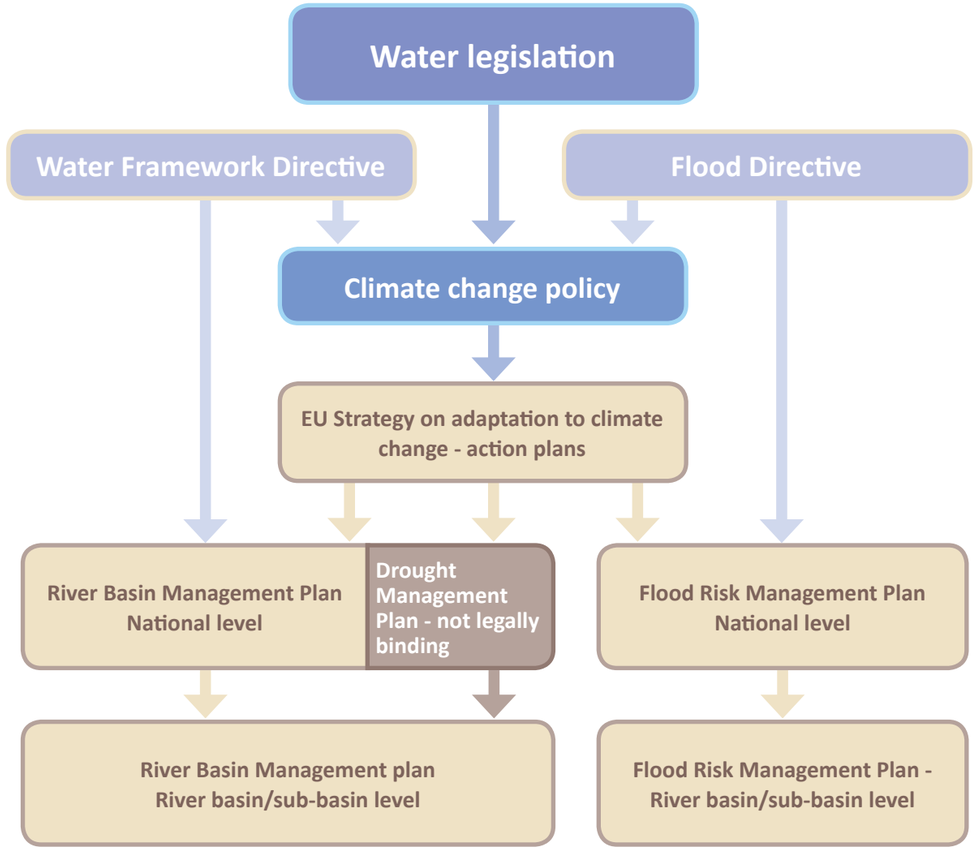


**Figure 3: Integrated water management – planning process in the context of the Water Framework Directive and Flood Directive**

The success of the WFD and Flood Directive depends primarily on close cooperation and coherent actions taking place at three levels: European Community, river basin, and national.

The interactions between different levels are illustrated in Figure 4.

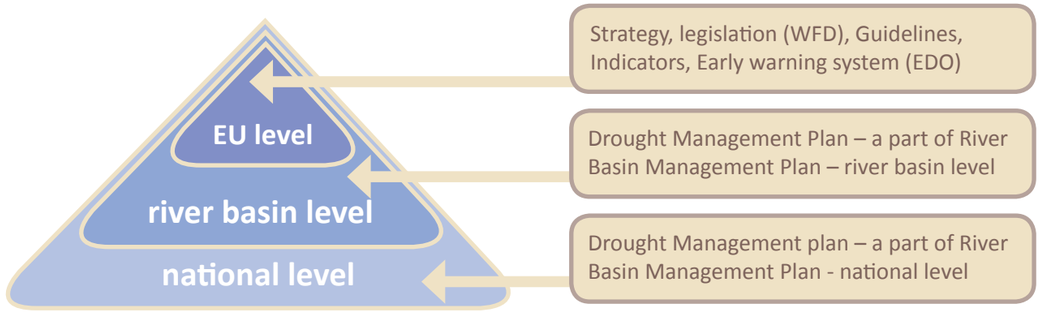


Figure 4: Drought strategy – interactions between EU, river basin, and national levels

At the Community level, a **Common Strategy for Implementation of WFD (CIS)** was established in 2001 with the aim to enforce a common approach to implementing the WFD and Flood Directive in Member States. The process is coordinated by the Strategic Coordination Group (SCG) under the supervision of the European Commission. A variety of technical guidance documents have been developed under the CIS process and approved by Water Directors (official representatives of the Member States). Although these documents are not legally binding, they have become "quasi" binding documents by achieving consensus among the competent authorities from all EU countries.

Although the CIS process is primarily focused on the preparation of RBMPs, many actions at the EU level have resulted in the development of EU drought policy. Several policy and technical documents dealing with drought were developed within the CIS process and issued at the Community level for Member States. The following documents, including the general guidelines for the DMP (used to develop these IDMP CEE Guidelines), represent the base of EU drought policy:

- Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change (Report 2007) – general guidance for the production of a Drought Management Plan in accordance with the RBMPs
- Communication from the Commission to the European Parliament and the Council - Addressing the challenge of water scarcity and droughts in the European Union (COM (July 2007) – drought strategy providing policy options and a set of key actions to tackle drought and water scarcity problems (hereinafter Communication 2007)
- A Blueprint to Safeguard Europe's Water Resources (November 2012) – policy document aims to tackle obstacles that hamper actions to safeguard water resources. A part of the document is dedicated to vulnerability problems and solutions, including those related to drought (hereinafter Blueprint)

In line with the Communication 2007, the Commission launched the development of a European Drought Observatory (EDO) which will enhance knowledge about drought issues and act as an early warning system for Europe to increase Member State preparedness. This system will integrate relevant data and research results, drought monitoring, and detection and forecasting at different spatial scales, from local and regional activities to an overview at the EU level. It will also enable the evaluation of future drought events. The Commission will continue to implement procedures for an operational EDO (Blueprint). Through this tool, the Commission will encourage Member States to better integrate drought risk management and climate change aspects into their future RBMPs.

Member States should harmonise their national drought policy with the common EU drought policy according to the policy and technical documents developed and adopted by Member States within the CIS process.

A harmonization process is also needed for the development of a DMP at the river basin scale as a part of the RBMP in cooperation with river basin commissions.

The CIS process continues to develop new drought-related components, such as definitions, drought indicators, water accounts, and ecological flows. Drought management planning also continues to be in progress at all levels within the EU (i.e. EC, river basin, sub-basin and national). Furthermore, as new technologies and methods evolve, Drought Management Plans will need to be revised in six-year cycles as a part of the updated River Basin Management Plans (at the national, sub-basin, and river basin level), together with the production of FRMPs.



Moreover, the **UNCCD** should be taken into account because EU countries, including countries of the CEE region, are Parties to the UNCCD. Chapters 4, 5, and 10 of the UNCCD, and the 10-year UNCCD Strategy adopted by the 8th Conference of Parties (Madrid, Spain, 2007), define the commitments of Parties regarding the mitigation of drought consequences. The following countries from the GWP CEE region signed the Convention and, as a result, are required to prepare National Action Plans:

- Slovenia and Hungary as part of the Northern Mediterranean region (Annex 4)
- Bulgaria, Moldova, Romania, Slovakia, and Ukraine as part of the CEE region (Annex 5)

## 2.2. Conceptual framework for drought management

The development of Guidelines for the preparation of Drought Management Plans requires a clear and agreed conceptual framework for drought management and definitions related to drought. Two basic approaches are currently applied:

**Reactive approach based on crisis management** -- includes measures and actions after a drought event has started and is perceived. This approach is taken in emergency situations and often results in inefficient technical and economic solutions, because actions are taken with little time to evaluate optimal options and stakeholder participation is very limited.

**Proactive approach based on drought risk management** -- includes all of the measures being designed in advance, with appropriate planning tools and stakeholder participation. The proactive approach is based on both short-term and long-term measures and includes monitoring systems for a timely warning of drought conditions. A proactive approach entails the planning of necessary measures to prevent or minimize drought impacts in advance.

Most EU countries are in the process of moving from crisis management to drought risk management. Accordingly, several guidelines based on the principles of drought risk management have been developed. They are usually adapted to specific local or regional conditions (e.g. legislative, administrative, natural). The following Guidelines documents from different regions were used to develop these CEE DMP Guidelines:

- World Meteorological Organization (WMO) and Global Water Partnership (GWP) National Drought Management Policy Guidelines: A Template for Action (2014) (D.A. Wilhite). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden (hereinafter WMO/GWP IDMP Guidelines). These provide a general approach towards developing national drought policies. The step-by-step approach was taken from this document and adjusted to CEE regional and national specifics. The suggested 10 steps were merged into seven steps which are recommended for the drought policy development and planning process (Chapter 3).
- ***Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change Aspects*** (Water Scarcity and Droughts Expert Network), European Commission, Technical report 2008-023, November 2007 (hereinafter Report 2007 or EU Guidelines). These EU Guidelines were used as a basis for adapting the generic steps described in the above WMO/GWP IDMP Guidelines to the specific conditions of the European Union according to EU water policy. Some principal elements were taken from this document (e.g. objectives, DMP content, and key elements of drought stages).
- Drought Management Guidelines (European Commission - EuropeAid Co-operation Office Euro-Mediterranean Regional Programme for Local Water Management (MEDA Water) Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN) (hereinafter Medroplan Guidelines). The Medroplan Guidelines provided practical recommendations for the planning process and some methodological components (e.g. definitions, impact assessment).

## 2.3. Legislative framework

The legal framework for EU water policy is Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (hereinafter the Water Framework Directive, or WFD).

The WFD contains several provisions dealing with quantitative aspects which are connected with water scarcity problems. However, legally binding requirements focused specifically on solving drought issues are not included. Despite this fact, the WFD is a rather flexible instrument, enabling the integration of drought issues into the context of integrated water management. According to Article 4 of the WFD, the preventive and mitigating measures needed for reducing drought impacts can or should be: included in RBMPs; and become a part of a programme of measures for achieving environmental objectives. Furthermore, Article 13 (5) of the WFD states: ***„River basin management plans may be supplemented by the production of more detailed programmes and management plans for sub-basin, sector, issue, or water type, to deal with particular aspects for water management."***

According to Article 13 (5), if a Member State considers drought to be a relevant issue, an additional management plan (Drought Management Plan) to deal with drought aspects should be produced. Individual Member States decide on whether drought is a relevant issue or not. If it is relevant, then the production of a DMP becomes an obligation of the Member State. If the production of a DMP is inevitable (with regard to drought relevance), the recommendation is to make it part of a RBMP (COM (2007)414 final and COM (2012) 673 final). The suggested measures included in a DMP should be interconnected and complementary with the RBMP programme of measures in order to comply with environmental objectives. Furthermore, the production of both planning documents (RBMP and DMP) should be coordinated in six-year planning cycles with deadlines in 2015 and 2021.

Where the WFD does not specifically cover drought issues, the WFD does include many quantitative elements connected with drought including, along with Article 13 (5):

**Article 4 (1b) (ii) WFD** – Requires ensuring a balance between the abstraction and recharge of groundwater, with the aim of achieving good groundwater quantitative status by 2015. An assessment of groundwater status requires data on current abstractions from groundwater, through a register of abstractions and available groundwater resources. This database should be used for drought and water scarcity assessment and for the development of the DMP. If an assessment finds bad quantitative status, then necessary measures (e.g. regulation of water abstraction) must be adopted in the programme of measures and subsequently implemented.

**Article 4 (6) WFD** – Creates an exemption from the environmental objective: "to prevent deterioration of the status of all bodies of surface water". The exemption can be applied if exceptional circumstances resulted in a prolonged drought, a temporary deterioration of water status, and effects (e.g. increased rates of fish mortality). Such a deterioration is not considered to be in breach of WFD requirements. The application of this exemption clause is connected with the necessary measures to be adopted:

- all practicable steps are taken to prevent further deterioration in water body status
- adopt appropriate indicators (in the RBMP) to determine conditions under which exceptional circumstances are foreseen
- adopt measures (in the RBMP programme of measures) to be taken under such exceptional circumstances
- review annually the effects of exceptional circumstances and take all practicable measures with the aim of restoring the water body to its status prior to the drought event

**Article 5 WFD** – Requires ensuring, inter alia, an:

- impact assessment of water abstraction on water status
- economic analysis of water use

According to technical specifications set out in Annex II and III, Member States are obliged, inter alia, to provide the following data:

- estimation and identification of significant water abstraction from surface water for urban, agriculture, industry, and other uses, including seasonal variation, total annual demand, and loss of water in distribution systems (Annex II, 1.4 WFD)
- abstractions from groundwater (Annex II, 2.1 WFD)
- sufficient data to calculate the long-term annual average rate of overall recharge (Annex II, 2.2 WFD)



¨Economic analysis¨, *inter alia*, requires:

- assessing trends in water supply, water demand, and investments
- carrying out an economic analysis of water uses in each River Basin District

The economic analysis is a basic document needed for the implementation of incentive pricing policies. Pricing policy is an economic instrument providing appropriate and adequate financial incentives for users to reduce their water uses and pollution as required in Article 9 of the WFD (CIS Guidance document No. 1: Economics and the environment).

**Article 9 of WFD** – Requires the establishment of pricing policy that stimulates effective water use. It is a strong economic instrument that can help reverse water scarcity trends and decrease vulnerability to droughts.

Regarding the list of articles above, only the most basic associated with water scarcity and drought issues have been presented. It is necessary to emphasize that these WFD requirements are legally binding, while DMP requirements are not. The fulfilment of these WFD obligations can promote better integration of water scarcity and drought issues into the water management system.

**Links between WFD and Nature Directives**

The nature directives **(Birds Directive 79/409/EEC and Habitats Directive 92/43/EEC)** form the backbone of the EU´s biodiversity policy protecting valuable species and habitats. The protected areas designated under these directives form the Natura 2000 network. The WFD introduces the concept of a joint framework for the implementation of measures needed for both the WFD and nature directives. One of the main objectives of the WFD is to reach a good ecological status of all surface waters. This includes water bodies that form part of a Special Protection Area under the Birds Directive or a Site of Community Importance under the Habitats Directive (Natura 2000 sites).

The WFD stipulates the obligation to achieve compliance with standards and objectives established for individual protected areas specified in Community legislation. For groundwater bodies, the main objective is to achieve good quantitative status. The definition of good quantitative status also includes the protection of associated surface waters and terrestrial ecosystems (e.g. wetlands). An RBMP must therefore also include, in its programme of measures, any measures needed to achieve compliance with the objectives for Natura 2000 sites. This means that the WFD also provides a legal basis for solving drought problems in relation to biodiversity conservation.

All of the above provisions are part of EU water legislation that is legally binding for Member States. As such, they must be transposed into national legal systems and subsequently implemented. As drought issues are not directly regulated by EU water legislation, additional regulations specifically for drought should be adopted at the national level. These should constitute duties and responsibilities in the field of drought management, as well as restriction measures to be taken by decision-making authorities during drought episodes.

## 2.4. Guiding principles

The guiding principles for the Guidelines were derived at the beginning of the IDMP CEE following the recommendations of CEE countries to respect the principles of EU legislation, water policy, and drought policy. They are based on the principles of integrated water management in the context of the WFD and Flood Directive.

***Principle 1:***

Drought policy is based on a proactive approach with an emphasis on drought risk management. It is associated with developing a preparedness plan in advance with the aim to prevent or minimize drought impacts.

***Principle 2:***

A Drought Management Plan is an administrative tool for the enforcement of preventive and mitigation measures in order to achieve a reduction of drought impacts on society, environment, and economy.

*Principle 3:*

The Water Framework Directive provides the legislative framework for the development of Drought Management Plans focused on the reduction of drought impacts in affected areas and the enhancement of resilience against droughts.

*Principle 4:*

A Drought Management Plan is an additional planning document that supplements a River Basin Management Plan developed as a part of planning cycles in accordance with Article 13.5 of the WFD. According to chapter 10 of the UNCCD, the relevant chapters of a Drought Management Plan are included in the National Action Plan to combat desertification.

*Principle 5:*

The development of drought policy and the production of the Drought Management Plan are consistent with policy documents issued by the European Commission and other technical and methodological documents developed and adopted within the process of the Common Implementation Strategy for implementation of the WFD. A link between the Drought Management Plan and national/local development plans/programmes/ strategies should be ensured.

*Principle 6:*

Professional experiences and scientific knowledge on drought risk management from other regions should be utilised.

*Principle 7:*

Three main elements are crucial for effective drought management: drought indicators and thresholds for the classification of drought stages (i.e. normal, pre-alert, alert and emergency) and a drought early warning system; mitigation measures to achieve specific objectives in each drought stage; and an organizational framework to deal with drought.

*Principle 8:*

A key factor for establishing effective and integrated drought management is ensuring the involvement of key sectors, decision-makers, professionals, stakeholders from impacted sectors, and the public in the process of developing and implementing a Drought Management Plan.

## 2.5. Definitions

The definitions used in the Guidelines are working definitions developed and agreed by experts within the IDMP CEE. The definitions of the terms “drought” and “water scarcity” were developed within the CIS process at the EU level. Both drought and water scarcity have to be identified and differentiated in RBMPs according to their causes and clearly addressed in the programme of measures.

**Agricultural drought**

Expressed in terms of the soil moisture required by a particular crop at a particular time.

**Available groundwater resource**

The long-term annual average rate of overall recharge of the body of groundwater less the long-term annual rate of flow required to achieve the ecological quality objectives for associated surface waters (surface waters that are recharged by groundwater), as specified under Article 4 of the WFD. The objectives are meant to avoid any significant diminution in the ecological status of such waters and significant damage to associated terrestrial ecosystems (Article 2(27) of WFD).

**Competent authority**

An authority or authorities identified under Article 3(2) or 3(3) of the WFD.

**Crisis management**

An unplanned reactive approach that implies tactical measures to be implemented in order to meet problems after a disaster has started.



**Drought**

Drought is a natural phenomenon. It is a temporary, negative and severe deviation along a significant time period and over a large region from average precipitation values (a rainfall deficit), which may lead to meteorological, agricultural, hydrological, and socio-economic drought, depending on its severity and duration (definition agreed to by Water Directors within the CIS process).

**Drought Impact**

A specific effect of drought on the economy, society, and/or environment, which is a symptom of vulnerability.

**Drought Impact Assessment**

The process of assessing the magnitude and distribution of the effects of a drought.

**Drought indicator**

Indicator of a meteorological, hydrological, agricultural, or socio-economic variable that provides an indication of potential drought-related stress or deficiency.

**Drought prevention**

The reduction of risk and the negative impacts of drought through preventive measures. Prevention means taking actions before drought occurs.

**Early warning**

The provision of timely and effective information, through identified institutions, that allows stakeholders at risk of a disaster to take action to avoid or reduce their risk and prepare for effective response.

**Ecological flow**

A hydrological regime consistent with the achievement of the environmental objectives of the WFD in natural surface water bodies, as mentioned in Article 4(1).

**Forecast**

The statistical estimate of the probability of occurrence of a future drought event.

**Hazard**

The probability of the occurrence of a drought event with a specific intensity.

**Hydrological drought**

Deficiency of water reserves in groundwater and surface water bodies.

**Meteorological drought**

Deviation of precipitation from normal status over some period of time.

**Mitigation**

The set of structural and non-structural measures undertaken to limit the adverse impact of hazards.

**Proactive management**

Strategic measures and actions are planned in advance, involving modifications to infrastructure and/or existing laws and institutional agreements.

**Quantitative status**

An expression of the degree to which a body of groundwater is affected by direct and indirect abstractions (Article 2(26) of WFD).

**Risk**

The combination of the probability of a drought event (hazard) with the potential adverse impacts for society, environment, and economic activity.

**Socio-economic drought**

Associated with an imbalance between water demand and water supply and having an impact on society and the economy.

**Soil sealing**

The permanent covering of an area of land and its soil by impermeable artificial material (e.g. asphalt and concrete), for example, from buildings and roads.

**Stakeholders**

Actors who are directly or indirectly affected by an issue and who could affect the outcome of a decision-making process regarding that issue or who are affected by it.

**Threshold**

The specific value of an indicator used for the classification of drought stages according to the level of impact severity (i.e. normal, pre-alert, alert, emergency).

**Vulnerability**

The degree to which systems are susceptible to the potential impact of a drought event on people, the environment, and economic activities.

**Water account**

A product of water accounting – a systematic process which integrates physical (hydrological) and economic information related to water consumption and use, to achieve equitable and transparent water governance for all water users and a sustainable water balance between water availability, demand, and supply.

**Water consumption**

The portion of water use that is not returned to the original water source after being withdrawn.

**Water demand**

The water requirement of a specific quality for different purposes.

**Water scarcity**

A man-made phenomenon, it is a recurrent imbalance that arises from an overuse of water resources, caused by consumption being significantly higher than the natural renewable availability. Water scarcity can be aggravated by water pollution (reducing the suitability for different water uses), and during drought episodes. (definition agreed to by Water Directors within the CIS process)

**Water supply**

The supply of water is a service of general interest as defined in the Commission communication on services of general interest in Europe (preamble 15 of WFD, OJ č. C281, 26.9.1996, s.3).

**Water use**

The total amount of water withdrawn from its source that will be used.

# 3. National drought management policy and planning process

This chapter is the core part of this document. It outlines the guidance for the development and implementation of drought management policy based on the concept of reducing risks associated with drought occurrence. The process for designing a drought risk-based management strategy must be linked with the production and implementation of a preparedness and mitigation plan – the Drought Management Plan (DMP). The DMP is an administrative instrument through which national drought policy is executed.

A step-by-step approach is recommended for drought policy development and the production of the DMP in the WMO/GWP IDMP National Drought Management Policy Guidelines (described in chapter 2.2). The 10 steps suggested in these Guidelines were merged into seven steps in the context of the WFD, as listed below:



| | |
|---|---|
| **STEP 1** | **Develop a drought policy and establish a Drought Committee** |
| **STEP 2** | **Define objectives of drought risk-based management policy** |
| **STEP 3** | **Make inventory of data for Drought Management Plan development** |
| **STEP 4** | **Produce/update Drought Management Plan** |
| **STEP 5** | **Publicize Drought Management Plan for public involvement** |
| **STEP 6** | **Develop scientific and research programme** |
| **STEP 7** | **Develop educational programmes** |

It is important to remember that drought management and DMP production are dynamic and iterative processes that need to be regularly revised and updated according to appropriate indicators. A periodic process of post-drought evaluation and updating of the DMP, based on a review of steps 2 – 7, should be linked with the six-year cycles of the RBMP planning process. Post-drought evaluations establish a baseline for the revision of drought policy and updating of the DMP and should include an analysis of climate, social, and environmental aspects, and an evaluation of the effectiveness and weaknesses of the drought policy and implemented mitigating measures.

## STEP 1: Develop a drought policy and establish a Drought Committee

The process for creating a national drought management policy should begin with policy actions aimed at establishing the national Drought Committee responsible for the development and implementation of risk-based drought policy. The main objective of this step is to ensure that the process is coordinated by the government and that all key national authorities, drought experts, and stakeholder groups dealing with, or impacted by, drought are included in the Committee. This first step requires policy actions focused on the following:

1. Identification/confirmation of the competent authority for drought risk management
2. An official announcement by the competent authority that drought is a relevant issue in the country (e.g. in a RBMP or other legally binding planning document)
3. Development of the national risk-based drought policy and a strategy on its implementation for government approval
4. A government resolution or other policy act (e.g. adoption of the legal regulation)
5. The establishment of the national Drought Committee with a mandate from the government

### Sub-step 1.1 Establish a competent authority

According to Article 3 of the WFD, Member States must identify an appropriate competent authority that is responsible for applying WFD rules. As drought is one of the significant water management problems, it should be solved within the context of the WFD. The administrative unit identified under Article 3 of the WFD should be the national competent authority for drought risk management as well. Therefore, the existing competent authority should be confirmed, or if one does not exist, a new competent authority should be established only for drought.

### Sub-step 1.2 Recognize drought as a relevant water management issue

An official announcement recognizing drought as a relevant issue, based on an evaluation of the drought situation, could/should be a part of the ongoing planning process in accordance with the WFD. According to the WFD, the development of a drought policy and DMP is not a legally binding requirement. Rather, the decision to develop them depends on how the Member State chooses to deal with drought issues.

According to an agreement by the representatives from the individual Member State, the RBMP should contain a chapter describing the situation for water scarcity and drought within their national parts of river basins. If drought risk is evaluated as a “not relevant water management issue”, then there is no duty to produce an additional planning document (i.e. DMP). However, if it is relevant, then the production of the DMP becomes an obligation of the Member State.

### Sub-step 1.3 Develop national drought policy and implementation strategy

If the competent authority considers drought to be a relevant issue, then a risk-based drought policy and strategy for its implementation should be developed. The policy/strategy document should be prepared as a framework document containing only the main principles of the drought policy together with a generic road map for its implementation, including all of the necessary steps for producing the Drought Management Plan (e.g. administrative, organizational, institutional, financial, and other). The national policy/strategy document should be approved by the government and subsequently elaborated in detail by the Drought Committee.

### Sub-step 1.4 Adopt a government resolution or appropriate legislation

A government resolution introducing the legal and institutional framework for the drought planning process is needed in those countries which do not have appropriate legislation for drought management. The resolution should appoint responsible bodies (e.g. ministries, municipalities, governmental agencies) and determine their duties in the drought management system.

### Sub step 1.5 Establish a Drought Committee

A Drought Committee should be established as a permanent committee with a strong mandate from the government. Establishing the Drought Committee and coordinating its actions is the role of the national competent authority. The main tasks of the Committee are to:

- supervise and coordinate the national drought policy development process (during initial phase)
- be responsible for implementation of the drought policy at all levels (national, regional, local), including:
  - DMP production and updating
  - design and operationalize a drought monitoring program
  - design and operationalize a drought early warning system
  - ensure a mechanism is developed for the timely and accurate assessment of drought impacts
  - provide accurate and timely information to the public
  - activate mitigation actions (measures) during drought occurrences according to the severity of drought stages (i.e. pre-alert, alert, emergency) taking into account priority needs
  - on-going and post-drought assessment
  - development and implementation of a drought mitigation programme during the normal drought stage
  - be responsible for cooperation on drought issues at the transnational (river basin) level;
- be responsible for cooperation on drought issues at the transnational (river basin) level
- develop research, science, and educational programmes

The mandate of the Drought Committee should contain:

- composition of the Drought Committee and its organizational structure
- establishment of specific working groups under coordination of the Drought Committee
- determination of the responsibilities and competences of the Drought Committee
- definition of duties and responsibilities of individual members of the Committee



- strategy on communications between the Drought Committee and competent authority (i.e. minister, national administration at all levels)
- coordination and communication measures providing clear relations among partners from different groups (e.g. sectors, experts, affected stakeholders) and governmental levels (e.g. central administration, local administration)
- assignment of Committee tasks specified for each drought stage (normal, pre-alert, alert, emergency)
- definition of the Committee´s duties connected with transnational obligations

The Drought Committee should have the right to design and establish expert working groups entrusted with specific tasks focused on the elaboration of background documents for the development of the DMP (e.g. evaluation of historical droughts, impact assessment, and monitoring).

### Composition of the Drought Committee

The composition of the Drought Committee should reflect the interdepartmental and multidisciplinary nature of drought management and should include all key representatives from:

- central administration for key sectors facing drought impacts with the power to take policy decisions (e.g. ministries responsible for environment, water, agriculture, energy, tourism, and industry; and other identified state bodies)
- decision-making authorities at the local level with the power to take operational decisions
- key professional institutions dealing with drought: environmental agencies, hydrometeorology service, agricultural research institutions, drought experts from universities, and other institutions providing expert services (e.g. monitoring, drought and impact assessment)
- affected stakeholder groups who can provide information on impacts during drought events: e.g. municipalities and local communities; industry, energy, and tourism sectors; farmers; water companies; and NGOs,

The organizational structure for drought management (Figure 5) reflects the optimal composition of the Drought Committee and the principle interactions among key players at different levels. This ensures the use of a participatory approach and responsible reactions from society. The structure was developed as an universal model based on recommendations taken from general guidelines (mainly the Report 2007 and WMO/GWP IDMP Guidelines).

Policy actions are crucial prerequisites for the development and implementation of drought risk-based strategy and reflect the political will to tackle problems.

The organizational arrangement of the Drought Committee is a key factor for establishing an effective and integrated drought management system. The success of drought policy depends on close cooperation among responsible sectors at all levels as well as the involvement of affected groups of stakeholders in the drought management system.

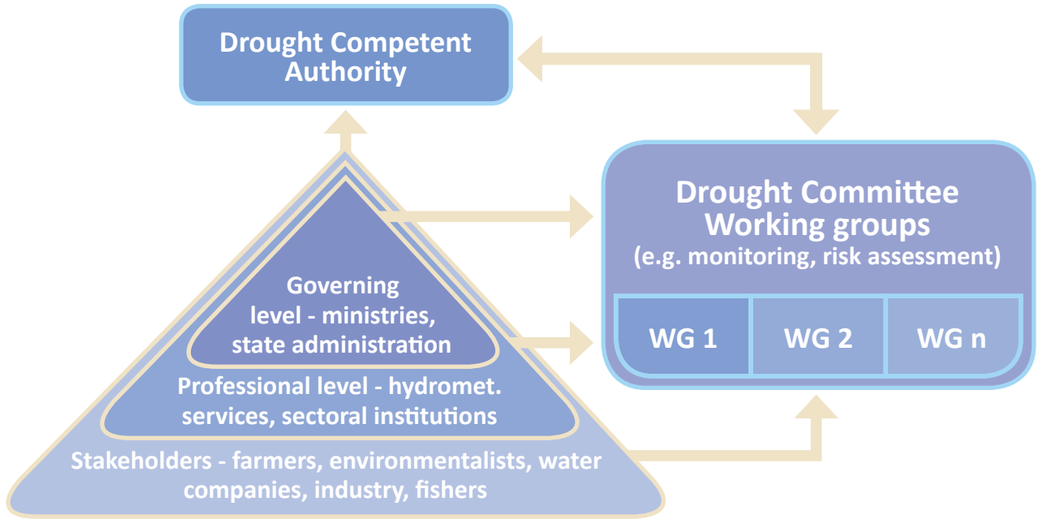


Figure 5: Organizational structures for integrated drought management

Most of the CEE countries indicated the readiness of existing bodies to supervise and coordinate the national drought policy development process. The common opinion expressed during the National Consultation Dialogues was that there is no need to create new bodies for drought management, and that existing water management units should be utilized. An example of such an organizational structure from Hungary is given below in Figure 6.

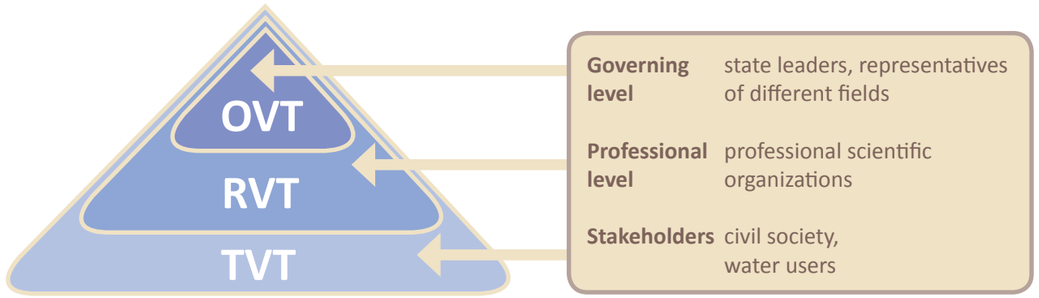


Figure 6: Schema of organizational structure for drought management recommended in Hungary

## STEP 2: Define the objectives of a drought risk-based management policy

Once the Drought Committee has been formed, its first official action should be the development of a statement on drought policy, noting the move from crisis management to a drought risk reduction approach and the establishment of specific and achievable goals for this policy. The appropriate objectives of the national drought policy, based on the principles of risk reduction, should be specified and adopted at an early stage. The objectives constitute the basis for development and implementation of the DMP and therefore **should be confirmed by the competent authority at the beginning of the drought planning process.**



The main objective of the DMP is to minimize adverse drought impacts on the economy, society, and the environment. It also aims at extending WFD objectives. This main objective can be achieved through a series of specific objectives that should include (as stated in Report 2007) the following:

- guarantee water availability in sufficient quantities to meet essential human needs and to ensure human health and safety during all drought stages
- avoid or minimize negative drought impacts on the status of water bodies, especially on ecological flows and the quantitative status of groundwater, especially through prolonged drought, as stated in Article 4.6 of the WFD
- minimize negative effects on economic activities, according to the priority given to water uses in the River Basin Management Plans in connection with other plans and strategies (e.g. land use planning)

A further recommendation is to create objectives for the development of the DMP:

- define mechanisms and a methodology for detecting and predicting droughts
- establish thresholds for different stages of drought as it intensifies and recedes
- define measures to achieve specific objectives in each drought stage
- ensure transparency and public participation in the development of drought plans

During the drought planning process, a list of concrete management objectives should be established by the Drought Committee as a basis for the development of the programme of measures in the DMP.

The objectives and application of the DMP must also comply with WFD environmental objectives.

## STEP 3: Make inventory of data for the development of the Drought Management Plan

Drought management depends on data that enables a characterisation of drought conditions and a quantification of drought intensity. Therefore, making an inventory of data for DMP development is a necessary step of the Drought Committee in the initial phase, which should include:

- determination of the data needs for DMP development
- analysis of the existing data collection system which could be used for drought risk and impact assessment and data availability
- identification of data gaps and modification of existing data and information delivery systems

Data in the form of drought parameters and indicators are essential for the identification and evaluation of different types of drought. The data needed for DMP development can be grouped into the following categories:

- meteorological data (e.g. temperature, precipitation, snow reserve) – for a quantitative assessment of climate anomalies in terms of intensity, spatial extent, and frequency; and for a characterization of meteorological drought
- hydrological data (e.g. stream flow, reservoir volume, reservoir outflows, spring discharge, groundwater level) – for quantifying the impacts of meteorological drought on water reserves in groundwater and surface water bodies and water quality (e.g. ecological status)
- agricultural data (soil moisture deficit) – for assessing the direct consequences of meteorological drought on soil water storage
- data on environmental impacts – for example, fish mortality, impacts on wetlands (e.g. Natura2000 sites), loss of biodiversity, and forest fire risk

- socio-economic data – for assessing, for example, impacts on households, industry, energy production, transportation, recreation, tourism, and water use
- drinking water supply data – such as water demand, water availability, existing water infrastructure, and water shortages

The key elements of a drought information system are usually monitored by many networks which are operated by different sectors and operators (e.g. state hydrometeorology services, agricultural institutions, nature protection services, stakeholders). Data is often scattered across many databases which are neither interconnected nor readily available for decision-makers, users or the public. **It is necessary to identify weaknesses and obstacles in data accessibility at the very beginning of the process. The establishment of open information channels to ensure an information flow between all sectors, decision-makers at all levels, professionals, and stakeholders is an essential step for further actions.**

It is also necessary to coordinate and harmonise the creation of the national data inventory with countries sharing the respective river basin district to facilitate the development of the international DMP for its entire territory.

An integral part of the process to develop a data inventory is an analysis of the constraints related to data exchange within the European territory that may impede the development of the European Drought Observatory (EDO) which is supported by the Commission (as stated in Blueprint). Similar to many continental and global monitoring platforms, the EDO intensively uses modelling systems to assess drought status. However, many meteorological variables (especially precipitation amounts) are very difficult to accurately simulate using only conventional and remote sensing measurements available through global data exchange. Country drought products prepared from local measurements are therefore crucial for assessing drought status. Moreover, the integration of existing national data into the EDO (which was performed in the IDMP CEE activity “Drought Data Exchange Platform”) increases the visibility of data and enables countries to justify requests for assistance in case of major natural disasters. It is necessary to open data flow channels in order to allow for the development of a transnational drought early-warning system.

The data inventory needed to support DMP development must be connected with the establishment of a national system of drought indicators to describe and evaluate meteorological, hydrological, agricultural, and socio-economic droughts. The creation of data inventories at the national level should be harmonised within river basin districts under the coordination of river basin commissions with the aim to develop joint international Drought Management Plans at the basin-wide level.

## STEP 4: Produce/update the Drought Management Plan

**The Drought Management Plan (DMP) is an administrative tool for the enforcement of a drought policy based on the risk reduction approach. The development of the DMP is a crucial step in the drought management process. Its main components are illustrated in Figure 7.**



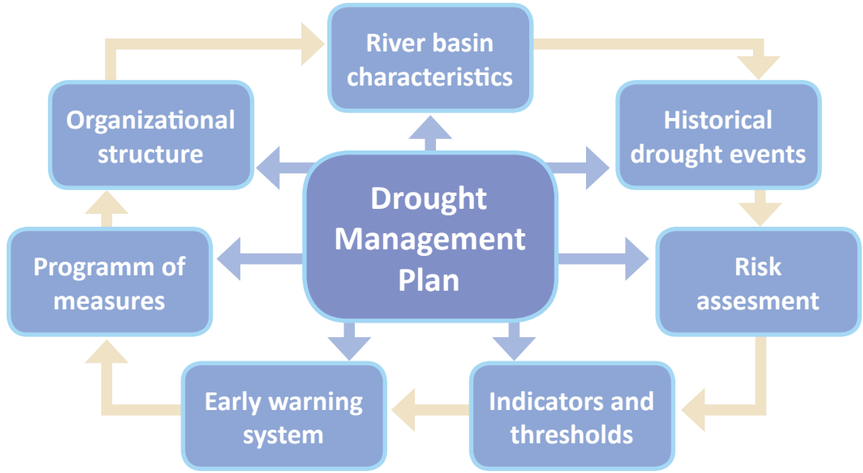


Figure 7: Elements of a Drought Management Plan

Three of the seven elements above are considered to be the key elements of the DMP framework (Report 2007):

- drought indicators and thresholds for drought classification and the drought early warning system
- measures to achieve specific objectives in each drought stage
- the organizational framework to manage drought

The entire planning process for the development of the DMP (Step 4) is divided into seven sub-steps:

**4.1:** Define the content of the DMP

**4.2:** Characterise and evaluate some historical drought events

**4.3:** Establish indicators and thresholds for drought classification

**4.4:** Establish a drought early warning system

**4.5:** Develop the programme of measures

**4.6:** Establish an organizational framework for the production, implementation, and updating of the DMP

**4.7:** Identify gaps and uncertainties

**4.3:** Establish indicators and thresholds for drought classification

**4.4:** Establish a drought early warning system

**4.5:** Develop a the programme of measures

**4.6:** Establish an organizational framework for the production, implementation and updating of the DMP

**4.7:** Identify gaps and uncertainties

### Sub step 4.1 Define the content of the Drought Management Plan

A possible content for the DMP should include (taken from Report 2007):

- general river basin characterisation (national part): basic elements relevant to drought occurrence taken from the RBMPs, such as climate conditions, quantitative and qualitative status of water bodies, water demand, water availability (current amount and trend scenarios), water infrastructure characterization, irrigation systems, protected areas (e.g. wetlands), and land use
- drought characterization based on an evaluation of historical drought events
- indicators and thresholds for the classification of drought stages
- drought early warning system implementation
- programme of measures for preventing and mitigating droughts
- organizational structure of the DMP – the identification of a competent entity, committee or working group which will identify drought impacts and propose management measures
- update and follow-up to the DMP
- water supply plan providing specific information on the existing water supply infrastructure and available groundwater resources usable for mitigating drought impacts
- assessment of prolonged droughts in line with Article 4.6 of WFD (i.e. temporary deterioration of water body status)

### Sub step 4.2 Characterise and evaluate historical drought events

The general objective of the characterisation of historical drought events is to analyse and evaluate drought risk. This is based on a long-term series of meteorological and hydrological data and other historical records associated with the consequences of drought in different sectors (e.g. agriculture, water supply, environment, industry, and forestry). Drought risk is defined as the intersection of the probability of a drought event (hazard) with the potential adverse consequences for people, the environment, and economic activities associated with a drought event (impacts).

**Risk = Hazard x Impacts**

**Hazard** is the probability of occurrence of a given intensity of drought phenomena in a given area. Hazard is dependent on natural conditions (e.g. precipitation, temperature, morphology, and geology) and their mutual interactions. Probability can be described in terms of:

- frequency – number of times occurring in a data series
- duration – number of weeks/months/years that the event lasts
- severity – intensity of the event according to the drought stages

**Impact = (exposure) x (vulnerability)** is the potential impact of a drought event on people (e.g. their water supply), the environment, and economic activities (e.g. agricultural, industry, power production, forestry, and tourism). The intensity of these impacts can be higher depending on the characteristics of the area affected by drought (e.g. population density, type of economic activities, type of natural ecosystems).

**The characterisation and evaluation of historical drought events** must be comprehensive, focused on evaluations of both hazards and impacts, and include assessments of all types of drought (i.e. meteorological, hydrological, agricultural, and socio-economic). Furthermore, it should include two interconnected assessments for: historical meteorological and hydrological monitoring data; and drought impact.



#### Assessment of historical meteorological and hydrological monitoring data

One of the main elements of the drought risk reduction concept is an assessment of the significant drought events that occurred in the past. All available historical datasets recorded during long-term monitoring programmes should be utilised. It is likely that data characterising drought impacts will be scarce. Therefore, meteorological (e.g. precipitation and air temperature) and hydrological data (e.g. water outflow, stream flow, reservoir volume, reservoir outflows, spring discharge, and groundwater level) should be used, as well as other appropriate indicators (e.g. soil moisture). It is important to remember that CEE countries have a seasonal climate – given that annual data can obscure short, extremely dry periods, a seasonal or monthly analysis is therefore required.

The following procedure is recommended for the assessment of historical drought events:

A) Focuses on an evaluation of historical data according to annual values of meteorological indicators (e.g. annual precipitation, annual temperature, and runoff) to characterize each year in terms of drought conditions, with the aim to:

- identify `dry years´
- characterize the intensity of `dry years´ (using terms such as low, medium, and extreme)
- evaluate a trend assessment of drought occurrence
- select significant dry years for a detailed evaluation of past drought events

B) Focuses on a more detailed evaluation of the selected significant dry years. The characterisation of each of these drought events should include an evaluation of:

- the temporal and spatial distribution of drought within the river basin (national level)
- the duration and evolution of drought during the drought event (e.g. based on a seasonal and/or monthly assessment of drought indicators)
- the severity of drought according to the classification of drought status (pre-alert, alert, emergency), and identification of drought-prone areas characterising the probability of occurrence of meteorological, hydrological, and agricultural drought within the national part of river basins or sub-basins through hazard maps
- the impacts of drought events on human and economic activities as well as on the environment, and a visualization of impacted areas on risk maps (if data is available)

C) Focuses on the evaluation of climate change and its consequences on drought occurrence and the severity of drought impacts. The objectives of the climate change assessment are to:

- identify current and future trends through meteorological indicators (e.g. precipitation, temperature)
- detect the possible effects of climate change on the frequency of drought and the severity of drought impacts through future scenarios
- design a system of adaptation measures that reduce the impact of climate change on droughts

The recommendations for the climate change evaluation are summarised in Section 4.3 of the Guidelines.

Drought is a national or regional phenomenon that can be characterised by its severity, duration, and geographic extent. It requires an accurate selection of drought identification methods and drought indicators (e.g. meteorological and hydrological) suitable for a clear description of drought conditions and its evolution in space and time. Criteria for assessing drought intensity (i.e. low, medium, and high) are also needed. The appropriate set of indicators and methodology should be selected according to the type of drought (e.g. meteorological, hydrological) and purpose of the analysis (e.g. evaluation of long-term data series, detailed characterization of historical drought events).

A review of the national methodologies used in individual CEE countries is presented in the box below. It shows that an inconsistent set of approaches and parameters is being used for drought assessment. In addition, there is a diversity of natural conditions within the CEE region. As a result, harmonising the indicator system and methodology for drought risk assessment across the region currently appears very difficult. A future vision is therefore needed to **support the development of a joint approach at the regional or river basin level (e.g. to develop a DMP for the Danube River Basin District**).

**Examples of national methodologies for the assessment of past drought events**

In **Hungary**, the Pálfay index (based on daily values) and Drought Pálfay index (based on monthly values) are used to assess long-term series of meteorological data. Both indexes are calculated using statistical values of precipitation and air temperature while taking into account seasonal climatic conditions. Six drought categories represent the criteria for drought intensity.

In **Bulgaria**, the methodology is based on the statistical analysis of a long-term series of average annual precipitation and temperature values compared to long-term values (1961-1990). This method enables the identification of positive and negative (drought) anomalies. A similar methodology is used in **Slovakia**.

In **Slovenia**, precipitation distribution is one of the basic identifiers of drought occurrence in a given region. To assess the impacts of drought on plants, the hydrological water balance is used. Furthermore, the Decadal index of drought stress (DISS) was developed specifically to monitor agricultural stress from drought for major crops.

In **Lithuania**, the main diagnostic tool for the identification of drought severity is the hydrothermal coefficient (HTC) of Selyaninov. A supporting index is the persistency of a period without precipitation.

In **Moldova**, trend analysis is used to assess tendencies based on meteorological data.

In the **Czech Republic**, the methodology focuses on meteorological drought characterization based on an assessment of the extremity of monthly precipitation and temperature and their combination. Drought intensity is assessed according to a criteria set of six drought categories (for temperature and precipitation).

**Poland** developed a national methodology based on the classification of meteorological drought using an analysis of the number of dry months in selected basins in the period 1966-2005. Another methodology, for the same period, focuses on hydrological drought assessment characterised by maximum low-water periods, taking into consideration the water deficit as well as the duration of the maximum low-water period. The drought classification system includes five drought categories.

In **Romania**, a different methodology is used which is based on a soil moisture indicator (calculated according to the soil water balance model) and an assessment of water resources using hydrological, hydrogeological, and meteorological data.

In **Ukraine**, a very complex methodology is used for drought analysis, with nine indicators (chosen from 35) based on, for example, precipitation, temperature, elasticity of water vapour in the air, and the content of productive moisture in soil.

**Source**: www.gwp.org/en/GWP-CEE/IDMPCEE/National-Planning



## Drought impact assessment

Impact assessment examines the consequences of a given drought event on human and economic activities as well as on the environment. Impact assessment should be part of the assessment of historical drought events (if data is available), and inevitably must be part of the risk assessment of future drought events. Drought is usually associated with a number of impacts that result from a reduction of water availability during a drought period or episode. Drought can affect a wide range of water-dependent users in different sectors. It is necessary to evaluate a potential impact for each user (or group of users) and subsequently make a comprehensive impact assessment for the whole area. It is appropriate to classify the types of impacts into three categories: economic, environmental, and social. A detailed checklist of impacts is provided in Table 1 (Source: Drought Management Guidelines: prepared by European Commission, MEDA Water, and MEDROPLAN).

**Table 1: Overview of main drought impacts**

| Category of drought impact | Drought impact |
|---|---|
| ECONOMIC | Decreased production in agriculture, forestry, fisheries, hydroelectric energy, tourism, industry, or financial activities that depend on these sectors |
| | Unemployment caused by decreased production |
| | Economic damage due to reduced navigability of streams, rivers, and canals |
| | Damage to the tourism sector due to reduced water availability in water supply and/or water bodies |
| | Pressure on financial institutions (e.g. more risks in lending, capital decrease) |
| | Income reduction for water firms due to reduced water delivery |
| | Costs in emergency measures to improve resources and decrease demand (e.g. additional costs for water transport and removal, costs for advertising to reduce water use) |
| ENVIRONMENTAL | Decreases in water supply and the quality of surface water and groundwater |
| | Damage to ecosystems, wetlands, and biodiversity (e.g. soil erosion, dust, reduced vegetation coverage) and disease |
| | Land degradation and desertification |
| | More and larger fires |
| | Lack of feed and drinking water |
| | Increased salt concentrations (e.g. in streams, underground layers, irrigated areas) |
| | Loss in natural and artificial lakes (fish, landscapes, etc.) |
| | Damages to river and wetlands life (e.g. flora, fauna, habitats) |
| | Damage to air quality (e.g. polluting dust) |
| SOCIAL | Damage to public health and safety, by affecting air and water quality or increased fire risk |
| | Increase in social inequality, through larger impacts on specific socio-economic groups |

| Category of drought impact | Drought impact |
|---|---|
| SOCIAL | Tensions between public administrations and affected groups |
| | Changes in political perspectives |
| | Inconveniences due to water rationing |
| | Impacts on way of life (e.g. unemployment, reduced capacity to save funds, difficulty in personal care, reuse of water at home, street and car washing prohibition, doubt on future, decrease of celebrations and amusements, loss of property) |
| | Inequity in drought impacts and mitigation measures distribution |
| | Abandoning of activities and emigration (in extreme cases) |

For each of the identified users (e.g. groups, sectors), a potential drought impact should be quantified using a set of appropriate indicators. For economic sectors (e.g. industry, agriculture, power production, forestry), economic criteria are usually used. For example, impacts on agriculture can be quantified in terms of production losses. For urban water supply, the shortage of water in meeting water demands (e.g. drinking water) should be calculated. For environmental impacts, the number of fires and fish mortality are often used as impact indicators.

It is necessary to emphasise that the identification and quantification of impact indicators is difficult and substantial efforts are required to find relationships between impact indicators and physical indicators (e.g. climate, hydrological). It is recommended to evaluate each indicator and their interrelationships after each drought event and revise them if needed. An update of indicators and thresholds should be part of the "iterative" drought risk management process.

Drought impacts affect many sectors. Some sectors have no responsibility to monitor and record drought impact data. As a result, in contrast to meteorological records, which are usually stored by one state institution, the records (e.g. databases) of sectoral drought impacts, if they exist, are scattered across many institutions with limited access for other users.

It is therefore the task of the Drought Committee to overcome this problem (e.g. upgrade monitoring programmes, establish information system) and facilitate the development of drought impact assessment using drought impact indicators.

Drought impact assessment is a basis for the characterization of agricultural drought and socio-economic drought. It also provides basic information on the extent and severity of possible future droughts (through risk assessment).

The output of an impact assessment should include the:

- identification of affected users (e.g. groups, sectors)
- identification of types of direct drought impacts
- assessment of expected damages caused by drought
- ranking of impacts – identification of prioritised impacts
- identification of areas with a potential risk of drought impacts, through risk maps



### Drought risk assessment

The results from the assessment of historical drought events (including the drought impact assessment) should be used for the risk assessment process. According to the general recommendations of the EU Guidelines (Risk Assessment and Mapping Guidelines for Disaster Management), the risk assessment process should be composed of the following processes:

- risk identification – finding, recognizing, and describing risks
- risk analysis – determining the level of risk (i.e. the quantitative estimation of the probability of occurrence and severity of potential drought impacts)
- risk evaluation – evaluating the significance of the drought risk

Details can be found in the EU Guidelines noted above which are intended for multi-risk assessment. However, a step-by-step approach can also be used for a single risk assessment of drought.

The results from the evaluation of historical drought events and risk evaluation are needed for decision-makers to set specific targets (objectives) for the development of a programme of mitigation measures.

## Sub-step 4.3 Establish indicators and thresholds for drought classification

This sub-step is closely connected with the assessment of historical drought events. Therefore, some indicators should be developed during sub-step 4.2. The process includes two interconnected steps:

- establish the national drought indicators system
- establish thresholds for different drought stages

### Establish the national drought indicators system

A national drought indicator system is one of the key elements of the DMP. It is an essential step in drought management which enables the identification and evaluation of drought conditions and the quantification of drought impacts. Due to the complexity of drought variability caused by climatic and geographic conditions, different parameters should be included in the national indicators system.

The national indicator system should be comprehensive, comprising of appropriate parameters and indicators needed for the characterization and evaluation of each type of drought, including the evaluation of different time categories of drought (e.g. historical drought event, ongoing drought episode, future drought). The complete drought indicator system should include different sets of indicators which can be grouped into the following sub-systems:

- Sub-system 1: appropriate indicators for the evaluation of different drought types:
  - meteorological drought based on climate parameters – e.g. precipitation, temperature, evapotranspiration
  - hydrological drought based on hydrological parameters – e.g. river flow, groundwater level
  - agricultural drought based on parameters characterising the water deficit in soil (i.e. soil moisture indexes)
  - socio-economic drought based on a socio-economic impact assessment

- Sub-system 2: sets of indicators appropriate for the:
  - evaluation of historical or past drought events
  - national drought early warning system

- Additional sets of indicators are needed for the identification of a `prolonged drought´ and the evaluation of impacts associated with the temporary deterioration of surface water quality (i.e. where the `good ecological status´ of water bodies, as required by the EU WFD, is not met).

Activities at the EU level are intended to solve drought issues at the river basin level, within the context of WFD implementation. For this purpose, a set of common EU drought indicators was established through the CIS. Detailed information describing each EU indicator (e.g. definition, relevance of indicator to drought, technical information including methodology for calculation) is included in the document Water scarcity and drought indicators Fact sheets developed within the CIS process (TYPSA, December 2013). To date, seven indicators (see Table 2) have been developed and endorsed by Water Directors – the official representatives nominated by EU countries.

**Table 2: EU drought indicators**

| Drought indicator | Drought type |
|---|---|
| FAPAR (Fraction of absorbed photosynthetically active radiation) | Meteorological drought |
| H (Groundwater level) | Hydrological drought |
| SSPI (Standardized snowpack index) | Meteorological drought |
| Soil moisture | Agricultural drought |
| SPI (Standardized precipitation index) | Meteorological drought |
| SRI (Standardized runoff index) | Hydrological drought |
| WEI + (Water exploitation index plus) | Water scarcity |

There is an expectation that these indicators will create the basis for a European indicator system enabling the development of the European Drought Observatory (EDO) which will act as an early warning system for Europe. Member States will be encouraged to carry out evaluations of drought on the national level according to indicators approved within the CIS process. Therefore, a European indicator system should become a basis of the national drought indicator system in each Member State. This will help the development of DMPs for entire river basin districts (e.g. Danube).

It is therefore strongly recommended to include EU drought indicators into each specific national drought indicator system in order to have a harmonised approach at the river basin level. While EU indicators should form the basis of a national indicator system, these should be supplemented by country-specific indicators taking into account the variability of climate and geographic conditions. It is important to remember that the development of a European indicator system is an on-going process bringing new incentives and changes.

| Review of additional national indicators used in CEE countries | |
|---|---|
| **Bulgaria** | Aridity Index (De Martonne), Palfai Index (PAI), Palfai Drought Index (PaDI) Standardized Flow index (SFI), Standardised groundwater index (SGI), and Canadian Fire Weather Index (FWI) |
| **Hungary** | Aridity Index (De Martonne), Palfai Index (PAI), and Palfai Drought Index (PaDI) |
| **Czech Republic** | Amount of usable water in loam soils, Basic water balance of grasslands, Potential evapotranspiration of grassland, weekly amount of precipitation, and Danger of Fires Index (DFI) |
| **Lithuania** | Percent of Normal, (PN) Deciles (PD), Effective Drought index (EDI), Stream flow Drought Index (SDI), and Selianinov hydrothermal coefficient (HTC) |
| **Moldova** | Dry Periods Index (IZU) after M. Nedealcov, and Climatic resources |



| Review of additional national indicators used in CEE countries | |
|---|---|
| **Poland** | Standardized Precipitation Index (SPI), Climatic Water Balance (CWB), Threshold Level Method (ThLM), and Ground Drought Risk Index (KN) |
| **Romania** | Palmer Drought Severity Index (PDSI), Standardized Precipitation Evapotranspiration Index (SPEI), Standardized Precipitation Index (SPI), Soil moisture reserve, precipitation and air temperature (statistical methods based on monthly and yearly values), stream flows (statistical indicators), and Groundwater levels |
| **Slovakia** | Palmer Drought Severity Index, Tomlain climatic indicator of irrigation, Konček index of irrigation, and forecast of forest fire risk index |
| **Slovenia** | Ten-day totals and comparison to long-term average (temperature, precipitation and sunshine radiation, water balance, evapotranspiration), water availability of plants, phenological development and impact of weather (drought) on plants, outlook for five days, Soil Water Balance, Precipitation Percentiles, Standardized Precipitation Index (SPI) |
| **Ukraine** | Standardized Precipitation Index (SPI), hydrothermal indicator (HTI) of Selyaninova, humidification indicator of Shashko (Md), Moisture Content Indicator of Protserova, number of days with relative humidity ≤ 30% (No), number of days with maximum temperature > 30 °C (NT), content/supply of productive moisture in 0-20, 0-50, 0-100 cm soil layer of the lands with winter, early spring and late ardent crops (W0-20, W0-50, W0-100) |

**Source**: http://www.gwp.org/en/GWP-CEE/IDMPCEE/National-Planning

(**Note**: Within the IDMP CEE Activity 1.3 Drought Data Exchange Platform, some of the indices mentioned above (calculated on a regular basis) were included in the European Drought Observatory: http://vap-xjedo.jrc.it/Search/Search.html)

The review of the national indicator systems used in CEE countries reveals two problems:

- A lack of homogeneity of the national indicator systems within the CEE region makes a comparison of the drought situation among countries and the development of a joint DMP at the river basin scale impossible.
- There are no examples of socio-economic indicators enabling an assessment of drought impact on society and economic activities. More attention should be paid to an evaluation of socio-economic drought.

## Thresholds for different drought stages

Drought should be characterised according to different levels of drought intensity and impact severity. The recommendation is to follow the Report 2007 which provides drought classification definitions for four drought stages characterised as:

- Normal status – no significant deviation in relation to average values is observed
- Pre-alert status – declared when monitoring shows the initial stage of drought development
- Alert status – declared when monitoring shows that drought is occurring and will probably have impacts in the future if measures are not taken immediately
- Emergency status – declared when drought indicators show that impacts have occurred and water supply is not guaranteed

**A more detailed characterization of drought stages, as stated in the Report 2007, follows:**

**Normal status:** This is the stage where hydrological planning occurs and where strategic and long-term measures are applied. These measures relate to water demand management (i.e. water efficiency), hydraulic infrastructure to improve the storage and regulation capacity of the river basin, infrastructure that promotes the use of non-conventional resources (e.g. facilities that re-use treated water), and any other measures with extended time frames.

**Pre-alert status:** The objective here is to prevent the deterioration of water bodies while ensuring the activation of specific drought management measures and meeting water demands. These are mainly informative and control measures, as well as voluntary water-saving measures.

**Alert status:** This is an intensification of the pre-alert status, where drought, and measures to address it, increase. A priority is to prevent the deterioration of a water body's status. Measures focus on saving water. Demand restrictions might be applied, depending on the prioritization of the most vulnerable groups affected by drought. Areas with high ecological value should be monitored more intensively to prevent deterioration.

**Emergency status:** If all previous prevention measures have been applied, the drought situation becomes critical, and water resources are insufficient to meet essential water demands (affecting and restricting public supply), then additional measures may be used to minimize the impacts on water bodies and ecological systems.

The classification system must be based on threshold values that have been determined for the chosen drought indicators. Thresholds are typically designed for meteorological and hydrological indicators. The thresholds used in individual countries (box below) are diverse, making the adoption of a joint drought classification currently impossible. The information gathered during the NCDs should be subject to further evaluation focused on a harmonization of national approaches.

| Examples of thresholds defining drought categories | |
|---|---|
| **Lithuania** | Application of a classification system based on two indices – the hydrothermal coefficient (HTC) and the persistency of dry spell (PDS). The thresholds for the HTC apply to three drought conditions – dry, drought, and severe drought. |
| **Moldova** | Thresholds through the Dry Period Index (IZU) define five drought categories – normal period, moderate dry period, significant dry period, dangerous dry period, and exceptional dry period. |
| **Poland** | Thresholds refer to a ground drought risk index (KN index) that is divided into three categories – no risk, risk of a low-water period, and low-water period ¬– to justify warnings and measures. |
| **Romania** | Thresholds for soil moisture reserve – an agrometeorological indicator that expresses the water supply degree of the soil function of the water demand of the agricultural plants at various times of the year and depths (i.e. 0-20 cm, 0-50 cm, and 0-100 cm). Threshold values classify drought into six drought humidity classes – extreme pedological (i.e. soil-related) drought, severe pedological drought, moderate pedological drought, satisfactory supply, optimal supply, and above normal moisture values. |
| **Slovakia** | Proposal of threshold values for four types of indicators – precipitation, river flow, groundwater level, and soil moisture deficit. Thresholds represent the limit values for four drought stages – normal, pre-alert, alert, and emergency. |
| **Slovenia** | Three-level concept for agricultural drought assessment – precipitation deficit, meteorological water balance, and agricultural drought crop stress. Thresholds for three drought stages have been set for levels 2 and 3. |
| **Ukraine** | Classification system with five classes by drought intensity – very strong, strong, medium, weak, and absence of drought. Threshold values were set for eight indicators: HTI, Md, V, No, NT, W0–20, W0–50, and W0–100. |

**Source:** http://www.gwp.org/en/GWP-CEE/IDMPCEE/National-Planning

The threshold values characterising drought stages should be re-evaluated and updated frequently (at least after each drought event). A post-drought evaluation should include an inter-calibration of threshold values of the chosen drought indicators e.g. meteorological, hydrological, impact indicators) in order to find relationship between impact indicators and physical indicators. The regular revision should identify weaknesses in the classification system and remove inconsistencies found during the past drought event when drought indicators fell into different drought stages.



## Sub-step 4.4 Establish drought early warning system

One of the main objectives of the DMP is to establish a reliable early warning system based on appropriate indicators and thresholds that classify drought stages according to drought intensity and impact severity.

The main objective of the early warning system is to provide timely warnings about:

- actual drought status in real time to enable decision-makers (Drought Committee) to take adequate measures (e.g. arrange a meeting of the Drought Committee)
- drought severity for stakeholders (e.g. farmers) that could be potentially affected by drought, currently or in the near future, enabling them to take appropriate measures (e.g. activation of irrigation systems)

Early warnings should be provided according to time period (adjusted according to stakeholder requirements):

- short-term warnings (1-7 days)
- medium-term warnings (10-15 days)
- seasonal forecasting (3-6 months)

To obtain timely information and a sufficient amount of spatial data about the actual drought situation, it is necessary to analyze the existing monitoring network for drought indicators that have been selected for the early warning system. The analysis should focus on examining the number of monitoring stations and frequency of measurements. An effective warning system should provide real-time information that is updated at least weekly. Usually, an upgrading of the existing monitoring system is needed, to increase the frequency of measuring the chosen indicators. A rational selection of representative monitoring stations is also needed to ensure comprehensive coverage.

One of the recommended agricultural drought monitoring methods (tested within IDMP CEE Activity 5.5) uses remote sensing data for the appropriate early warning of droughts before irreversible crop yield loss and/or quality degradation occur. (See description: www.gwp.org/GWP-CEE/IDMPCEE/)

To deliver early warnings to the general public, it is recommended to use existing technical means that are being applied to other types of warnings (e.g. floods). It is usually possible to transfer information to the public through web and/or electronic communications, media (e.g. radio, TV), or special brochures.

A description of the early warning system should be included in the DMP.

**Table 3: Early warning system in Slovenia: three-level concept of agricultural drought monitoring**

| Level | Activity | Description | Indicators |
|---|---|---|---|
| Level 1 | Early drought warning | Precipitation deficit (meteorological drought) | SPI3 < –1,<br>Share of cumulative precipitation in the vegetation period (% of long-term average) |
| Level 2 | First signs of agricultural drought | Meteorological water balance (reference crop) | Meteorological water balance below statistical threshold (percentile analysis):<br>- $75^{th}$ percentile – dry<br>- $90^{th}$ percentile – very dry<br>- $98^{th}$ percentile – extremely dry |
| Level 3 | Agricultural drought | Agricultural crop drought stress (water balance for specific crop) | $DISS_k$ for selected crop:<br>- $75^{th}$ percentile – dry<br>- $90^{th}$ percentile – very dry<br>- $98^{th}$ percentile – extremely dry |

**Example of early warning system in Romania**

Romania's functioning system delivers early warnings to the general public through:

**1. Standard agro-meteorological bulletin:** disseminated to the Presidency, Government, Ministry of Environment and Forests, and Ministry of Agriculture and Rural Development, for informational and decision-making purposes

**2. Specialized agro-meteorological bulletin and forecasts:** disseminated to farmers through mass-media. Periodic broadcasts (i.e. Village Life) are made through public radio and TV with national and regional coverage, targeting rural audiences.

**3. Agro-meteorological forecasts for several specialized publications and magazines:** disseminated weekly or monthly in electronic format (www.gazetafermierului.ro; www.profitulagricol.ro; www.revista-ferma.ro) and paper format (*Village World*).

## Sub-step 4.5 Develop a programme of measures

A programme of measures is a crucial element of a DMP. Its main objective is to minimize the risk of drought impacts on the economy, society, and environment. A programme of measures should be designated for each drought stage (i.e. normal, pre-alert, alert, and emergency). The measures can be classified according to their purpose and grouped as follows (as stated in Report 2007):

- preventive or strategic
- operational
- organizational
- follow-up
- restoration

***Preventive or strategic measures*** are developed and used under normal status. The aim is to increase resistance to drought and mitigate potential drought risk and impacts on the economy, society, and environment. The program of preventive measures should be interconnected with the program of measures included in RBMPs and FRMPs developed in line with WFD and Flood Directive requirements. The direct links between drought issues covered by the DMP and integrated water management issues covered by RBMPs should be ensured through an assessment of groundwater quantitative status and of the ecological status of surface water bodies (more details in Chapter 4 of the Guidelines).

Preventive or strategic measures included in the DMP are only complimentary to those measures adopted in the RBMP that relate to quantitative groundwater status and ecological surface water status aimed at achieving good water body status. They can also contribute to the mitigation of drought risk. Clear links between both programmes of measures in the RBMP and DMP must be ensured.

In order to improve the resilience of aquatic ecosystems, it is necessary to follow the water efficiency options and suggestions provided in the Communication from Commission A Blueprint to Safeguard Europe´s Water Resources, adopted in 2012 (Blueprint). **Green infrastructure**, particularly **natural water retention measures (NWRM),** is among the measures that greatly contribute to limiting the negative effects of droughts. This includes restoring floodplains and wetlands which can hold water in periods of excessive precipitation. NWRM can provide multiple benefits for various sectors and policies and should be included in action plans (e.g. River Basin Management Plans, Flood Risk Management Plans, Rural Development Programmes, Adaptation Strategies, Natura 2000 management plans, and local development plans).



Within the IDMP CEE demonstration project (Activity 5.3), guidelines on NWRM were prepared (see www.gwp.org/GWP-CEE/IDMPCEE/). These are supplemented by several examples of good practices applied in CEE countries. Similar NWRM guidelines that present alternative green infrastructure to classical grey infrastructure (e.g. dikes, reservoirs, ponds, and canals) have been developed through the CIS process by the Commission, Member States, and stakeholders in 2014 (Technical Report – 2014 – 082) .

Another measure that can diminish drought risk is the reduction of soil sealing by **increasing water holding capacity in the soil** – this is also a good example of an agro-environmental measure supported by the EU Common Agricultural Policy. Details of this methodology, accompanied by examples from four CEE countries, are described in the IDMP CEE Activity 5.1 report: *Increasing soil-water holding capacity in agriculture* (see http://www.gwp.org/GWP-CEE/IDMPCEE/).

An alternative water supply option is **water re-use for irrigation or industrial purposes**. While it is expected that a regulation establishing common standards (e.g. health, environmental) will be proposed by the Commission and completed soon, possibly in 2015, current use of this instrument is limited.

The program of preventive and mitigating measures included in the DMP should also become a part of a cross-sectoral and multi-hazard risk management plan (including flood risk and climate change) based on an integrated disaster management approach. The identification, selection, and prioritization of cost-effective adaptation measures should be based on a multi-criteria analysis reflecting, at least, time-effectiveness, costs, benefits, and general acceptability.

***Operational measures*** are typically applied when droughts occur, during pre-alert and emergency status. Operational measures should be based on the management objectives specified for each drought stage (Report 2007).

### (1) Pre-alert

The management objective in the pre-alert phase is aimed at preparing for the possibility of drought impacts and preparing the Drought Committee and affected stakeholders for future actions. The main actions should be focused on: the activation of the Drought Committee; intensification of monitoring; and managing a drought early warning system that increases public awareness and evaluates future scenarios. The measures in the pre-alert situation are generally of an indirect nature (e.g. recommendations), implemented by stakeholders on a voluntary basis (e.g. through irrigation measures).

### (2) Alert

The management objective here is to overcome the drought and avoid the emergency situation. The priority is to mitigate drought impacts that have already affected specific water use groups and prevent the deterioration of a water body's status. Measures should preferably be focused on saving water. Demand management measures, including partial restrictions for water uses, may be applied, depending on their socio-economic impacts and the consensus of affected stakeholders. Areas with high ecological value should be monitored more intensively to prevent their deterioration.

### (3) Emergency

The management objective is to mitigate impacts and minimize damages. The priority is to satisfy the minimum requirements for drinking water. Other water uses are second priority. Measures adopted under drought emergency conditions may be: non-structural, such as water restrictions for all users (including urban), or subsidies and low interest loans; or structural, such as new infrastructure, permission for new groundwater abstraction points, and water transfers.

The application of operational measures should be linked to specific advisory services. For example, advisory services for irrigation have been established in some countries to provide information to farmers about the recommended irrigation dose at a given stage of drought.

***Organizational measures*** establish an appropriate organization to ensure the production and implementation of the DMP and the enforcement of programmes of measures. They can also create coordination protocols among administrations and public and private entities directly affected by the drought, especially those managing public water supply. Organizational measures should be specified for all drought stages.

***Follow-up measures*** assess compliance with the DMP and the effects of its implementation.

***Restoration or exit drought measures*** include the deactivation of measures adopted during the drought event (e.g. restrictions for water abstraction) and the activation of restoration measures aimed at the achievement of normal status for water resources and the aquatic ecosystem.

## Sub-step 4.6 Establish organizational framework for the production, implementation, and updating of the Drought Management Plan

It is important to remember that drought management based on risk reduction has three DMP phases:

- production
- implementation
- review/update

A Drought Committee should ensure the execution of all phases. Specific tasks needed for each phase should be included in the DMP.

This chapter of the DMP should contain basic information about the establishment of the drought management organizational structure needed for the production, implementation, and update of the DMP. While the organizational structure is a key element of effective drought management, its creation is not regulated by EU legislation. Therefore, a variety of different organizational arrangements and steering-system diagrams can be applied. At the same time, the main principles of integrated water management (i.e. the integration of drought management into water management according to the WFD) and the participatory approach (i.e. the involvement of all affected actors) must be ensured in any case.

The following elements should be included in the DMP:

- information on the results of policy actions -- identification of competent authority, and establishment of Drought Committee and working groups
- list of involved sectors, institutions, and stakeholders
- organizational arrangements and allocation of the roles and responsibilities of individual committee members
- coordination among competent authorities, entities, and stakeholders
- description of the planning process for the production of the DMP: (1) as a part of the RBMP, respecting the same planning cycles for update (six years) and deadlines for WFD planning documents, including its public participation process; or (2) outside the scope of the WFD planning process
- details on DMP implementation (e.g. enforcement of programme of measures, monitoring of the measures, evaluation of the effectiveness of the executed measures)
- details on the activation of the early warning system
- operational measures needed during the drought occurrence for mitigating impacts (e.g. regulation measures)
- post-drought evaluation of drought impacts and a process for adopting follow-up and restoration measures
- evaluation and update of the DMP
- contact points and procedures for obtaining the background documentation and monitoring data gathered during the drought episode
- summary of the public information and consultation measures taken with the aim to encourage public participation
- obligations at the transnational/river basin level



## Sub-step 4.7 Identify gaps and uncertainties

Before development of the first DMP, a comprehensive analysis of current drought management according to the criteria summarised in Table 4 is recommended.

**Table 4: Recommended key elements and criteria for the identification of gaps and uncertainties**

| Elements | Criteria |
|---|---|
| **Legislation** | Legislation in compliance with WFD in place |
| | National regulations for drought management in place |
| **Administrative arrangements** | Competent authority for drought management designated |
| | State administrative bodies (e.g. ministries, local state authorities) listed |
| | Professional institutions dealing with drought identified |
| | Stakeholders potentially affected by drought identified and listed |
| | Drought Committee established |
| | Drought Committee mandate issued |
| | Working groups established |
| | Objectives for drought management defined |
| **Drought risk reduction policy** | Drought policy based on principles of risk reduction developed |
| | Drought risk reduction policy/strategy approved by the Government |
| **Data inventory** | Data inventory of precipitation and temperature analysed |
| | Data inventory for meteorological drought assessment analysed |
| | Data inventory for agricultural drought assessment analysed and completed |
| | Data inventory for socio-economic drought assessment completed |
| | Data availability for DMP development ensured |
| **Drought Management Plan** | Complex drought indicator system established |
| | Thresholds for drought stages determined |
| | Drought classification system completed |
| | Assessment of historical drought events completed |
| | Drought risk assessment completed |
| | Drought hazard and risk maps completed |
| | Early warning system functioning |
| | Program of measures developed (preventive, operational organizational, follow-up, and restoration) |
| | Drought Management Plan made publicly available |
| **Links between DMPs, RBMPs, FRMPs** | Link between drought assessment in DMPs and groundwater quantitative status assessment in RBMPs ensured |
| | Drought issues and water scarcity issues clearly distinguished |
| | Link between drought assessment in DMPs and ecological status assessment in RBMPs ensured |
| | Interactions between programme of measures between planning documents (DMPs, RBMPs, FRMPs) ensured |
| **Climate change** | Assessment of impacts of climate change on frequency of drought occurrence and severity carried out |

The first DMP is usually based on available monitoring data that may be insufficient or of poor quality. Therefore, an evaluation of the quality of the data used for DMP development is also recommended. The evaluation should identify the main weaknesses of the information system (e.g. lack of data, imprecise data) requiring attention in the next phases. For example, it is expected that the data characterising social-economic drought (e.g. impacts on society and the economy) can be missing in the first DMP.

This identification of gaps and uncertainties should be supplemented by designing specific measures to improve data collection and evaluation. The identified gaps and uncertainties should also be used as a basis for designing a research programme (see Step 6 below).

The process of identifying gaps and uncertainties should be repeated regularly (at least once during each six-year planning cycle).

## STEP 5: Publicize Drought Management Plan for public involvement

The aim of publicizing the DMP is to encourage public participation and the active involvement of interested parties in the production, implementation, and updating of the DMP. Public participation is an essential element of the drought management system and representing an opportunity to achieve consensus around the social, economic and environmental aspects of the plan. The process of public participation relates to:

- publishing the DMP (including provisional planning documents)
- making the DMP available for comments
- consultations aimed at active involvement of the interested parties

### Publication for comments

If the DMP is developed within the context of the WFD as an additional planning document, then its publication will be ensured together with that of the RBMP, in accordance with WFD rules (according to Article 13.5, the DMP must be part of, and be published together with, the RBMP). The procedure for ensuring public information and participation is defined in Article 14 of the WFD. Member States are required to publish RBMPs (and the DMP), and to make available the following provisional planning documents for public comment:

- timetable and work programme for the production of the plan
- interim overview of the significant water management issues identified in the river basin, at least two years before the beginning of the period to which the plan refers
- draft copies of the RBMP, at least one year before the beginning of the period to which the plan refers

Both the RBMP and DMP should contain at least basic information on the relevance of drought issues supported by relevant evidence. The public has the right to comment on the documents within a six-month period.

The public must have access to all background documents used for the development of the RBMPs and DMPs. If the DMP is developed outside the scope of RBMP development (e.g. in the middle of planning cycles), then similar procedures for publicizing the DMP and making the draft publicly available for comments should be applied by the Drought Committee.

Details on how to organize a public participation process are provided in CIS Guidelines No. 8 Public participation, as required by the Water Framework Directive.

Public participation in DMP development is also obligatory as DMPs fall within the scope of the Strategic Environmental Assessment (SEA) Directive which requires active participation based on the principles of the Aarhus Convention.

### Consultation

After receiving comments, a consultation processes should be launched. The Drought Committee should develop a consultation strategy and communication plan in advance. Basically, there are two forms of consultations:



- written
- oral or active consultations that can be organized in different ways (e.g. bilateral meetings, workshops, conferences)

Once the consultations are completed and the related changes to the DMP have been made, then a summary about the consultation process and related changes should be prepared and shared with interested parties who were involved in the consultations.

## STEP 6: Develop research and science programme

The Drought Committee should identify the needs of a national scientific and research programme which can contribute to a better understanding of drought, its impacts, and mitigation alternatives. The development of the programme should be connected with the process which identified gaps and uncertainties during DMP production, taking into account relevant related issues (e.g. existing knowledge on climate change and its impacts on water resources, new effective monitoring methods based on remote sensing data, harmonisation of data inventory).

**Key current research topics for IDMP CEE**

Based on an evaluation of existing national drought policies, key themes have been proposed which include:

- harmonisation of data collection and monitoring (Hungary, Romania, Czech Republic; and forest monitoring in Ukraine)
- improvement of planning processes – e.g. drought indicators, historical evaluation, and drought forecast (Poland, Moldova, Hungary); methodology for risk assessment including the development of hazard and risk maps (Romania, Lithuania, Slovakia)
- improvement of agricultural drought management (Slovenia)
- support for the implementation of measures – e.g. limiting water supply system leakages, increasing reservoir volume, construction of small water storage ponds, use of treated waters for irrigation (Bulgaria, Slovakia, Hungary); increasing soil water holding capacity (Slovakia, Poland, Czech Republic, Hungary); determination of e-flows (Lithuania, Slovakia)
- climate change modelling (Czech Republic, Lithuania, Slovakia)

**Source:** http://www.gwp.org/en/GWP-CEE/IDMPCEE/National-Planning

## STEP 7: Develop an educational programme

A broad educational programme should be developed by the Drought Committee. The goal is to raise awareness of the new drought risk management policy by providing information on the DMP and the programme of measures associated with the needs of specific groups affected by drought. Educational programmes should be preferably oriented to interested groups at the local level (e.g. decision-makers, farmers, municipalities).

The development of education programmes includes:

- establishment of a task group responsible for training activities
- identification of vulnerable groups potentially affected by drought and groups having the potential to influence an outcome (e.g. decision-makers)
- scope, time frame, form (e. g. workshops, education trainings)
- development of training materials

# 4. Related issues

This chapter summarises the basic information on issues which are regulated by the WFD and which are directly linked with the drought risk assessment. While the drought issues described in the previous chapter are based on non-legally binding recommendations, groundwater quantitative status and prolonged drought assessment (part of the ecological status assessment of surface water), and climate change aspects (to some degree), are subject to WFD binding regulations. These elements must be an integral part of RBMP development. A direct linkage between quantitative groundwater status assessment, climate change assessment, and drought risk assessment is a necessary condition for the development of an effective DMP.

## 4.1. Groundwater quantitative aspects

Groundwater quantitative aspects covered by the WFD are associated with environmental objectives set for groundwater. A general objective is the achievement of good quantitative status by 2015. Quantitative status expresses the degree to which a water body is affected by direct and indirect abstractions. One main aim is to ensure that available groundwater resources are not exceeded by the long-term annual average rate of abstraction. Another is that the groundwater level is not subject to anthropogenic alterations resulting in damages to associated surface waters and terrestrial ecosystems (e.g. wetlands). The data needed for a quantitative status assessment must be obtained from a comprehensive monitoring network of groundwater level measurements. The monitoring programme must ensure that enough data exists for a reliable quantitative status assessment including an assessment of the available groundwater resources.

The output of a groundwater quantitative status assessment is the identification of groundwater bodies which fail to reach good quantitative status and which thereby have potential effects on surface water, associated ecosystems, and sustainable water use (e.g. water supply). Moreover, both drought and water scarcity should be identified during the quantitative status assessment and clearly distinguished in the RBMPs. This means that areas influenced by water scarcity are identified during the production of the RBMPs and should be distinguished from areas impacted by drought. The necessary measures for achieving the good quantitative status of groundwater bodies must be developed and included in the programme of measures of RBMPs, including measures relating to both water scarcity and drought.

Where there is an increase of water scarcity and/or drought problems, appropriate water efficiency measures should be taken through the RBMPs. The Blueprint provides several options for the improvement of quantitative water management and water efficiency including:

- **Implementation of pricing policies**, in accordance with Article 9 of the WFD, to stimulate the efficient use of water in primary water-use sectors. It is necessary to stress that this measure is obligatory and must be included in RBMPs as a legally binding requirement. A pre-condition for an incentive pricing policy is the improvement of water metering.
- **Development of water accounts** – improvement of water balance calculation at the river basin and sub-catchment levels. Water accounts are closely linked to the identification of ecological flow (see CIS Guidelines No. 31), ensuring that the flow requirements of an aquatic ecosystem are respected and that water balances stay within sustainable limits. The guidelines on water accounts are under development within the CIS process with a 2015 deadline.
- **Acceleration of good practices to stop leakages from water distribution networks** – strategic future vision focused on the improvement of the technical conditions of water infrastructure (Blueprint).
- **Common Agricultural Policy (CAP) reform** (CAP 2014-2020) suggests **improving irrigation efficiency and water holding capacity** – based on a philosophy of water use reduction as a pre-condition for irrigation projects under the Rural Development Programme (Blueprint).
- **Efficient water appliances in buildings** – based on voluntary EU Eco-label and Green Public Procurement criteria for key water-related products (Blueprint).
- **Improvement of water governance** – overall improvement of WFD implementation.



The quantitative data collected during the WFD planning process should be used as a basis for the development of the DMP. The data and information relevant to both planning documents (RBMPs and DMP) can be grouped into the following categories:

- database of water abstractions according to users
- database of available groundwater resources calculated for all groundwater bodies
- water demand data (current + future trend scenarios)
- water supply data (water supply infrastructures, operators, capacity of water supply system, leakages from water distribution networks, trends in water consumption)
- lists of areas (groundwater bodies, surface water bodies, terrestrial ecosystems) affected by water scarcity, supplemented by a mapping illustration of groundwater bodies with bad quantitative status
- evaluation of water scarcity using the WEI+ indicator (approved in CIS process)
- identified shortcomings of quantitative management (e.g. estimation of amount of `black abstractions´ without authorisation)

The development of the programme of measures needed for reaching good groundwater quantitative status during RBMP production, and the development of complimentary mitigation measures summarised in the DMP, are subject to separate practices. To introduce effective drought risk-based management, direct links between both processes are essential. Distinguishing between water scarcity issues and drought issues is another basic requirement.

## 4.2. Prolonged droughts

The term `prolonged drought´ is introduced in the WFD in connection with exemptions from environmental objectives indicated in Article 4.6 which allows for a temporary deterioration of water status caused by natural elements. The legal definition of this term is not included in the WFD. Prolonged drought can be understood as a specific type of drought resulting in the temporary deterioration of water body status. For a better understanding of the term `prolonged drought´, the following conditions set in Article 4.6 can be used for application of the exemptions:

- prolonged drought is a result of natural causes, or force majeure, which are exceptional or which could not reasonably be foreseen, and which are reviewed periodically (e.g. through a follow-up to the Programme of Measures of the RBMPs and/or the Drought Management Plan)
- all practicable steps are taken to avoid further deterioration
- measures taken during the prolonged drought do not compromise the recovery of the water body after the prolonged drought and are included in the Programme of Measures
- measures to restore the water body are taken as soon as are reasonably practicable and are included in the next update of the RBMPs
- a summary of the effects of the prolonged drought is included within the RBMPs

In order to identify the occurrence of a prolonged drought, and to avoid drought effects, three types of indicators can be identified:

- natural indicators, based on precipitation as the main parameter (including evapotranspiration, where relevant, and with a statistical series), indicate that it is a ‘natural cause or force majeure’, and that the circumstances are exceptional or could not have reasonably been foreseen
- environmental impact indicators to prove that the prolonged drought has resulted in a temporary deterioration of one (or several) water bodies as an integral part of the monitoring programmes established under Article 8 and Annex V of the WFD

- indicators to illustrate the socio-economic impacts of prolonged droughts (e.g. on drinking water supply, agriculture, industry)

The first and second types of indicators should be used to prove the occurrence of a prolonged drought and the associated temporary deterioration of water bodies. The second and third types of indicators should be used to:

- take appropriate measures in order to mitigate the impacts of prolonged drought and recover the quality of water bodies, according to Article 4.6 (c) and (d)
- draft the annual review of the effects of prolonged droughts (4.6(d))
- draft the summary of effects (4.6(e))

Prolonged droughts require exceptional measures which need to be included in the programmes of measures and/or the Drought Management Plan. Detailed recommendations are summarised in Guidance Document No. 20 (Guidance on Exemptions to the Environmental objectives) developed through the CIS.

Prolonged drought is a specific drought type used when a river basin authority declares a `temporary derogation´ of good water status. The identification and characterization of prolonged drought and the development of appropriate measures must be ensured according to binding rules set in the WFD and non–binding guidelines for the development of RBMPs and the DMP. The outcomes should be included in both the RBMPs and DMP.

## 4.3. Climate change aspects

Water scarcity and drought have been broadly documented as phenomena which are expected to be aggravated by climate change and related reductions in water availability. Therefore special consideration should be given to climate change aspects with the aim to integrate them into water management planning. The first step should be focused on the identification of the current and future consequences of climate change, followed by the development of adaptation strategies with action plans and adaptation measures.

In 2013, the Commission issued the Communication An EU Strategy on adaptation to climate change (COM(2013) 216 final) accompanied by Guidelines on developing adaptation strategies (SWD(2013) 134 final). The guidance document was designed to help Member States in developing a national adaptation strategy.

According to the Guidelines, a climate change adaptation process requires the development and use of statistical methods, special indicators, and modelling techniques that allow for a reliable distinction between changes caused by climate and those caused by anthropogenic activities. It is also necessary to differentiate between `drought´ and `water scarcity´ in order to clearly distinguish between their causes.

The WFD offers the potential to address drought consequences and water scarcity issues. There are many links between climate change adaptation measures related to water scarcity and droughts and the WFD environmental objectives, such as good groundwater quantitative status which ensures a balance between abstractions and groundwater recharge. Another is the WFD requirement of achieving good ecological status for surface waters and the establishment of minimum water flows on which aquatic life depends. Measures to achieve these objectives must be reported in the RBMPs. A River Basin Management Plan is the basic tool for addressing water scarcity and drought issues assessed in connection with, and impacted by, climate change scenarios.

The details on how to integrate climate change aspects into the WFD planning process are described in Guidance document No. 24 River basin Management in a Changing Climate.  The guidance has been developed through the CIS process and approved by Water Directors.

**Guilding principles for integrating water scarcity, drought, climate change and the WFD**

**Overall guiding principle**

**Use the Water Framework Directive as the basic methodological framework to achieve climate change adaptation in water-scarce areas and to reduce the impacts of droughts.**



**Guiding principles**

- Make full use of the Water Framework Directive environmental objectives (e.g. the requirement to achieve good groundwater quantitative status to ensure a robust water system, which is more resilient to climate change impacts).
- Determine, on the basis of robust scientific evidence and on a case-by-case basis, whether a prolonged drought allows for the application of WFD Article 4.6, and take into account climate change predictions in this case-by-case approach.
- Pay special attention to the requirements of WFD Article 4.7 when developing measures to tackle water scarcity under a changing climate and which may cause deterioration of water status.

**Source**: Guidance document No. 24 River basin Management in a Changing Climate

Detecting the effects of climate change will most likely require the adaptation of existing monitoring systems. Related recommendations are expressed in the guiding principles and suggested actions in CIS Guidelines No. 24.

**Guidelines No. 24: Guiding principles and suggested actions**

**Guiding principles**

- Diagnose the causes that led to water scarcity in the past and/or which may lead to it in the future.
- Monitor water demand closely and forecast it, based on improved knowledge about demands and trends.
- Collect as much high quality information as possible to anticipate changes to water supply reliability, which may be caused by climate change, in order to detect water scarcity early.
- Distinguish climate change signals from natural variability and other human impacts using a sufficiently long monitoring time series.

**Suggested actions**

- Adapt the hydrometric networks to track the impact of climate change on water resources, providing enough redundancy to obtain accurate estimations of naturalised stream flow series from observation, closing the water balance in each sub-basin.
- Establish a system to monitor water use and demand.
- Develop a comprehensive set of indicators at appropriate temporal and spatial scales which can link phenomena in order to predict drought and water scarcity impacts.
- Diagnose water scarcity based on past water demands and improve knowledge about past and current water demands and future trends, incorporating climate change projections.
- Analyse how predicted changes in mean annual runoff will change supply reliability and how those changes will affect the socio-economic system behind the water resources system

Four GWP CEE countries (Bulgaria, Slovenia, Lithuania, and Ukraine) worked on an assessment of drought impacts on forests. Forest vulnerability zones (by De Martonne aridity index) were identified for the current climate (1950-2000) and for the future (2050 and 2070) according to IPCC AR5. A distribution of forest areas and tree species was then made for each vulnerability zone. The main results of this demonstration project were identified measures for adaptation and mitigation of the negative impacts for each vulnerability zone. Details are available at the IDMP CEE website.

Climate change is a cross-cutting issue which causes impacts to different sectors at the transboundary scale. In 2013, the International Commission for the Protection of the Danube River (ICPDR) developed a strategy document for the Danube region entitled Strategy on Adaptation to Climate Change. The document provides support for integrating climate change adaptation issues into river basin management, including flood and drought risk management. The necessary steps at the national level should be carried out in close cooperation with ICPDR activities and working groups.

# 5. Conclusions and proposals for follow-up

The recommendations for the development of a drought management system described in these Guidelines provide a set of basic steps that EU and/or accession countries can use to develop national drought policy aimed at risk reduction. The Guidelines are intended for those countries that are trying to move from crisis management to drought risk reduction policy. The step-by-step planning process is based on the National Drought Management Policy Guidelines (WMO, GWP 2014) and was harmonized for EU and/or accession countries in compliance with the key principles of integrated water management and within the context of the Water Framework Directive. The links between the development of the Drought Management Plans and River Basin Management Plans may have a synergistic effect in achieving environmental objectives. The recommendations here are connected with the EU's long-term water protection strategy (Blueprint) utilizing the outputs (e.g. guidelines, technical reports) achieved through the ongoing CIS process and at the river basin level coordinated by river basin commissions. A direct connection with EU water policy can facilitate the development of national drought policy based on the principles of risk reduction and the improved implementation of the Water Framework Directive.

It is recommended to follow these Guidelines and to take necessary actions:

- **at the national level** by analysing current drought management policy, identifying main gaps and uncertainties, and designing an action plan for inevitable changes to the national drought management policy.
- **at the regional level** by launching initiatives that harmonize the methods used for developing the main elements of Drought Management Plans (e.g. indicator system, classification of drought stages, thresholds, early warnings), and designing regional research programs (e.g. quantitative issues, climate change).



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