



Stock-taking analysis and outlook of drought policies, planning and management in EU Member States

Final report

Under contract: Technical and scientific support to the European Drought Observatory (EDO) for Resilience and Adaptation - Lot 2: In-depth assessment of drought management plans and a report on climate adaptation actions against drought in different sectors (ENV/2021/OP/0009)

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ABBREVIATIONS

- AT - Austria
- ATG – Ad-hoc Technical Working Group (of the CIS)
- BE - Belgium
- BG - Bulgaria
- CIS – Common Implementation Strategy of the EU Water Policy
- CY – Cyprus
- CZ - Czech Republic
- DE - Germany
- DK - Denmark
- DMP – Drought Management Plan
- EC – European Commission
- EDO – European Drought Observatory
- EE - Estonia
- EL - Greece
- ES - Spain
- EU – European Union
- FI - Finland
- FR - France
- GDO – Global Drought Observatory
- HR - Croatia
- HU - Hungary
- IE - Ireland
- IT - Italy
- LT - Lithuania
- LU - Luxemburg
- LV - Latvia
- MS – Member State
- MT - Malta
- NAP – National Adaptation Plan
- NAS – National Adaptation Strategy
- NL – The Netherlands
- PL - Poland
- PT - Portugal
- RBMP – River Basin Management Plan
- RBD: River Basin District
- RO - Romania
- SE - Sweden
- SI - Slovenia
- SK - Slovakia
- SWD – Staff Working Document
- TWG – Technical Working Group (of the CIS)
- WFD – Water Framework Directive

1. EXECUTIVE SUMMARY

This background report supports the aim of the European Commission to establish a better understanding of drought impacts and risks for different sectors of society, raise awareness amongst all water stakeholders regarding the increased risk of drought due to climate change, exchange information on effective options for dealing with drought risk and steer discussion towards a harmonised approach at the European level. This report presents a **stock-taking analysis of drought policies, planning and management in EU Member States** (MS) and an outlook of planned work within the Member States and EU levels. It has been developed based on individual Member State **assessments** of the corresponding legislation, planning and management, including the latest available versions of (draft) River Basin Management Plans in spring 2022, using a common questionnaire, as well as more than 70 **interviews** with Member State administrations and stakeholders and a wide review process.

Drought and water scarcity have become more evident and impactful across the EU in the past decade, and with global warming **the risk of droughts will further increase for large parts of Europe**. This has triggered further Member State action to reduce water demand and/or increase water supply for an improved preparedness, as well as strengthening capacities to manage drought event relief and recovery, and thus reduce drought impacts on society, economy, and ecosystems. Currently, in two third (19 out of 27) of the EU Member States, the way to deal with drought is regulated by legislation. EU Member States use a significant **variety of approaches, governance setups and actions** at policy, planning and management levels, which reflect the varying relevance of droughts as well as policy and management choices. **Sharing of good practice and lessons learned** from past drought management can foster better management systems.

However, **preparedness for drought can be significantly improved in the EU**. This starts by improving the national water abstraction control and inspection systems, and taking further measures to remove the significant abstraction pressures which affect 7% of the EU's water bodies. For example, in six Member States there is no ministry with an assigned lead role for dealing with drought, and the **cooperation between sector policies** is still weak and insufficient regarding transformational approaches such as crop changes or reduced irrigation areas and low-water-optimised ships for river navigation. Furthermore, the **engagement of stakeholders** in drought management is often limited to water consumers only and ignores other water-dependent interests.

Transboundary drought management faces significant challenges, including the differences of indicators, governance setups and priorities for water use across borders. **Water allocation systems** in place across Europe usually do not apply criteria of sustainability, efficiency and/or equity of water use; and water security for the environment/ecosystems is not always considered or can be reduced during droughts. This is concerning because drought periods often overlap with increases of other pressures such as water abstractions and more concentrated pollution levels. However, **WFD Art.4(6) temporary exemptions** for not achieving good status of water bodies because of prolonged droughts have so far only been applied in 2022 in three EU MS (Hungary, Netherlands, Portugal) to overall 286 water bodies. However, the justifications of such exemptions might not necessarily cover all the requirements of Art.4(6) or are not included in the (draft) River Basin Management Plans. The Netherlands provides a water body specific ex-post exemption, containing information on the application of Article 4.6 exemptions for each affected water body

1.1. Member State legislation for droughts

Currently, in two third (19 out of 27) of the EU MS, the way to deal with drought is regulated by **legislation**:

- In 10 EU MS by a law adopted as primary legislation by Parliament; however, these laws often only include a very brief mention of drought or enable further regulatory development.
- In 7 of these 10 EU MS, primary legislation is further detailed by subsidiary legislation and/or backed by additional or emergency legislation.
- In 2 EU MS (Germany, Latvia), on the contrary, there is only emergency legislation in place.

- No legislation is yet in place in 8 EU MS: Austria, Estonia, Finland, Croatia, Ireland, Luxemburg, Slovenia and Slovakia.

One notable finding is that recent legislative updates have been made in at least 8 EU MS: Czech Republic (2020), Hungary (2020), France (2021), Lithuania (2021), Latvia (2020), Poland (2021), Portugal (2017), and Romania (2019, 2020). Germany and Slovakia are in the process of establishing specific legislation regarding drought.

Drought **definitions** identified in MS legislation vary significantly. The most significant differences refer to the duration of drought, with one Member State (Hungary) referring to a “number of days” and another, a “non-limited” duration. The latter term used by Cyprus makes drought rather indistinguishable from aridity or man-made water scarcity. Only the Polish definition makes an explicit reference to drought effects on ecosystem functions. The differences in definition (which also exist regarding the indicators and thresholds used) can hamper transboundary cooperation and harmonization at the EU level of further action.

Seven Member States refer to **risks** when defining droughts in their legislation: either to different drought intensity levels or to the risk of drought and water scarcity considering somehow hazard, vulnerability and exposure. No full definitions of drought risk are included in any Member State legislation.

Where available (eight EU MS), the regulatory references to **water scarcity** are consistent with the EU definition, which refers to it as a period in which water use requirements exceed water availability and recognise that water scarcity can be aggravated by droughts. In addition to the two terms (water scarcity and drought), Spain defines different severities of water scarcity, and Malta includes in its regulation a definition of aridity. In addition, 13 EU MS make an explicit link between droughts and **climate change**, referring to the expected increasing frequency and intensity of droughts, and listing other similar extreme events likely to increase with climate change such as floods, heat waves and wildfires.

1.2. Drought Management Plans

Droughts shall be managed by preparing and following different types of strategies, plans or other documents. The European Commission recommends establishing specific **Drought Management Plans** (DMPs) where relevant (EC, 2019a; EC, 2021) and the European Council recognises the value of drought management plans (European Council, 2010) and calls for “the improvement of flood risk and water scarcity and drought management strategies” (European Council, 2021).

These drought (risk) management plans and strategies are an administrative tool for the implementation of a drought policy based on the risk reduction approach and should include three key elements in their frameworks (CIS, 2007):

- 1) Indicators and thresholds establishing onset, ending, and severity levels of the exceptional circumstances (prolonged drought);
- 2) Measures to be taken in each drought phase to prevent deterioration of water status and to mitigate negative drought effects; and
- 3) An organizational framework to deal with drought and the subsequent revision and updating of the existing DMP.

Drought Management Plans are in place in 13 EU MS (Belgium¹, Cyprus, Germany, Greece, Spain, France, Hungary, Ireland, Italy, Netherlands, Portugal, Romania and Sweden), at different levels such as the Member State, regional, River Basin District (RBD), province or local level (see Table 1 below). Several EU MS (including Czechia, Finland, Croatia, Luxemburg and Slovenia) are in the process of preparing or updating such plans. The above-presented three key elements are, however, not included in all the DMPs; evidence for all of them

¹ Belgium has been assessed for both Flanders and Wallonia, with significantly different results, which have been reflected in the text and overview tables. When sums have been made reflecting the number of EU Member States, Belgium has only been accounted once, usually according to the more advanced position.

has been found for Belgium, Spain and Romania. **No DMPs are in place or planned in nine EU MS:** Austria, Bulgaria, Denmark, Estonia, Lithuania, Latvia, Malta, Poland and Slovakia.

Table 1 Drought management planning in the different EU MS

Geographical scope	In place	In preparation	Planned
the whole Member State territory	CY, IE, NL, PT, RO	CZ, FI	CY, DE, (HR), IE, SE, (SI)
one or several regions	BE-FL, BE-WL, DE, SE	BE-WL, CZ, DE	DE, FI, LU
one or several river basin districts	EL, ES, FR, HU, (IT)	BE-WL, EL, FI, FR	DE, PT, SE
one or several local areas (like municipalities)	BE-FL, FR, IT	FI, HU, PT ¹	
any other territorial unit	BE-FL, FR		BE-FL
other approaches	IT		

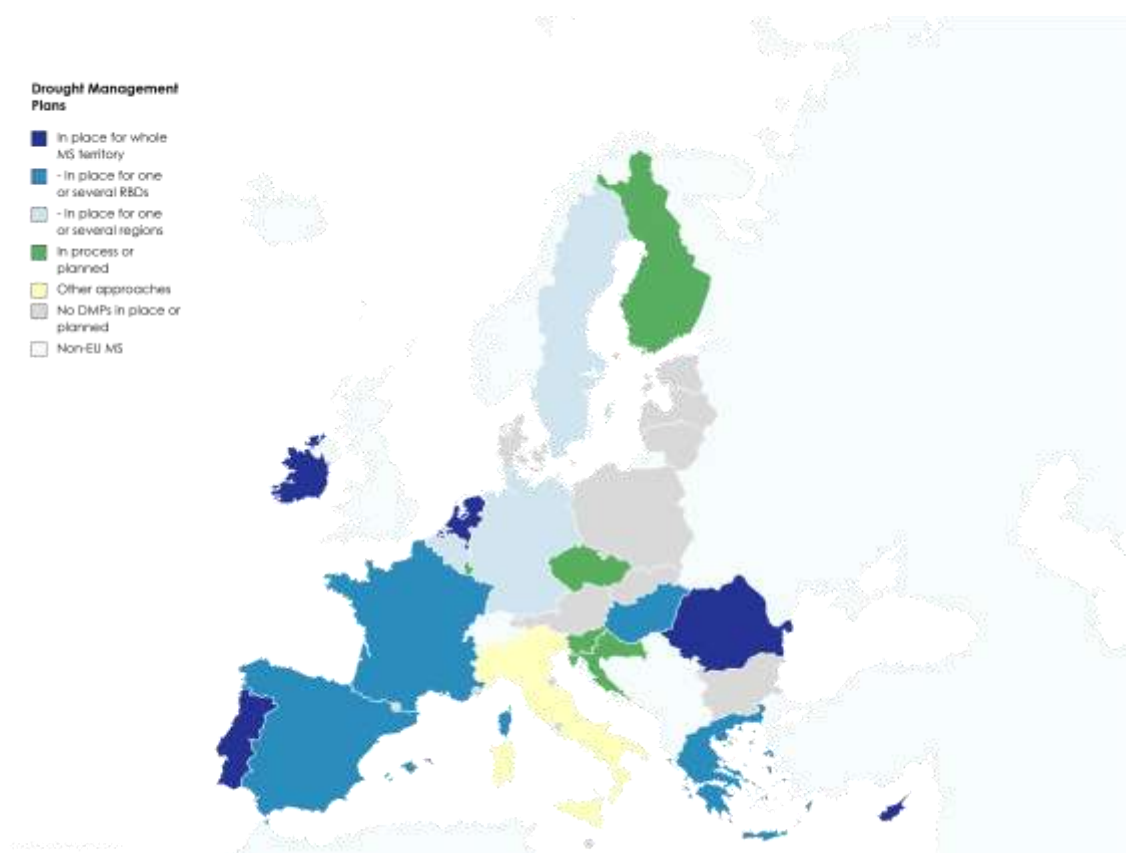


Figure 1: Drought Management Plans

Furthermore, drought management is often also part of **other strategies or plans**, especially but not only if no DMP is in place: droughts are (also) dealt with in RBMPs (16 EU MS), other water management plans (13 EU MS) and/or climate adaptation plans or strategies (20 EU MS); however, they are often not very specific on drought management or targeting drought.

As supporting technical background for drought management, nine EU MS have a **drought management guidance document** in place at the national level and five EU MS do so at another level. Such guidance documents can ensure a coherent approach at national or international scale. Several of these documents are recent, i.e., from the past five years. In addition, two EU MS are planning to develop such guidance.

1.3. Governance

In most of the Member States, drought **governance** involves several administrative levels and bodies, following a subsidiary approach. *Drought policy* lies usually at national level, with the lead at the ministry responsible for the environment, though often in co-lead with the ministry responsible for agriculture, and in some cases (Belgium, Germany, Italy, Netherlands) this is shared with or undertaken by the regional level. In four MS, there is no assigned ministry as policy lead for droughts (Denmark, Croatia, Ireland, Slovenia). Usually, *drought management planning* is assigned to the same body or bodies responsible for drought policy. In four EU MS (Austria, Germany, Ireland, Lithuania), the local level (including water service utilities) has an important role in drought planning. *Drought management* is often executed by different bodies, including river basin authorities; regional, provincial and local authorities and utilities; and national administrations.

Drought **coordination bodies** are in place in 16 EU MS. In some of them, the bodies are specifically established for dealing with droughts whilst in others, broader topics such as floods or water management are also addressed. The composition of the bodies varies significantly; with some bodies only including public administrations, and others using mixed compositions including water users and other stakeholders. Finally, some bodies consist only of scientific members or include them. According to the information found, only in France environmental NGOs are represented in such bodies. The majority of these bodies provides analysis or advice whilst in some cases they are also responsible for decision-making, e.g. defining specific measures (Czechia, Italy). Recent changes with regard to drought coordination bodies are reported from 2016 (Italy), 2017 (Belgium-Wallonia, Bulgaria), 2020 (Spain), 2021 (Greece), and even 2022 (Luxembourg, Czech Republic planned), illustrating the relevance of coordination for drought management. In addition, some transboundary river commissions (e.g. Rhine, Danube, Elbe) have started activities to manage drought situations.

1.4. Approaches and measures for drought management

Most EU Member States follow more than one overall **drought management approach**. *Water resource management* and *risk management* are the approaches most used by EU MS; *climate adaptation* and *ecosystem conservation* have a lower presence across EU MS. Several EU MS (e.g. Spain, France) use their RBMPs to address permanent over-abstraction of water whilst their DMPs address temporary drought events. Regarding *sector-focused management*, many Member States address irrigation agriculture, followed by rainfed agriculture and urban water management. Other sectors are only addressed in very few Member States.

Specific drought management **relief and response measures** are implemented by the Member States. Most common are operational *demand* and *supply* measures, which are being used by 22 and 19 EU MS respectively. The following types of measures are being used in less than half of the Member States: economic impact compensation measures (12 EU MS), increased control and enforcement measures (13 EU MS), operational measures for the environment (14 EU MS), and organisational measures (12 EU MS). On the lower end, follow-up measures (6 EU MS) and recovery measures (2 EU MS) are only used by a few EU MS. No relief and response measures have been identified for 3 EU MS (Estonia, Latvia, Poland).

Water allocation priorities under droughts are in place for 16 EU MS, whilst **none are in place for 12 EU MS**; in Estonia, Croatia, Ireland, Lithuania, Luxemburg, Latvia, Malta, Poland, Sweden, Slovenia and Slovakia. In MT, allocation priorities are established for desalinated and reclaimed treated wastewater, for urban water supply and agricultural irrigation respectively. Out of the 16 EU MS with a priority water allocation schema, only six of them base the allocation on recent water accounts for the RBD, which improves the accountability and transparency of administrative action. The EU MS assign priorities to types of uses, with more or less complexity and detail. The level of complexity and detail might be related to the severity of droughts in the different MS and possible water use restrictions, affecting more than the principal water use sectors. In most of the systems, the primary priorities are assigned to the maintenance/functioning of *critical infrastructure* (like dykes, and hospitals), *drinking water* (which is sometimes aggregated as/to domestic or urban water uses, which might include smaller industries as well as livestock holding) and in some MS to

the environment. The scale and significance of commercial and recreational inland navigation varies between countries, but even in Member States where navigation is significant, the sector is not always considered in the water allocation priorities of drought management planning. Furthermore, when the sector is considered, navigation and sports/recreation are typically low down in the list of priorities.

Regarding the priority ranking of the environment/ecosystems, often considered in terms of **ecological flows**, the situation is very different across the EU, with ecological flows in some of them almost on top of the priority list and in others not considered. In addition, there are at least 6 EU MS (Cyprus, Spain, France, Italy, Romania, Slovenia) where ecological minimum flows can be reduced during droughts.

Overall, 25 out of 27 MS have **drought indicators** in place. No drought indicators are in place in LU and SE. However, there is a huge variety in the drought indicators being used across the EU MS.

- 20 EU MS use the Standardized Precipitation Index (SPI), a statistical indicator comparing the total precipitation received at a particular location during a period of n months with the long-term rainfall distribution for the same period of time at that location, which is thereby the most used drought indicator across the EU.
- The Standardized Precipitation Evapotranspiration Index (SPEI), an extension of the widely used Standardized Precipitation Index (SPI), is designed to take into account both precipitation and potential evapotranspiration, and is used in 10 EU MS,
- the Low-Flow Index is used for the operational, near real-time monitoring of hydrological (i.e. streamflow) drought, in 7 EU MS and
- the Standardized Runoff Index (SRI) used to assess hydrological drought considering stream flow data, is applied in 6 EU MS.

The GRACE Total Water Storage (TWS) Anomaly Indicator is not used by any EU MS. Most of the drought indicators are used to monitor drought evolution and less for forecasting and assessing drought status or informing plans. **Only for 9 EU MS** (Belgium-Flanders, Czechia, Greece, Spain, Hungary, Italy, Portugal, Romania, Slovakia) information has been found to show that **indicators are used in drought management to trigger the activation of specific measures** according to the drought severity levels. Most references for the activation of measures are made to the Standardized Precipitation Index (SPI) (6 EU MS).

1.5. Exemptions under Article 4(6) of the Water Framework Directive

The **Water Framework Directive's Art.4(6)** allows for **exemptions** to achieving the set environmental objectives due to force majeure, including droughts, floods or accidents. The transposition of this article into national legislation is fully consistent in 15 EU MS but shows (sometimes small) gaps in 12 EU MS (Austria, Belgium-Flanders, Belgium-Wallonia, Bulgaria, Denmark, Spain, Finland, Croatia, Ireland, Italy, Lithuania, Portugal, Sweden, Slovakia). This includes besides the complete non-inclusion of this provision in national law, other gaps that refer to specific elements, such as the need to carry out a the validation of exemptions by appropriate indicators (gap in 5 EU MS), the inclusion of measures into the RBMP (gap in 4 EU MS), and the inclusion of a summary of drought effects and measures into the RBMP (gap in 3 EU MS).

Within the second cycle RBMPs, only NL explicitly applied **Art.4(6) exemptions** caused by drought (this was for 18 water bodies). In the assessed third cycle RBMPs, three EU MS (Hungary, Netherlands, Portugal) have included Art.4(6) exemptions caused by droughts for 286 water bodies. No justifications are provided by Portugal and Hungary in the draft documents reviewed, but will be included in the final RBMPs. The Netherlands provides a water body specific ex-post exemption, containing information on the application of Article 4.6 exemptions for each affected water body, elements affected (e.g. phytoplankton, specific pollutants, physico-chemical parameters), justification of the reasons, measures planned and anticipated impact of the measures. Spain and Hungary include in the plans a generic ex-ante exemption, in case such exemptions might be used during the 2022-2027 period for further water bodies.

1.6. Strengths and weaknesses of Member State approaches

Overall, the number of recognised strengths of the **national drought management system** as identified by national authorities, stakeholders and the consultants is larger than the number of weaknesses, indicating that a wealth of good practice could be shared. Administrations and stakeholders in the Czech Republic and the Netherlands identified the most strengths in their drought management system; in the case of the Netherlands, the only identified weakness is regarding transboundary cooperation.

The drought system aspects for which the largest number of EU MS stakeholders identified own **strengths** are the following:

- Focus action on the most drought-prone areas or sectors within the country,
- Support of stakeholders and/or policy,
- Public access to data, to foster awareness, early action and transparency of decision-making (e.g. when water usage will be restricted)
- Trusted coordination/implementation body,
- Risk mitigation by adequate measures at the right time,
- Fostered institutional cooperation, as droughts affect often different systems (water, ecosystems, agriculture, health, energy, etc.) and
- Inclusion of rapid response actions, with immediate effects.

The topic areas with the largest number of EU MS presenting **weaknesses** are the following²:

- Absence of a proactive risk management approach, reducing water scarcity and addressing droughts already in early stages
- Absence of rapid response actions, with immediate effects,
- No maintenance by a designated drought management institution, for a long time with adequate resources,
- Inadequate monitoring, ensuring evidence-based decision-making,
- No updated forecasts of drought event frequency and intensity,
- No integration of economic sectors, environmental and social concerns,
- Lack of focus on people and their livelihoods, including the most vulnerable and marginalised groups and individuals,
- Insufficient detection of changes in the production of ecosystem services, and
- Lack of transboundary (cross-country) cooperation.

Most EU MS have been improving their drought management system, with five EU MS where no system was in place previously having made changes recently. Most recent Member State action has been oriented towards improving the technical background work (e.g. indicators) and gathering information on exposure and vulnerability. Only four EU MS (Belgium-Wallonia, Czech Republic, Netherlands, Slovenia) have recently improved transboundary drought cooperation. Regarding their plans for future improvements of drought management systems, 16 EU MS aim to extend their temporal forecasts; many of those have already made such investments. Other

² Some of the topics considered strengths might be also reflected as weaknesses

technical aspects to be addressed were identified within 10-12 EU MS. Among the possible changes, engagement of media and dissemination as well as the development of transboundary cooperation rank lowest in terms of the number of interested EU MS. No further changes are planned by Estonia, Croatia, Luxemburg, and Latvia.

1.7. Current EU action and potential topics for further action

According to the information found, the use of the **European Drought Observatory** (EDO) services has so far been limited; however, many Member States plan to make greater use of EDO, and the further developed European Drought Observatory for Resilience and Adaptation project (EDORA²), which aims to improve drought resilience and adaptation throughout the EU.

There are common areas of weakness for Member State, and EU-wide such as a **further collection and exchange of good practice in drought management** might be relevant for them. In particular, the following topics might be of special interest for further strengthening and harmonisation at the EU level, given their relevance for the achievement of WFD objectives:

- Integration of economic sectors, environmental and social concerns,
- Focus on people and their livelihoods, including the most vulnerable and marginalised groups and individuals,
- Detection of changes in the production of ecosystem services,
- No deterioration of the status of water bodies, and
- Transboundary cooperation.

2. INTRODUCTION

Drought periods are a natural feature and have occurred across Europe historically. However, climate change is fuelling the increasing frequency and severity of droughts in many parts of the world, including Europe. Several droughts with significant economic impacts have hit large parts of the EU in the past decades, e.g. in 1994-1996 in the Mediterranean, 2003 in central Europe, 2010-2012 and most recently 2018-2020 in western and central Europe. In Europe, most of the losses caused by drought (~EUR 9 billion/year) affect agriculture, the energy sector and the public water supply. If climate change were to increase average global temperatures by 3°C, droughts would occur twice as often and the absolute annual drought losses in Europe would rise to EUR 40 billion/year, with the most severe impacts in the Mediterranean and Atlantic Regions³. In consequence, drought management and climate adaptation are increasingly linked.

This background report supports the aim of the European Commission to reach a better understanding of drought impacts and risks for different sectors of the society, raise awareness amongst all water stakeholders regarding the increased risk of drought due to climate change, exchange information on effective options for dealing with the increased risk of droughts and promote a consensus towards a harmonised approach in the areas of interest at the European level. This report provides a detailed overview of Member State legislation, policies and actions for drought management. It is based on desk research as well as over 70 interviews. Please see the endnotes and the reference section for document citations. Please note that, to make the text more concise, Member State abbreviations are frequently used.

An earlier version of this background report was shared with Member State experts, whose additions and corrections have been incorporated. Please note that the inputs from Member State officials to this report are not intended to represent official positions. Moreover, the information provided in this background report does not represent the position of the European Commission.

The following sections present the detailed findings:

- Section 3: drought policy frameworks in the EU and its Member States
- Section 4: Member State drought management plans
- Section 5: WFD exemptions (the use of Art. 4(6) of the WFD)

- Section 6: Challenges and lessons learned

3. POLICY FRAMEWORKS FOR DROUGHT MANAGEMENT IN THE EU AND ITS MEMBER STATES

3.1. Policy framework in the EU

In 2007, the European Commission issued a **Communication addressing the challenge of water scarcity and droughts in the European Union** (COM (2007) 414 final). In this document, Drought Management Plans (hereinafter DMPs) were identified as one of the main policy instruments to combat droughts, also reflected in a specific technical report on the framework of such plans (CIS, 2007). The development of drought management plans or strategies has also been supported by the European Council (European Council, 2010 and 2021).

As a follow-up to the mandate by the 2007 Communication, a CIS Technical Working Group (TWG) on Water Scarcity and Drought was set up between 2009 and 2012. Within its various activities, the group developed common and EU-wide drought and water scarcity indicators and assessed the relevance of drought management within the first cycle (2009-2015) River Basin Management Plans (RBMPs).

The **European Drought Observatory** (EDO) was initiated by the European Commission's Joint Research Centre (JRC) in 2008 and, since 2018, is part of the Copernicus Emergency Management Service (CEMS), providing up-to-date information on the evolution, occurrence and (limited) forecasting of droughts in Europe. The EDO portal contains drought information, graphs and time series at the European level. These data can be freely downloaded for offline analysis. EDO also provides a tool enabling the comparison between several indicators or the comparison between the values of the same indicator at different times.⁴

In addition, and as part of the activities of the JRC - the European Commission's science and knowledge service - it supports EU policies with independent scientific evidence throughout the whole policy cycle; and the JRC creates, manages and makes sense of knowledge and develops innovative tools and makes them available to policy makers.⁵ This includes the publication of reports, e.g. on Drought Risk Assessment and Management (Vogt et al., 2018) and Global warming and drought impacts in the EU (Cammalleri et al., 2020). In addition, in 2020 – and updated in 2021, the European Environmental Agency (EEA) has – based on JRC data - undertaken a drought indicator assessment⁶ including a backwards-looking trend assessment, and a review of forward-looking projections up to 2100, identifying an increased frequency of droughts in large parts of the EU.

In 2012, a growing number of Member States had developed Drought Management Plans or similar tools. ES had separate DMPs already in place while FR and NL had equivalent operative tools. CY had included its DMP as an Annex of the RBMP and EL was working on them within the same framework. MT and CZ were also in the drafting stage. In IT, AT, BE, HU, RO & SK drought management was considered as part of RBMPs or in regional plans. Other countries had tools focused on emergency management (LU) or specific early warning systems (PT, PL). In 2012, up to 78 River Basin Districts (RBDs) had implemented DMPs (or similar tools) or had planned it in the framework of the Programme of Measures (PoM), while other 89 showed no explicit intention in this regard, though may count with some simpler drought management tools (Benitez-Sanz & Schmidt, 2012). In 2016, IT set up a network of seven RBD Permanent Observatories for water resource uses in the framework of the PoM, as a national strategic tool to address integrated water governance, including water scarcity and drought management and climate change adaptation.

In 2019, the Commission issued the **5th report on the implementation of the Water Framework Directive and the Floods Directive** (EC, 2019a), assessing the second RBMPs and the first FRMPs. This work was underpinned by more specific assessments and recommendations per Member State; some of the recommendations included the need to make more use of drought management plans and better address water quantitative issues and climate change impacts in the third RBMPs that were due for adoption at the end of 2021.

In particular, the corresponding Staff Working Document (SWD) (EC, 2019b) states that “only in about half of the Member States droughts were considered as a relevant feature for water management (e.g. Cyprus, Spain, the Netherlands, Portugal) ... The key management measure to mitigate drought impact although not explicitly mentioned in the Water Framework Directive is a Drought Management Plan. However, the Drought Management Plan has not been adopted in all

relevant RBDs; [and such plans are only reported for 6 EU MS]. A few Member States [3] have, however, progressed in their drought management since the first cycle by developing drought indicators and extending the number of RBDs with Drought Management Plans (Slovenia, United Kingdom), [even though the previous Implementation Reports had included recommendations for a larger number of EU MS, addressing BG, HR, FR, DE, HU, PL, SI, ES and SE]. The adoption of elements within the RBMPs that address the key elements for drought mitigation (indicators, measures, organisational set-up) can provide a step-wise approach.” The SWD also includes an overview table on the strengths and weaknesses of Member State’s drought management in the second RBMPs.

The subsequent 2019 **Fitness Check of the EU water legislation** (EC, 2019c) concluded that for future challenges, the Water Framework Directive is sufficiently prescriptive about the pressures to be addressed, and yet flexible enough to reinforce its implementation as necessary concerning climate change and water scarcity.

The increasing risk of droughts due to climate change is explicitly referred to in the 2021 **EU Strategy on Adaptation to Climate Change** (EC, 2021; part of the European Green Deal) as an example of how the need to take action in the water and related sectors. This includes promoting a set of specific measures, such as listed: “The EU may respond to droughts with short-term emergency measures under the Union Civil Protection Mechanism, and EU-wide early warning systems are in place. Member States are implementing integrated river basin management through the Water Framework Directive, and some have adopted **Drought Management Plans** for vulnerable river basins. Given that in the longer term, almost all river basins could be exposed, organisational and technical adaptation solutions are required. This includes in agriculture the sustainable (re-)use of water, soil management and vegetation cover, drought-resistant crops, vertical farming, or even land-use planning and restoration of damaged areas. In energy and transport, this includes preparing for disruptions on particular waterways with freight transport, hydropower and cooling for power plants. For drinking water, promoting residential water saving, or additional supply and storage infrastructure.”

Within the Strategy, the Commission is also committed to “help ensure climate-resilient, sustainable use and management of water across sectors and borders by improving coordination of thematic plans and other mechanisms, such as water resource allocation and water permits; help reduce water use by raising the water-saving requirements for products, encouraging water efficiency and savings, and **by promoting the wider use of drought management plans** as well as sustainable soil management and land use; help to guarantee a stable and secure supply of drinking water, by encouraging the incorporation of the risks of climate change in risk analyses of water management.”

3.2. Overview of drought policy and management in the EU MS

Despite the EU action on droughts – including guidance documents, recommendations and exchanges of practices – , the approach to droughts in the EU MS remains very diverse, and exchanges on approaches which lead to changes in the national systems remain limited. This includes drought regulation, governance, planning as well as the implementation of measures.

A detailed summary for each of the EU Member States is presented in Annexe 8.2.

3.3. Member State legislation for drought management

3.3.1. Legislation to manage droughts

In more than half (19/27) of the EU MS, drought management is regulated by legislation; in ten EU MS by a law adopted as primary legislation by Parliament; however, often only includes a very brief mentioning of drought or enabling further regulatory development. In some EU MS (e.g. ES, HU, IT, NL, PL, RO), the law is further detailed by subsidiary legislation and/or backed by additional or emergency legislation. LT, for example, has developed a large set of subsidiary legislation. On contrary, DE and LV have only emergency legislation in place. No legislation is yet in place in eight EU MS: AT, EE, FI, HR, IE, LU, SI, and SK⁷.

Recent legislative updates have taken place in at least eight EU MS: CZ (2020), HU (2020), FR (2021), LT (2021), LV (2020), PL (2021), PT (2017), RO (2019, 2020) and drought legislation is under development for DE⁸ and SK.

Table 2 Drought management legislation and other regulations in the different EU MS

	In place
Law adopted as primary regulation by Parliament	BG ⁹ , CZ ¹⁰ , ES ¹¹ , FR ¹² , HU ¹³ , IT ¹⁴ , NL ¹⁵ , PL ¹⁶ , RO ¹⁷ , SE ¹⁸
Subsidiary legislation (e.g. decree or sub-law) as secondary regulation adopted by the Government	BE-FL ¹⁹ , BE-WL ²⁰ , BG ²¹ , DK ²² , ES ²³ , FR ²⁴ , HU ²⁵ , LT ²⁶ , MT ²⁷ , NL ²⁸ , PL ²⁹ , RO ³⁰
Ministerial (or similar) internal (secondary) regulatory measure	CY ³¹ , EL ³² , FR ³³ , HU ³⁴ , PT ³⁵
Additional (emergency) regulation	CZ ³⁶ , DE ³⁷ , EL ³⁸ , HU ³⁹ , IT ⁴⁰ , LT ⁴¹ , LV ⁴² , NL ⁴³ , RO ⁴⁴
None	AT, BE-FL, EE, FI, HR, IE, LU, SI, and SK ⁴⁵

3.3.2. Defining droughts and water scarcity

In 2012, the European Water Directors took note of the following definitions of droughts and water scarcity, which were intended to ease policy, planning and management (Schmidt et al., 2012):

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 might lead to meteorological, agricultural, hydrological and socioeconomic drought, depending on its severity and duration.

Water scarcity is a man-made phenomenon. It is a recurrent imbalance that arises from the 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.

If droughts or water scarcity pass certain thresholds, they can significantly affect the environment (terrestrial and freshwater ecosystems, air, soils), the economy (agriculture and water use) and society (e.g. public water supplies, welfare, recreational activities, cultural and aesthetic concerns).

Drought risk is commonly defined and assessed as: risk = hazard x exposure x vulnerability. Drought hazard represents the likelihood of a drought event of given subtype, onset, intensity and/or duration, exposure the value or area of an affected interest or economic sector, and vulnerability the degree to which the sector is likely to be impacted. These three components must be described in terms that are sector specific, location specific, and dynamic (Duel et al., 2022).

Table 3 Drought management definitions and elements included in the legislation, regulation or planning in the different EU MS

	Yes
Definition of drought (event)	CY ⁴⁶ , CZ ⁴⁷ , EL, ES, HU ⁴⁸ , LT ⁴⁹ , LV ⁵⁰ , MT, NL, PL, PT, RO
Definition of drought risk	BG, CY ⁵¹ , CZ ⁵² , EL ⁵³ , HU ⁵⁴ , LV ⁵⁵ , PL ⁵⁶
Link or distinction between droughts and water scarcity	BG ⁵⁷ , CY ⁵⁸ , CZ ⁵⁹ , ES ⁶⁰ , FR ⁶¹ , MT ⁶² , NL ⁶³ , SE ⁶⁴
Link between droughts and climate change	BG ⁶⁵ , CY ⁶⁶ , EL ⁶⁷ , ES ⁶⁸ , FR ⁶⁹ , LT ⁷⁰ , LU ⁷¹ , MT ⁷² , NL ⁷³ , PL ⁷⁴ , RO ⁷⁵ , SE, SI ⁷⁶
Definition of a/several competent drought management	BE-FL ⁷⁷ , BE-WL ⁷⁸ , BG ⁷⁹ , CY ⁸⁰ ,

authority/ies	CZ ⁸¹ , DE ⁸² , EL, ES ⁸³ , FR ⁸⁴ , HU ⁸⁵ , IT ⁸⁶ , LT ⁸⁷ , LU, LV, NL, PL ⁸⁸ , PT, RO ⁸⁹ , SE
Definition of drought management actions	BG, CY ⁹⁰ , CZ, DE ⁹¹ , EL ⁹² , ES, FR ⁹³ , HU ⁹⁴ , LT, LU ⁹⁵ , NL, PL ⁹⁶ , PT, RO ⁹⁷
Allocation of the drought management actions to (specific) competent authorities	BG ⁹⁸ , CY ⁹⁹ , CZ, EL ¹⁰⁰ , ES, FR, HU, NL, PL, RO ¹⁰¹

Drought definitions identified in the EU MS regulation are listed as an endnote¹⁰² in this report and vary significantly across the EU MS. In some cases (e.g. IT, following strongly the EU definitions), such definitions are included in other official technical documents.¹⁰³ The most significant differences refer to the duration of a drought, as indicated below, between “number of days” vs. “indefinite”. The latter term used by CY makes it rather indistinguishable from aridity or man-made water scarcity. Only the PL definition makes an explicit reference to drought effects on ecosystem functions; no other references have been found e.g. to the adaptation of ecosystems to droughts over the past.

This gap in definition (which can also be related to the indicators and thresholds used) can hamper transboundary cooperation and harmonization at the EU level of further action. The following definition components can be identified:

- Causes of droughts:
 - Natural: EL, ES, LV, MT, PL, RO
 - Rainfall/precipitation deficit: CZ, EL, ES (“mainly”), HU, IT (“mainly”), LV, NL, PL, RO
 - Others: CY (“several parameters”), HU (“temperatures”), IT (“several meteorological parameters”)
- Characteristics of droughts:
 - Duration: CY (“indefinite”), EL (“significant”), FR (“2 years out of 10”), HU (“number of days”), IT (“a sufficiently long time”), LV (“extended”), MT (“temporary”), NL (“once every 10 years”), PL (“long-term”)
 - Extension: EL (“wide area”), IT (“a sufficiently large area”)
 - Other: CY (“extreme”)
- Impacts of droughts:
 - Decrease of water resources: CZ, ES (“temporary”), IT, MT, PL (“periodic”), RO (“major”)
 - Limitations to water use: IT (“water shortage for socio-economic activities and ecosystems”, PL (“to use water, access water services or the possibilities of agricultural or forestry production”; “functioning of ecosystems”), RO (“production systems”)

Eight EU MS refer to risks when defining droughts; either to different drought intensity levels or to the risk of drought and water scarcity considering hazard, vulnerability and/or exposure, but not necessarily all components explicitly. No full definitions of drought risk are included in any of the EU MS regulations.

Where available (7 EU MS), the regulatory references to water scarcity are consistent with the above-mentioned EU definitions and refer to it as a period in which the water use requirements exceed water availability, and recognise that water scarcity can be aggravated by droughts. In addition to the two terms, ES defines different severities of water scarcity, and MT includes in its regulation a definition of aridity.

In addition, 13 EU MS make an explicit link between droughts and climate change, referring to the expected – though uncertain – increasing frequency and intensity, and list other similar extreme events like floods, heat waves and wildfires.

Not all the 18 EU MS which define drought management authorities assign specific actions to these.

3.4. Member State strategies, plans and other documents, including guidance

Droughts can be managed on an ad-hoc basis or by addressing them in different types of strategies, plans or other documents. As stated above, the European Commission recommends establishing specific Drought Management Plans where relevant (DMPs) (EC, 2019a; EC, 2021). In addition, guidance documents can provide a background to ensure national or international coherence for drought management, though they are not plans themselves.

3.4.1. Drought Management Plans: an overview

The Drought Management Plan (DMP) is an administrative tool for the enforcement of a drought policy based on the risk reduction approach (GWP, 2015), usually an additional planning document that supplements a WFD River Basin Management Plan and often included in the National Action Plan to combat desertification. Three elements are considered to be the key elements of the DMP framework (CIS, 2007):

- Indicators and thresholds establish the onset, ending, and severity levels of the exceptional circumstances (prolonged drought).
- Measures to be taken in each drought phase in order to prevent deterioration of water status and to mitigate negative drought effects. These measures may be of different types: strategic, operative, organizational, follow-up and recovery).
- Organizational framework to deal with drought and subsequent revision and updating of the existing DMP.

These key elements are however not included in all those so-called DMPs; e.g. in PL and SK the corresponding plans primarily focus on preparedness measures which increase water storage capacity, whilst not establishing measures to be taken during the drought phases and enabling drought event management, and thus they are not considered as DMPs in this report. In IT, the 2016 Po DMP is not specific on the measures to be taken and rather offer a portfolio of possible measures; in any case, IT has opted since then for a different planning approach described further below.

Drought Management Plans are in place in 13 EU MS (BE, CY, DE, EL, ES, FR, HU, IE, IT, NL, PT, RO, SE), at different levels such as the Member State, regional, River Basin District (RBD), province or local level. Two additional EU MS (CZ and FI) are amongst those in the process of preparing such plans, and three additional EU MS (HR, LU, SI) are amongst those EU MS planning to develop them in the coming years. No DMPs are in place or planned to be developed in nine EU MS: AT, BG, DK, EE, LT, LV, MT, PL, and SK.

Table 4 Drought management plans in the different EU MS

Geographical scope	In place	In preparation	Planned
the whole Member State territory	CY, IE, NL, PT, RO	CZ, FI	CY, DE, (HR), IE, SE, (SI)
one or several regions	BE-FL, BE-WL, DE, SE	BE-WL, CZ, DE	DE, FI ¹⁰⁴ , LU
one or several river basin districts	EL, ES, FR, HU, (IT ¹⁰⁵)	BE-WL, EL, FR	DE, PT, SE
one or several local areas (like municipalities)	BE-FL, FR, IT	FI ¹⁰⁶ , HU, PT ¹⁰⁷	
any other territorial unit	BE-FL, FR		BE-FL
other approaches	IT		

Further, more specific information can be provided for the following EU MS:

- BE-FL: An exceptionally dry summer in 2018 provided the impetus for the Flemish government to develop a more proactive set of policy measures on drought, which has resulted in **the Action Plan Drought and Flooding '19 and '20**¹⁰⁸ and a **Blue Deal**¹⁰⁹, formulating a set of concrete measures and connecting the various strategies and plans on drought in Flanders. In addition, there are various provincial drought strategies in place¹¹⁰, and others in place or planned at the municipal level, based on a Blueprint¹¹¹.
- BE-WL: Several drought management plans are in place, the Wallonia Drought Regulation (*Dispositif Sécheresse Wallon*, DSW¹¹²) is supported by the Regional Water Resource Schema (*Schéma 20asïn20al des ressources en eau*, SRRE¹¹³), both cover the whole Wallonia Region. The RBMPs are not specific for the drought but several measures of the measures can apply. The planned Drought Strategy will cover the whole Wallonia Region and be included in the third cycle RBMP, with a new *Dispositif sécheresse Wallon 2.0* and a new SERRE 2.0 in preparation), and aims to strengthen the governance of the two existing processes (DSW and SRRE), as well as to ensure the coherence of the numerous works and their progress, to federate all the competences, to support the processes by appropriate means and to identify priorities.
- CY: The DMP is a part of the RBMP, and the second DMP approved in 2016 is currently under implementation. In the framework of the development of the third cycle RBMP, the DMP will also be updated, modified and improved, as deemed necessary. The relevant consultancy tender has been announced on 28/01/2022 and is expected to be awarded in June 2022. It is foreseen that the draft revised DMP will be prepared by November 2022 and will go through a 6-month public consultation process, along with the draft third cycle RBMP. The final versions are expected to be ratified by the Ministers Council in September 2023.
- CZ: Regional drought management plans will be developed by January 2023 by the regional authorities and one central plan by January 2024 prepared by the Ministry of Agriculture and Ministry of Environment.
- DE: So far, most of the action on drought management planning has taken place at the regional level. Strategies for dealing with low water exist at the level of the Federal states, e.g. Thuringia¹¹⁴, Brandenburg¹¹⁵ and Bavaria¹¹⁶, whilst other plans have a focus on future water supply, e.g. in Lower Saxony¹¹⁷. Dealing with drought is often also part of the climate adaptation strategy of the federal states, e.g. in Saxony-Anhalt¹¹⁸. Other Federal states are preparing water supply plans to secure water supply even under the conditions of climate change, e.g. Baden -Württemberg¹¹⁹, Berlin¹²⁰, Hessen¹²¹, North Rhine-Westphalia¹²² and Saxony¹²³. Other Federal states are planning to develop such instruments. Dealing with drought and water scarcity is also central to the National Water Strategy¹²⁴, currently in the process of adoption.
- EL: There is one DMP for each of the 12 RBDs that were included as an integral part of the first cycle RBMPs (out of a total of 14 RBDs). The DMP for EL13 Crete¹²⁵ was published in 2021, while the DMP for EL14 Aegean islands is still pending.
- ES: All RBDs except the Canary Islands have established DMPs: ES010 Miño-Sil, ES014 Galicia-Coast, ES017 Eastern Cantabrian, ES018 Western Cantabrian, ES020 Duero, ES030 Tagus, ES040 Guadiana, ES050 Guadalquivir, ES060 Andalusian Mediterranean Basins, ES063 Guadalete and Barbate, ES064 Tinto, Odiel and Piedras, ES070 Segura, ES080 Jucar, ES091 Ebro, ES100 Catalonia, ES110 Balearic Island, ES150 Ceuta, ES160 Melilla.¹²⁶
- FI: The Finnish Environment Institute stated in April 2022¹²⁷ that a nationwide drought risk management is being developed as part of a project called *Kuhasuo*.
- FR: Drought management plans (in the form of *arrêtés-cadre départemental*) must be prepared at the level of each *département* administrative unit. They must define rules for restricting water use for each management hydrological zone (called "alert zones"). In theory, there are 96 DMPs for mainland France and Corsica plus 4 for outer sea *départements*. These have been adopted since at least 1992 when the Law formally established their legal basis. Where drought management must be coordinated across a catchment, there are *arrêté-cadre interdépartemental* binding drought management action across the administrative units of the catchment. No estimated number for these plans is

available. They have been adopted over time as users and authorities recognised the disparity of rules set out in individual DMPs in the same catchment. Finally, since the 2021 decree¹²⁸, each river basin must have a coherent approach at the river basin level, through the establishment of an *arrêté d'orientation de niveau 21basin*. In the process of being finalized, there will be 6 of these plans in mainland France (covering the 6 RBDs). In addition, a national guide published in 2021 clarifies the entire drought management system at each governance level. It allows a first level of harmonization. In March 2023, the French President unveiled the governmental "water" plan. This plan allows for resilient and sober management of the resource in order to guarantee quality water for all and preserve ecosystems. In particular, it will improve the response to droughts. It thus responds to three major issues: organize the sobriety of uses for all actors; optimize the availability of the resource; preserve water quality.

- HR: The Climate Change Adaptation Strategy of the Republic of Croatia (CCAS¹²⁹) for the period until 2040 with a view to 2070 indicates the requirement of a drought management plan. No further information is available.
- HU: 12 general water scarcity/drought management plans have already been prepared, territorially covering the areas of the 12 regional Water Directorates (VIZIG). These general plans can be found in the OVF's (General Directorate of Water Management) repository in written form. In addition, 84 detailed plans (for each water scarcity/drought district) are to be formulated by the end of 2022. These detailed plans describe the specific circumstances of the water directorates and water scarcity/drought district areas from geographical, meteorological, hydrological, water management, infrastructure etc. points of view. They will contain information about the available water resources, agricultural water supply systems, needs and possibilities, and measures that can be implemented to prevent or mitigate drought effects.
- IE: Appendix E of the National Water Resources Framework¹³⁰ directly addresses drought planning. It is expected that the National Water Resources Plan (NWRP), when completed, will provide a basis for future development of drought management planning. Four regional water resources plans will give greater detail and are scheduled to be published later in 2022. The two national climate adaptation framework documents reference the National Water Resources Plan as being the central document.
- IT: In all RBDs, there is a Permanent Observatory for water resource uses (*Osservatorio Permanente per gli utilizzi idrici*) required since 2016, that manages drought according to specific indicators, drought severity levels and trends. Each scenario has measures associated but this information is not organized in a DMP or an official document. For instance, the *Appennino Centrale Permanent Observatory*¹³¹ includes reports that specify the alert level by management unit (AATO) and region and describes the measures to implement. However, no plan summarizes all those rules.
- MT: The second cycle RBMP includes a section on management of extremes, though it is not focused on the operational/contingency management of drought anomalies, but rather on preparedness, ensuring water supply and efficient use.
- NL: The 2021 Deltaplan Freshwater concerns the whole member state, and divides it into 6 regions: the North of the Netherlands, High Sands East, High Sands South, Rivers Region, West of the Netherlands and the Southwest Delta.¹³² Agreements on responsibilities, finance, cost-sharing and the planning of all measures are laid down in administrative agreements per region. Each freshwater region takes a step-by-step approach.
- PL: The 2021 Plan for Counteracting the Effects of Drought (PPSS) and the 2008 National Strategy and Action Plan/Plan of Measures for Mitigating the Effects of Drought and, Combating Land Degradation and Desertification in the short-, medium-, and long-term.¹³³ include preparedness measures, primarily for increased water storage, but no operational measures for dealing with drought events.
- PT: The 2017 National Drought Prevention, Monitoring and Contingency Plan and local drought contingency plans are in place or being prepared by most of the large water users (urban supply companies, irrigation facilities, hydropower producers), as determined under Section VI.5 of the National Plan. Drought contingency plans per river basin are foreseen under the third cycle River Basin Management Plans (2022-27).

- RO: Two strategies are in place dealing with droughts: The 2007 National Strategy for reduction of the effects of droughts on short-, medium-, and long-term¹³⁴ and the 2008 National Strategy and Action Plan/Plan of Measures for Mitigating the Effects of Drought and, Combating Land Degradation and Desertification on short-, medium-, and long-term.¹³⁵
- SE: A sub-action programme¹³⁶ and a sub-management plan¹³⁷ against drought and water scarcity 2022-2027 are both in place in the Southern Baltic Sea. Depending on the next revision of the analysis of pressure and impact in the river basins in respective water district, measures against water shortage and drought might be developed for the RBDs Bothnian Sea, Gulf of Bothnia, North Baltic and North Sea in 2022-2027.
- SI: There is no official drought management planning in place. The 2014 handbook *A Way to Better Drought Management in Slovenia (Pot k boljšemu upravljanju s sušo*¹³⁸) gives an overview of the current state of drought management in Slovenia and provides suggestions for preparation of national drought management strategy. Based on GWP Guidelines (GWP, 2015), a 2015 country-specific handbook *Drought and the WFD (Suša in vodna direktiva*¹³⁹) gathers general information on national drought management policy for each of the steps of preparation of DMP as described in GWP's Guidelines. Finally, the Slovenian Environment Agency ARSO will translate and adapt the Danube Drought management Strategy¹⁴⁰ to Slovenia and suggest the document as the Slovenian Drought Management Strategy.
- SK: The 2018 Action plan to address the consequences of drought and water shortages entitled *H2ODNOTA JE VODA*¹⁴¹ contains preventive measures to fight the consequences of drought in Slovakia. It combines measures in several areas and sectors (agriculture, forestry, water management and urban areas) into one document. It is historically the first cross-sectoral document on the issue of drought in Slovakia. The Action Plan was endorsed by the government and its implementation is monitored on an annual basis. The action plan will be evaluated in 2025. However, the 2021 evaluation of Slovakia's preparedness to manage drought carried out by the Supreme Control Authority¹⁴² (Slovakia's independent national audit office) concluded that the Action Plan does not assess water scarcity and droughts as separate issues with various causes. However, the inspection carried out by the Slovak National Audit Office was criticized from the beginning by the Slovak Ministry of the Environment. Just the title itself, which reads "Preparedness of the Slovak Republic to deal with the consequences of drought" contradicts the focus of the control action. Instead of checking the sectors/ministries that are affected by the drought in Slovakia (environment, agriculture, healthcare, education, research, interior...) the check was focused only to comment on text of the action plan, without assessment of preparedness to deal with the drought impacts. The Audit Office did not explore and assess existing mechanisms in place to deal with the drought. For example, there is a monitoring system in place (intersucho.sk) that has been developed as a response to the action plan endorsement. The Slovak Ministry of the Environment considers this inspection to be a waste of the opportunity to find out the comprehensive state of preparedness for drought in Slovakia, as well as a waste of public funds spent on its implementation. In mid-2022, a new strategic document "Concept of water policy until 2030 with a vision up to 2050" was endorsed by the government addressing droughts explicitly¹⁴³. It imposes measures to address drought and water scarcity in a holistic way.

3.4.2. Other strategies and plans

Furthermore, drought management is often also part of other strategies or plans, especially but not only if no DMPs are in place. For example, some DMPs are considered sub-plans of RBMPs (e.g. BE-WL, EL, ES). These other plans are not necessarily hierarchically organised or coordinated.

Table 5 Other strategies or plans addressing drought management in the different EU MS

	Yes
River Basin Management Plans	AT, BE-FL, BE-WL, BG, CY, CZ ¹⁴⁴ , EE ¹⁴⁵ , EL, FI, FR, HR, HU ¹⁴⁶ , IT, MT, NL ¹⁴⁷ , RO, SI ¹⁴⁸ , SK ¹⁴⁹
Other water management plans	BE-WL ¹⁵⁰ , BG ¹⁵¹ , DE, FI ¹⁵² , HR ¹⁵³ , HU ¹⁵⁴ , IE ¹⁵⁵ , IT, NL ¹⁵⁶ , (PL ¹⁵⁷), PT ¹⁵⁸ , RO, SE ¹⁵⁹

Adaptation Plans or Strategies	AT, BE-FL, BE-WL, BG ¹⁶⁰ , CY, CZ ¹⁶¹ , DK ¹⁶² , EE ¹⁶³ , EL, ES ¹⁶⁴ , FI ¹⁶⁵ , HR ¹⁶⁶ , HU ¹⁶⁷ , IE ¹⁶⁸ , IT ¹⁶⁹ , LU ¹⁷⁰ , MT ¹⁷¹ , PT ¹⁷² , RO ¹⁷³ , SE ¹⁷⁴ , SI ¹⁷⁵ , SK ¹⁷⁶
Sector plans	BE-FL ¹⁷⁷
Agriculture	CY ¹⁷⁸ , EE ¹⁷⁹ , EL ¹⁸⁰ , FR ¹⁸¹ , MT ¹⁸² , SE ¹⁸³ , SI ¹⁸⁴ , SK ¹⁸⁵
Environment	HU ¹⁸⁶ , (MT ¹⁸⁷)
Investment plans	BE-WL(RRP ¹⁸⁸), CY (RRP ¹⁸⁹), CZ (NRP), IT (NPRR ¹⁹⁰ and the Environment Operational Plan ¹⁹¹), NL
Emergency plans	BE-FL ¹⁹² , BG ¹⁹³ , CY ¹⁹⁴ , DE, HR ¹⁹⁵ , FR ¹⁹⁶ , LV ¹⁹⁷ , PL ¹⁹⁸
Other plans	BG ¹⁹⁹ , (EL ²⁰⁰), HR

The overview shows that droughts are (also) dealt with in RBMPs (16 EU MS), other water management plans (13 EU MS) and climate adaptation plans or strategies (20 EU MS); however, they are often not specific on drought management. Droughts are often “packaged” with floods, heatwaves and wildfires or only briefly referred to, without specific management solutions.

Regarding the drafts of the Common Agriculture Policy (CAP) Strategic Plans, droughts are explicitly mentioned in 6 EU MS; they address the new development of irrigation and/or its efficiency increases as a means to reduce the impacts of droughts on the agricultural sector (MT, SI, SK), as well as (in the case of MT) switching to less climate-vulnerable production systems, e.g. by moving from dairy cattle to buffalo or goat dairying; switching choice of vegetables to drought-tolerant species and varieties and moving into various forms of permanent cropping. Similar investments are supported by resilience and recovery plans in several EU MS.

Finally, several of the plans which refer to droughts have been adopted recently, e.g. CY (2019), CZ (2021), HR (2019, 2020), IE (2021), LV²⁰¹ (2020), NL (2021), PT (2017), SK (2018). This shows the recently growing awareness and/or need to adapt.

The following further details can be provided for some of the EU MS:

- BE-FL: The third cycle RBMP for Flanders will include an integrated water scarcity and drought risk management plan²⁰² addressing the balance of water use and water supply and avoiding the negative impacts of drought by preventive measures to avoid future crises and reactive measures in the advent of or during a crisis to control the damage. Aspects such as the cost-benefit balance, prevention, protection, readiness to act and shared responsibilities between different levels of government, citizens and sectors are addressed. Furthermore, drought policy was already included in the Climate Action Plan 2013 – 2020 and will be integrated into the next Climate Action Plan 2021-2030, currently under amendment by the Flemish government. A Decision-making framework for prioritising water use during drought and water scarcity²⁰³ was created by the Flemish Government together with stakeholders to determine preventive measures and prioritisation of water usage during water scarcity. Regarding the interrelation of the various strategies and plans addressing drought management in Flanders, the aim is that the set of actions in the Blue Deal and the drought-related aspects from the Climate Adaptation Plan will become an integral part of the third cycle RBMP.
- BE-WL: The Wallonia Resilience plan (2021) includes investments in several projects linked to Climate Change and droughts, such as a) Improving the management of the “water” resource in the waterways, especially in the perspective of resource circularity (7 750 000 EUR), b) Launch calls for projects for the creation of green spaces in urban areas in the context of adaptation to the climate crisis (62 500 000 EUR), c) Improve agri-environmental infrastructure and implement water storage and irrigation structures through land development (3 200 000 EUR), d) Improve the performance of public water supply infrastructure (7 000 000 EUR), e) Climate and health risk prevention study, including floods and droughts (5 000 000 EUR).

- BG: 1) The National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria²⁰⁴ contains an analysis of water consumption and future water demand, threats and risks, and sets strategic development objectives, incl. for water supply for the population and business under climate change leading to drought, the institutional framework for the development of the water sector, incl. responsibilities for drought management policy. 2) The National Climate Change Adaptation Strategy and Action Plan until 2030²⁰⁵ sets a framework for action on adaptation to climate change and priority areas until 2030, addressing climate risks and vulnerabilities in the sectors of the Bulgarian economy and in the interactions between sectors, including with regard to drought. The factors and conditions for successful adaptation to climate change are considered. 3) The National Action Program for Sustainable Land Management and Combating Desertification in the Republic of Bulgaria²⁰⁶ considers areas with significant and potential atmospheric drought conditions, the risk of all types of drought – atmospheric, soil, soil-atmospheric, hydrological, and relation with the soil erosion. The need for scientific and applied provision of sustainable land management in drought-prone areas, incl. for the development and implementation of technological solutions related to the cultivation of agricultural crops under non-irrigated conditions, selection of alternative crops, construction of protective forest belts, etc. is also considered.
- CY: The 2019 Strategic Study for Water and Drought Management²⁰⁷ includes a number of medium- and long-term measures, as well as measures to increase preparedness in periods of exceptional and persistent droughts in the future.
- CZ: 1) The three RBMPs refer to ongoing or currently completed research projects, including possible scenarios of climate change in the medium and long term, and the effects on the aquatic environment. One of the most important initiatives is the *Intersucho* project²⁰⁸, which deals with the current climate situation in the Czech Republic and gradually introduces monitoring of the development of drought and water scarcity, especially of groundwater sources and soil. The RBMPs also refer to measures specified in the National Program for Climate Change Mitigation, involve other sectors of the economy and regions in long-term water demand forecasts when adapting to projected climate change, and prepare proposals for legislative measures to achieve coherence in the elaboration of sub-basin plans with the solution of complex landscaping, require the acquisition of spatial planning documentation at various levels and stages improving the water regime of the landscape, unify and bindingly define the method and criteria for setting the minimum environmental flow. Within the list of basic measures, there is one generic measure focused on drought management (CZE31700001). There are also 10 sub-basin plans where the issue of drought is developed at a more detailed level, though these are only drafts as of April 2022. 2) The Common Agricultural Policy Strategic Plan for 2021-2027 refers to drought as an issue in several Needs and Objectives sections.²⁰⁹ 3) The National Recovery Plan (NRP) is a financing instrument for such investments. Regarding droughts, Intervention 5.3.20 includes measures on anti-erosion and flood protection, the protection of the land, and access to land and water management. In particular, projects aimed at reducing the impact of agricultural drought, and protecting agricultural land from erosion or flooding will be preferred in project selection.
- DE: The draft National Water Strategy²¹⁰ addresses droughts and water scarcity, as well as existing water supply concepts at different administrative levels, e.g. for municipalities. A drought risk assessment for Germany under worst case conditions to analyse and identify needs for action²¹¹ was carried out to improve emergency management.
- EE: Although there is no explicit strategy or action plan to combat and mitigate droughts, droughts are somehow addressed in the Estonian national climate change adaption development plan for up to year 2030²¹² and in the action plan for mitigating impacts of climate change in agriculture (2012-2020)²¹³, even if they do not address water management. The Nature Protection Development Plan 2020²¹⁴ and its action plan²¹⁵ list several measures to improve resilience of ecosystems to droughts, like restoring wetlands and rivers, developing guidance for city planning, research for clarifying impacts of climate change on biodiversity, and the protection of forest ecosystems. The draft third cycle River Basin Management Plans and the respective Programme of Measures²¹⁶ aim at increasing preparedness via the efficiency of water systems and water use by better calculation of water supplies, reusing wastewater, renovating and optimising water supply systems and thus decreasing water losses, also in irrigation. Other related measures include buffer strips in riparian zones and keeping agricultural land under cover of vegetation.

- EL: DMPs are an integral part of most RBMPs, even if they are not updated according to the RBMP cycles. In addition, the 2016 National Strategy for Climate Change Adaptation²¹⁷ discusses projections for the increase of drought phenomena in specific regions of Greece and defines actions, including on water resources. Some of the proposed actions on water resources related to drought management, e.g. on desertification, maintenance of ecological flows, irrigation and water supply networks, and water-saving measures. Moreover, similar actions are included in the Regional Plans for Climate Change Adaptation, which are under development.
- ES: Spain furthermore undertook in 2017 a Climate risk analysis addressing water resources and droughts (EEA, 2022).
- FI: The Government has approved seven regional water management plans and a marine management plan as part of third cycle RBMPs. In general, the plans mention the need to explore the potential for water storage as a means of preventing the damage of drought. They also propose a groundwater measure, preventing climate change effects on the functioning of water supplies and groundwater quality or quantity.
- FR: 1) The River Basin Management Plans mainly address water scarcity rather than droughts. However, RBMPs have specific sections on drought management plans, and they set out the following in relation to droughts: a) To highlight the increasing risk of droughts, and their impact on the aquatic environment and water uses, b) To outline general principles for drought management to follow, for instance, the priority sequence between uses in the event of drought and other management principles such as the need to reserve certain resources/water bodies to drinking water supply, c) To establish minimum environmental river flows, water levels in wetlands and groundwater levels (i.e. alert and crisis thresholds – *seuils d’alerte et de crises*) at strategic nodes of the river basin that sustain aquatic life and uses downstream of these strategic nodes. These are further specified for additional points within each catchment (sub-basin) through specific catchment management plans and drought management plans. The drought management plans must comply with the minimum flows and levels set out in the RBMPs and the catchment management plans. 2) The 2018 National Adaptation plan²¹⁸ mentions the issue of drought, but mainly focuses on measures tackling water scarcity (e.g. in agriculture, promoting more resilient production systems, enhancing soil quality for water storage, etc). Similarly, adaptation plans are developed by each region and by several *départements*/administrative units – but they usually only tackle water scarcity rather than droughts. 3) Furthermore, A) agricultural water associations may propose crisis management measures by implementing restrictions on the allocated volume to their members, including by anticipation with spring thresholds to avoid the crisis or at least delay it. B) Large industrial plans (i.e. *Installations Classées pour la Protection de l’Environnement* (ICPE) system in France) will be regulated by the general DMPs (*arrêtés-cadres*) but can also be regulated by decrees with specific complementary drought prescriptions corresponding to measures more adapted to their process. C) Drinking water: on a structural level, local authorities must have a drinking water supply master plan to plan and manage their drinking water supply. Furthermore, the recent "water plan" aims to secure the supply of drinking water. In terms of crisis management, each prefect must establish a crisis plan for drinking water networks (as part of his general civil security plan ORSEC). D) Hydroelectricity & nuclear power have specific management approaches by *Electricité du France* (EDF) and the Ministry of Ecological Transition and territorial cohesion.
- HR: The draft third cycle RBMP mentions drought as one of the predicted climate change effects that will impact agriculture. Irrigation is mentioned as an adaptation measure. Drought management is included only at an informational level. The most comprehensive drought-related plan is the National Irrigation and Agricultural Land and Water Management Project (NAPNAV²¹⁹) which was prepared in 2005 and later updated in 2021. It includes agricultural and hydrological drought and provides the current status of irrigation procedures in Croatia and a plan for its improvement (drought mitigation). It defines drought as a natural phenomenon with a consequence of low water availability for human use (e.g. agriculture). It also defines agricultural drought as a phenomenon when not enough water is available for plants which result in lower growth and development and consequently lower yield. It establishes that rising temperatures and diminishing precipitation trends are the main drought-related consequences of climate change. It identifies the national Water Agency (*Hrvatske Vode*) as the central coordinating body for irrigation development and requests regional authorities (*županije*) to plan and manage irrigation at the local level.

- IT: Since the regions have many competencies on waters, there are also regional documents that provide indications about how to manage drought. For instance, in 2021 the Piemonte region approved guidelines for provinces²²⁰, the City of Turin and other public and private entities. They define what should be done and by whom in each drought alert level. These guidelines are directly linked to the Po DMP but their implementation is not compulsory, as actions affect the competencies of several authorities and agencies beyond the Piemonte Region. Moreover, during the 2022 water crisis, all the regions of the Po RBD governed the rules for the management of the e-flow exceptions according to the water severity conditions defined by the Permanent Observatory of the Po RBD. The Eastern Alps RBD commits the regions to achieve greater water savings in agriculture and to verify the reuse of purified wastewater as required by a recent EU regulation. In the second update of the RBMP, the RBA of the Central Apennine provided measures for the experimentation and implementation of decision support systems capable of simulating hydrological and water resource management scenarios for multiple uses, including environmental use, as a support to the study of ecological flow and socio-economic impacts. The applications can concern both the planning and programming phase of water resources use, and the preventive management of critical issues with the monitoring of the available resource. These systems can also provide early indicators of water scarcity conditions in a multi-resource-multi-user supply system²²¹. The Region of Sicily has a specific 2020 Regional Plan to fight against drought²²² that was prepared by the Sicily RBA by mandate of the Regional Government. After a brief characterization of the issue, it describes measures to deal with drought impacts in the short, mid and long terms. Most of the measures are taken from the RBMP. There is a specific chapter on funding sources to support different measures foreseen by the Plan. It should be noted that the plan does not have complete financial coverage; it contains an estimate of the needs. In the second update of the RBMP of Sicily, a drought management plan has been developed which considers the aforementioned program, the non-structural measures, the monitoring program and reaffirms the role for the drought monitoring and management of the Permanent Observatory for water resource uses.
- NL: 1) The 2019 Final Report of the PolicytableDroughts (*Eindrapportage Beleidstafel Droogte*) sets out 46 recommendations to make the Netherlands more drought resistant. Most of the recommendations are part of the Freshwater Delta Programme. The implementation of virtually all recommendations is on schedule or has been completed. The drafting of the regional prioritisation ranking is an important action which is still in the completion phase. 2) The Delta plan Freshwater falls under the Delta programme Freshwater which is jointly implemented by the national government, provinces, municipalities, water boards, *Rijkswaterstaat* and various civil society organisations under the leadership of the Delta Commissioner²²³. 3) The Delta Decision Freshwater aims to maintain and promote a healthy and balanced groundwater system, protect crucial utilisation functions and use the available freshwater effectively and economically. It comprises a national preferred strategy for the main water system and a preferred strategy for each of the six freshwater regions, which are the compass for implementing measures in the second phase of the Freshwater Delta Programme. This Freshwater Delta Plan comprises all programmed measures and investments by *Rijkswaterstaat*, provinces and water boards. 4) Smart Water Management (*Slim watermanagement*) is a measure from the implementation programme of the Delta Programme Freshwater, running up to 2021. Within Smart Water Management, water boards and *Rijkswaterstaat* are working intensively together to improve operational water management. The aim is to postpone and prevent flooding and water shortages. This cooperation ensures that the potential of the entire water system is used optimally. Together, water managers 'direct' the water to where it causes the least inconvenience or where it is most needed. Management boundaries are not an obstacle.²²⁴
- PL: In the draft RBMP for the Vistula River, drought is mentioned several times, in most occurrences as a risk factor or a pressure in the context of quantitative analysis of water availability. However, there is no specific section devoted to drought management in the RBMP. A project on the preparation of adaptation plans in 44 cities in Poland, supported by EU funding, was carried out in the years 2017-2019²²⁵. Within this initiative, a climate adaptation plan for Warsaw was adopted in 2019²²⁶. A national plan for adaptation to climate change was adopted in 2013 and covered the perspective until 2020, no update has been published.
- RO: RBMPs include management guidelines for water distribution. In the case of hydrological drought, river basin districts develop and maintain plans for restrictions and water use during droughts. The methodology regarding the elaboration of the plans of

restrictions and use of water in the deficient periods.²²⁷ includes binding measures for all water users and is to be elaborated and updated annually in the period of 1-30 April according to the hydrological conditions. In addition, RO has undertaken in 2017 a climate risk analysis of vulnerability to drought (EEA, 2022).

- SE: Supporting work has been developed in the past years for the development of sub-management plans on drought in the frame of the third cycle RBMPs. In addition, each competent authority has a specific sectorial action plan for climate change adaptation. These cover to different degrees drought management. The action plan of the Swedish Board of Agriculture includes multiple specific actions to manage drought.

In addition to the EU Member States, also transboundary river commissions (e.g. Rhine²²⁸, Danube, Elbe) including navigation commissions (Rhine²²⁹, Danube) are aware of climate change effects and have started activities to manage drought situations.

3.4.3. Guidance documents

Guidance documents on drought planning and management can support a coherent approach across larger scales such as Member States or international river basins. They themselves are not plans, but indicate how such plans shall be drafted, which data shall be used or criteria shall be applied.

Table 6 Existence of guidance documents on drought management in the different EU MS

Geographical scope	In place	Planned
At the national scale	CZ, ES, ²³⁰ FR, HU ²³¹ , IT, NL, PL, PT, SE	(IE ²³²), LU
At other scale	BE-FL, ES, FI, RO, SI	

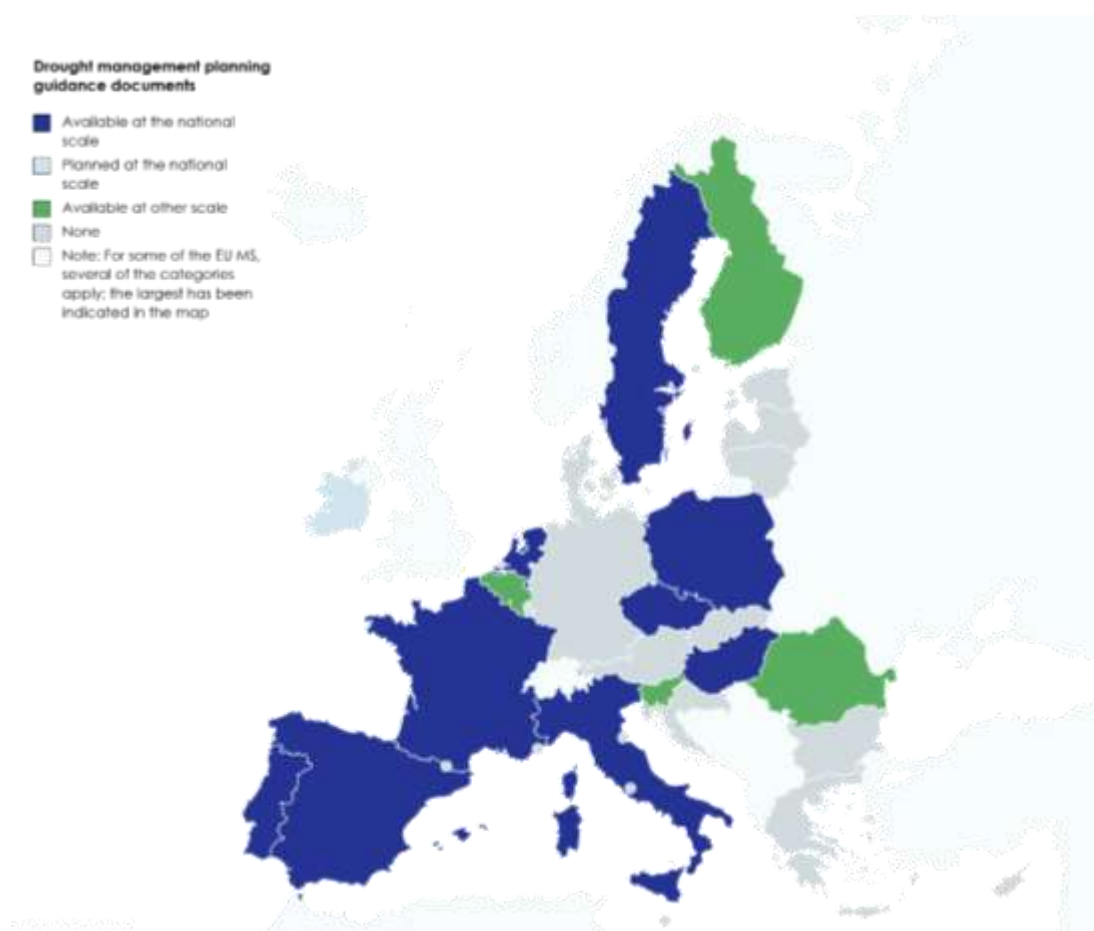


Figure 2: Drought management planning guidance documents

Nine EU MS have a drought management guidance document at a national scale in place and five EU MS do so at another level; in some EU MS (e.g. RO), the 2015 guidance developed by Global Water Partnership (GWP, 2015) is considered as a national guidance document, whilst in others, this is not the case (e.g. SI). Several of these documents are recent from the past five years. In addition, two EU MS are planning to develop such guidance. A brief description of the guidance document approaches in the concerned EU MS is provided below:

- BE-FL: The Blueprint for municipal rainwater and drought plans²³³ guides the creation of municipal drought plans. Furthermore, there is a Decision-making framework for prioritising water use during drought and water scarcity²³⁴, to facilitate decision-making by governments during events of drought and water scarcity. Also, there is a Water scarcity and drought coordination plan / roadmap²³⁵, a “living document” that is regularly updated (in early 2023, the most recent version was dated June 2021).
- CZ: In May 2021, the Ministry of Agriculture and the Ministry of the Environment prepared a common methodology²³⁶, which represents the basic starting points and procedure for the creation of Plans for Drought Management and Water Scarcity following the provisions of Section 87b of the Water Act. The methodology aims to unify the procedure for elaboration of individual drought plans at the regional level and in the territory of the Czech Republic.
- ES: In addition to the 2017 Technical Instruction for the elaboration of the Special Drought Plans and the definition of the Global System of Indicators of Prolonged Drought and Water Scarcity²³⁷ at the river basin level, two urban-focused guidance documents have been developed by the water utility association and researchers²³⁸ in 2018 and 2019.
- FI: In 2020, guidelines for preparing a drought risk management plan²³⁹ were published; it is a practical guide intended primarily for the 15 local government Centres for Economic Development, Transport, and the Environment.
- FR: The Ministry for Ecological Transition published a guidance document²⁴⁰ in 2021.
- HU: The 2021 guidance on drought management plan to determine drought risk management actions and identification of water management measures to improve climate resilience²⁴¹ aims to provide water management decision-makers, water management organizations and professionals with a comprehensive picture of the concepts related to the topic of water scarcity and drought, the methods that can be used to define them and to systematise possible tools for prevention and mitigation at the time of the drought event. It aims to provide a comprehensive picture of the domestic situation and the expected changes thus it can be the basis for the development of a complex drought strategy.
- IT: The national guidance on drought and water scarcity management is provided by the National Committee for Technical Coordination of the RBD Observatories, led by the Italian Ministry of Environment and Energy Security, that was established in 2016. National guidelines²⁴² on the use of drought and water scarcity indicators at the regional and national levels and technical notes²⁴³ for the management of water crisis during drought have been also promoted by the Committee and published. In addition, guidance documents are available at river basin district level to monitor drought and water scarcity events and to elaborate a stepwise action plan to manage drought (e.g. the 2016 Po DMP²⁴⁴).
- LU: A guidance will likely be developed by the newly established working group for Water Scarcity and Droughts.
- NL: The measures for drought are set up in a prioritization ranking, for which the manual (*handleiding*²⁴⁵) was updated with recommendations from the Policytable Droughts in 2019.
- PL: Drought hazard guidelines are included in the Drought Management Plan (PPSS) Annex no. 4 containing a catalogue of activities.
- PT: Section VI.5 of the national DMP defines guidelines and exemplifies a structure that can be followed by contingency plans elaborated by water users.

- RO: The GWP-Central and Eastern Europe Guidelines to Preparation of the Drought Management Plans in the context of EU WFD are considered national guidance (GWP, 2015)
- SE: The document Drought and water scarcity – suggestions for continued work²⁴⁶ was published by the Swedish water authorities in April 2022 and proposes developments for future work to combat drought in Sweden. It has been produced as part of the water authorities' work with the Sub-Management Plan against drought and water scarcity. The report is intended as a basis for discussion before the work on the fourth water management cycle and should not be seen as an action program.
- SI: Several documents²⁴⁷ have been developed through international projects by the research community, but have not been endorsed by national authorities.

3.5. Member State governance

In most of the EU MS, drought governance involves several administrative levels and bodies, following a subsidiary approach.

Drought policy lies usually with the corresponding ministry responsible for the environment, though often in co-ownership with the ministry responsible for agriculture (CY, CZ, DE, FI, LT, PT, RO, SE), and some cases (BE, DE, IT, NL, SE) is shared with or executed by the regional level. In 4 EU MS, there is no assigned policy lead for drought management (DK, HR, IE, SI), and these lie in low drought risk areas.

Usually, drought planning is assigned to the corresponding Ministry for the Environment, water management institutions, River Basin Authorities and/or regions. In 4 EU MS (AT, IE, LT, SE), the local level including utilities has an important role in drought planning.

Drought management is often executed by different bodies, including River Basin Authorities, regional, provincial and local authorities and utilities, but also national administrations.

Data, information and knowledge on drought are collected and developed by a large variety of institutions and organisations; including research or non-governmental organisations. This list is not comprehensive. Knowledge exchange across countries might be hampered by such variety.

Table 7 Responsible bodies for drought policy, planning, management and data, information and knowledge gathering and assessment in the different EU MS

	Policy	Planning	Management	Data, information and knowledge
Ministry for the Environment	BG, CY, CZ ²⁴⁸ , DE ²⁴⁹ , EE, EL ²⁵⁰ , ES ²⁵¹ , FR, IT ²⁵² , LT, LU, LV ²⁵³ , MT ²⁵⁴ , PT, RO, SE ²⁵⁵ , SK	BG, CY, CZ ²⁵⁶ , EE, EL, FR, LT, LU, MT, PT, RO, SK	BG, CY, CZ ²⁵⁷ , EE, FR, LT, MT, PT, RO, SK	CY ²⁵⁸ , ES ²⁵⁹ , MT, SE ²⁶⁰
Ministry for Agriculture	AT, CY, CZ, DE, FI ²⁶¹ , (HU), IT, LT, PT, RO, SE ²⁶²	AT, CY, CZ, IE, LT, RO	AT, CY, CZ, FI ²⁶³ , LT, PT, RO	CY ²⁶⁴ , IT,
Ministry for Infrastructure	DE ²⁶⁵ , NL ²⁶⁶ , PL	IE, NL, PL	IT, NL, PL	
Other ministries or national institution	CY, HU ²⁶⁷ , SE ²⁶⁸	HU, IE ²⁶⁹ , IT ²⁷⁰ , LU ²⁷¹ ,	DE ²⁷² , FI, HR, HU, IT, (LT ²⁷³), RO ²⁷⁴	BE ²⁷⁵ , CZ ²⁷⁶ , DK, FR ²⁷⁷ , HU ²⁷⁸ , IT ²⁷⁹ , SE ²⁸⁰

River Basin Authorities	SE	BG, EL, ES, FR, IT, (PL), RO	BG, EL, ES, FR, HR, HU, IT ²⁸¹ , PL, PT ²⁸² , SE	CZ, EL, ES, HU, IT ²⁸³ , SE
Regional/province authorities	BE-FL ²⁸⁴ , BE-WL ²⁸⁵ , DE, IT, NL	BE-FL ²⁸⁶ , BE-WL ²⁸⁷ , CZ, DE, (ES ²⁸⁸), FR, IT, NL, SE ²⁸⁹	BE-FL ²⁹⁰ , BE-WL ²⁹¹ , CZ ²⁹² , DE, (ES), FR, HU ²⁹³ , IT, NL, SE	(ES), IT ²⁹⁴ , SE ²⁹⁵
Local authorities & utilities		AT, DE, FR, IE, LT, SE	AT, BE-FL, BE-WL, CY, DE, ES, FR, IE, IT, LT, LU, MT ²⁹⁶ , NL, PT, SE ²⁹⁷	ES
Research institution(s)		IT	IT	EL ²⁹⁸ , FI, FR ²⁹⁹ , IT, SE
Non-governmental organisation(s)				ES ³⁰⁰
Other			LV ³⁰¹ , SE	HU ³⁰² , PT ³⁰³
None	DK, HR, IE, SI	DK, FI, HR, SE, SI	DK, SI	

The following MS-specific summaries provide further insights into the water governance setup.

- CY: The Water Development Department (WDD) of the Ministry of Agriculture, Rural Development and Environment is responsible for the implementation of the general water resources management policy, which includes the drought management policy. However, the general water resources management policy of the government, including the water allocation policy, the water pricing policy and the policy for the use of recycled water is approved by the Council of Ministers, following a relevant proposal by the WDD and considering the opinion of the Water Management Advisory Committee (WMAC). The WMAC consists of the Permanent Secretary of the Ministry of Agriculture, Rural Development and Environment and representatives from the Ministry of Interior, the Department of Agriculture, the Geological Survey Department and the Department of the Environment, as well as representatives from various organizations, users and stakeholders (from water supply, sewage, industry, agriculture, environment, and engineering). In case of drought, the authorities in charge of taking the appropriate measures are at the national level the Water Development Department and at the regional and local level, the Water Boards of large cities and the municipalities or communities e.g. to implement measures for intermittent supply (Eureau, 2020).
- CZ: According to §108(3q) of the Water Act, the Ministry of the Environment exercises the powers of the Central Water Authority in matters of managing drought and water scarcity together with the Ministry of Agriculture.
- DE: The policy lead on drought management is split across three Ministries: the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection responsible for Requirements for integrated water management (Federal Water Act), the Federal Ministry on Food and Agriculture responsible for economic instruments for subsidisation of crops resistant to heat, and the Federal Ministry for Digital and Transport responsible to ensure safe and smooth navigation on federal waterways and reliably calculable transport conditions, even in the event of frequent climate change-related

extreme low-water periods. Regional and local institutions are leading drought planning and management.

- DK: While there is nobody taking a leading role, the Danish Environmental Protection Agency publishes reports on climate change and drought.³⁰⁴
- EL: The Ministry of Environment and Energy leads the preparation of the RBMPs (including the DMPs) upon request of the regional RBD Water Directorates. These are part of the governmental decentralized administration and are responsible for updating the Drought and Water Scarcity Management Plans, supervised by the General Directorate for Water of the Ministry, based on a measure included for this purpose in the second cycle RBMPs.³⁰⁵
- ES: The Ministry for Ecological Transition and Demographic Challenge (MITERD) plays the main role in drought policy. The RBAs are the responsible body for drought planning; they are dependent either on the MITERD (for inter-regional RBDs) or the regional authorities. In addition to these, at the urban level management and monitoring lie in municipalities and utilities, especially those with more than 20,000 inhabitants who have to establish Drought Emergency Plans. Other public agencies monitor and analyse droughts such as the Meteorological State Agency (AEMET³⁰⁶), the Spanish National Research Council (CSIC³⁰⁷), and the Centre of Studies and Experimentation of Public Works (CEDEX³⁰⁸). In addition, there is a research- and project-based Citizen Drought Observatory³⁰⁹ which has been active over the past years.
- FI: The draft national strategy for climate change adaptation to 2030 stipulates that the Ministry of Agriculture and Forestry will have the responsibility over risk management of drought together with the Centres for Economic Development, Transport and the Environment (ELY Centres), the flooding centre, Ministry of the Interior, and in cooperation with municipalities and other actors.³¹⁰ the Finnish Environmental Institute SYKE (an Institute under the Ministry of Environment) collects data on water, including droughts).³¹¹
- FR: The River Basin Authorities, embodied by the basin coordinating prefect sets the overall framework which is implemented by each prefect in the departments. The representative of the State in the form of the *préfet* is in charge of coordinating drought planning and implementation, primarily at the territorial district level of *départements*. The decentralised services of the State in the form of DDT (*Direction Départementale des Territoires*) are the main administrative body supporting the *préfet*. The *préfet* ensures transparency and consultation between the various users concerned by drought management plan. The "water resources committees" ("*comités ressources en eau*") constitute the consultation body on water management at the local level, particularly with regard to low water levels. Their composition is adapted to the perimeter of drought management plan (departmental, interdepartmental) and must reflect the issues relating to the environments and uses of the territory concerned. Various public institutions produce field observation and expert data for drought monitoring. They are also represented in the "water resources committees" ("*comités ressources en eau*").
- HR: The National Hydro-Meteorological Institute (*Državni hidro-meteorološki zavod*) is responsible for meteorological and (partly for) hydrological drought monitoring. The Croatian Water Agency (*Hrvatske vode*) provides hydrological drought monitoring and is responsible for water resources management (art. 185. Water Act), including the activities related to the assessment and management of natural disasters, e.g. droughts (art. 199 Water Act). The Advisory Service for Agriculture provides recommendations to farmers on agrotechnical measures for plant protection from potential drought damages. The State Directorate on Rescue and Protection is responsible for supplying water on the terrain in case of drought. A standard operative procedure is applied using the national 112 emergency system.
- PT: Although both the Ministry of Environment and of Agriculture share the coordination of the Interministerial Permanent Commission, the former leads in practice the drought policy development and planning, given that the Environmental Agency (*Agência Portuguesa do Ambiente, APA*) and to a minor extent the Portuguese Institute for Sea and Atmosphere (IPMA), both institutions under the Environment Ministry rule, have the responsibility to lead the development and implementation of the DMP.
- MT: Malta's water management policy is led by the Ministry for the Environment, Energy and Enterprise (MEEE) through the Energy and Water Agency (EWA). The policy framework

addresses Malta's water scarcity conditions, where due to the semi-arid climate of the country natural water resources are not sufficient to meet the water demands. Malta's River Basin Management Plan therefore primarily focuses on ensuring security of supply under water scarcity conditions and hence promotes the conjunctive use of water demand management and water supply augmentation measures.

- NL: The State has a system responsibility: it assigns tasks and powers and sets (national) frameworks and standards. Provinces are responsible for strategic groundwater policy, groundwater withdrawals for drinking water and for large industrial withdrawals per year, and implementing the Water Framework Directive where groundwater is concerned. Under the Water Act, water boards, as managers of the regional water system, are co-responsible for groundwater management. This makes the water boards the competent authority for the most common and smaller groundwater abstractions. Provinces and municipalities are responsible for land use and assigning specific functions to locations, taking into account the quality of the soil and groundwater.³¹²
- PL: The Ministry responsible for water management (currently The Ministry of Infrastructure) adopts and updates the Drought Plan (*Plan przeciwdziałania skutkom suszy, PPSS*), guided by the need to counteract the effects of drought (art. 185 paragraph. 6 of the Act of July 20, 2017 - Water Law) and supervises the State Water Holding Polish Waters. Counteracting the effects of drought is the task of the state and local government administration bodies and Polish Waters (art. 183 of the Water Law).³¹³ Drought management is carried out according to the PPSS. It was prepared by the Water Management Authority Polish Waters in agreement with the ministers competent for agriculture, rural development, fisheries and inland navigation and the regional administration (*voivodes*), taking into account the division of the country into RBDs. The River Basin Authorities took part in the Working Group which coordinated the process of the creation of the PPSS. These authorities play also an important role in the planning and implementation of many of the investments that are included in the PPSS catalogue.
- SE: The Water authorities (*vattenmyndigheterna*) are county administrative boards appointed by the government to act as water district authorities, including the preparation of management plans and action programs. In addition, a wide range of bodies is cooperating on the topic of drought management, including the Geological Survey of Sweden (SGU), the Swedish Meteorological and Hydrological Institute (SMHI), the Swedish Agency for Marine and Water Management (HaV), the Swedish Civil Contingencies Agency (MSB), county administrative boards of Sweden (*Länsstyrelserna*), the Environmental Protection Agency (*Naturvårdsverket*), the Swedish Board of Agriculture (*Jordbruksverket*) and municipalities. Information about delegation of responsibilities can be found on the website of the Swedish Agency for Marine and Water Management.³¹⁴ The roles of different bodies cover a broad set of responsibilities, including policy development
- SI: The Slovenian Environment Agency is developing a drought monitoring system on project-based funding, without a mandate from the government. It works closely with the Chamber of Agriculture and Forestry of Slovenia and the Biotechnical Faculty to provide support to farmers, especially through technical instructions on the ground to ensure water supply and advice on activities during drought events to mitigate impacts and ensure compensation for lost income.

Table 8 Coordination bodies for drought management in the different EU MS

	Yes	No
Coordination body	BE-FL, BE-WL, BG, CY, CZ, DE, EL, ES, FI, FR, IE, IT, LU, NL, PT, RO, SE	AT, DK, EE, HR, HU, LT, LV, (MT), PL, SI, ³¹⁵ SK

Coordination body
 ■ In place
 ■ Not in place



Figure 3: Coordination body

Drought coordination bodies are in place in 16 EU MS. Recent changes are reported from 2016 (IT), 2017 (BE-WL, BG), 2020 (ES), 2021 (EL, FR), and even 2022 (CZ planned, LU), illustrating the relevance of coordination for drought management.

In some of them, the bodies are specifically established for dealing with droughts (e.g. BE, BG, CY, CZ, EL, ES, FR, IT, LU, RO) whilst in others broader topics such as floods or water management are also addressed (e.g. BE-FL, BG, IE). The **composition of the bodies** varies significantly; with some bodies only including public administrations (e.g. BE-FL, CY, CZ, HR, IE, LU), others with mixed compositions including water users (e.g. BE-WL, ES (only agriculture), FR, IT, PT), and other stakeholders (e.g. RO, FR (environmental NGOs, consumer protection associations, leisure associations) and finally some bodies consisting only of scientific members (EL) or including them (IT, RO). According to the information found, **environmental NGOs are represented in these drought coordination committees only in FR**, whilst for the purpose of achieving WFD objectives, their presence might be relevant in other countries as well.

The major part of the bodies provides analysis or advice (e.g. BE-FL, BE-WL, CY, EL, ES, FR) whilst in some cases, they are also responsible for decision-making, e.g. defining specific measures (CZ, IT).

The coordination set-ups of different EU MS are described in further detail below:

- BE-FL: The **Coordination Commission Integral Water Policy** (CIW) has a central coordinating role, functioning as a discussion platform for the different policy areas and levels of government involved in water policy in Belgium.³¹⁶ Within the Flanders Environment Agency, a drought coordinator has furthermore been appointed to supervise and coordinate drought-related planning, activities and management on various levels of government in Flanders.
- BE-WL: A drought unit, led by the Walloon Regional Crisis Centre (CRC-W), is active since the spring of 2017. It brings together the various actors involved in water management (Administration services, water producers/distributors, etc.). This unit analyses the state of resources by closely monitoring the evolution of groundwater levels, river flows (navigable

and non-navigable rivers), levels of water reserves of the reservoirs and the capacities of the catchments according to the demand.

- BG: Section 7.2. defines the institutional framework of the Water Strategy³¹⁷ and determines the establishment of the **Operational Centre for Water Management and Warning in case of Flood and Drought events** at the Ministry of Environment and Water, and its functions. According to the Rules of Procedure³¹⁸ of the Ministry of Environment and Water, adopted by the Decree of the Council of Ministers N° 208 dated 27.09.2017, the "National Coordination Centre" Directorate participates in the operational management of surface waters in case of emergencies related to floods or droughts.
- CY: There is an ad hoc **Expert Drought Committee** (DC) in WDD (internal procedure) comprising four District Officers, the heads of the Water Supply Service, the Irrigation Service, the Electromechanical Service, the Water Treatment and Quality Control Service, the Groundwater Service and the Programming Service. The DC meets during severe drought situations and based on the current drought conditions, the DMP and the Strategic Study for Water and Drought Management, propose appropriate measures. These recommendations are approved by the WDD Director and the Ministry of Agriculture, Rural Development and Environment. In severe drought situations and depending on the actions proposed by the DC, an additional budget might need to be approved. Furthermore, there is a **Water Management Advisory Committee** (WMAC) with an advisory role in water allocation policy, the water pricing policy and the policy for the use of recycled water.
- CZ: **Regional commissions for drought management** are already functioning, and a Central Commission for Drought Management is planned to be established. The **Central Drought Commission** is set up by the government, which also approves its statute, and is chaired by the Minister of Agriculture or the Minister of the Environment. It manages and coordinates individual measures of the Regional Drought Commission in case the drought impacts more regions and if necessary, issues additional measures. During the period when a drought/water scarcity is officially declared, the competent authorities are the regional drought commissions in cooperation with water authorities and the Central Drought Commission. In addition, since 2013, a Collaboration platform - the Inter-ministerial commission between the Ministries of Agriculture and Environment named *Sucho a voda* ("Drought and Water") - aims to propose activities and measures leading to securing the main objectives of the drought management plans and thus provide a basis for a comprehensive concept to address the negative effects of drought and water shortage in the Czech Republic. The proposed measures aim to increase the water retention capacity of the landscape, increase the total available water resources and improve water and waste management. Drought indicators and their application in monitoring systems will also be introduced.
- DE: Federal states can give obligatory regulation to their executive authorities or give guidance to them.
- EL: In the RBD of Crete³¹⁹ (1 of 14 RBDs), a DMP has just been published in 2021 which states that a **Special Task Force** is set up at the Decentralised Administration of Crete to take responsibility for the assessment of any drought - water scarcity event. The Task Force will consist of at least 3 specialised scientists.
- ES: The Water Directorate (DGA) of the Ministry of Ecological Transition (MITERD) is responsible for the coordination and monitoring of plans and actions to be carried out in drought situations³²⁰. Moreover, the so-called **Drought Roundtable** (*Mesa de la Sequía*) meets on an ad hoc basis to analyse and monitor the effects that the shortage of rainfall may have on agricultural production and to study the measures to be adopted to deal with them. This is an inter-administrative coordination forum that brings together the Ministries of Agriculture, Fisheries and Food and MITERD, regional administrations, agricultural organizations, agri-food cooperatives, and irrigation communities, with a permanent technical working group³²¹. No information has been found on legal attributions and composition.
- FI: There is a high-level **national flood and drought risk guidance group**³²², which is the national coordination body. Its mandate was renewed in 2022 and drought management role was highlighted more. There is also a **flood center** (but it also handles droughts), which follows water balances and indices, issues drought warnings and helps the local authorities.

- **FR: Water resources committees** are set up at the department level by each *préfet*. These have primarily a consultative role for the state, including the main water users, and they meet at least 1) at the end of the winter to assess the hydrological situation of winter groundwater recharge and forecasts for the coming months and review the “arrêté cadre”, 2) during the summer period when needed, and 3) at the end of the summer period to assess the past year. A *préfet* is identified to coordinate drought planning and management across a catchment crossing department boundaries. The *Préfet coordinateur de bassin* is responsible for coordinating drought planning across the large 6 river basins of France. A national committee (i.e. *comité d’anticipation et de suivi hydrologique*) composed of members representing water users as well as operating institutions also follows the state of water resources and can propose recommendations and actions at the national level. In addition, the Ministry of ecological transition and territorial cohesion publishes a monthly synthesis of key indicators on meteorological and hydrological conditions.
- **IE: A National Emergency Coordination Group**, comprising different ministries and local authorities is responsible for a range of emergencies (including droughts). In addition, IE has a **water forum** *An Fóram Uisce* that brings together different water stakeholders on water quality. This is an important means of working on water governance directly with a wide range of stakeholders, connecting them with high-level policy-making in ministries. While the focus is not solely on drought, the body has engaged with drought.³²³
- **IT:** In each of the seven RBAs there is a **RBD Permanent Observatory for water resource uses** that includes the following agencies and institutes: the RBA administration, the Ministry for the Environment and Energy Security (MASE, former Ministry of Ecological Transition, MITE), the Ministry of Agriculture, Food and Forestry, the Ministry of Infrastructure and Transportation, the Civil Protection Department (DPC), the Italian Institute for Environmental Protection and Research (*Istituto Superiore per la Protezione e la Ricerca Ambientale*, ISPRA), the National Statistical Institute (*Istituto nazionale di Statistica*, ISTAT), the Council for Agricultural Research and Analysis of Agricultural Economics (CREA), the Water Research Institute of the National Research Council of Italy (IRSA-CNR), the Regions, the National Association of Reclamation, Irrigation and Land Improvement (ANBI), lake regulation consortia, energy and environmental water companies, and hydropower companies. As specified in the agreement accompanying its creation (*Protocollo d’Intesa*).³²⁴, the Permanent Observatory constitutes a permanent operational structure of a voluntary and subsidiary type in support of integrated water governance that, in particular, takes care of the collection, updating and dissemination of data on the availability and use of water resources in the RBD. The purpose of the Permanent Observatory is to provide guidelines for the regulation of withdrawals and uses and possible compensation, especially during drought and/or water scarcity events, in compliance with the objectives of the RBD Management Plan and the control of the balance of the RBD water balance, also taking into consideration the National Strategy for Adaptation to Climate Change (SNACC), and to define actions and measures to be adopted, according to the severity of water shortage. At a national level, there is the **National Committee for the Technical Coordination of the RBD Observatories**³²⁵, established in October 2016, with the specific task of "promoting the harmonization, throughout the national territory, of the criteria for determining the levels of severity of scarcity phenomena, for the identification of benchmarks (hydrological, hydraulic, agronomic, drought environment and economic impact) necessary for monitoring and evaluation of environmental conditions and the effects of the measures adopted, and for the definition of procedures for the transmission and validation of data." The Committee, chaired by the MASE, includes representatives of the RBD Authorities, as well as that of DPC, ISPRA, ISTAT, CREA, IRSA-CNR, ANBI and Utilitalia (federation of water, environment, electricity and gas utilities), and has defined initial priorities for: 1. identification and collection of the data necessary for the management of water resources, particularly with regard to those related to abstractions and water use and consumption (activity led by ISTAT, in collaboration with ISPRA, CREA and ANBI and with the participation of all the other authorities that constitute the Committee); 2. identification of indicators useful for monitoring drought and water scarcity events, with particular regard to the definition of a common protocol/set of indicators to be adopted in each Observatory (activity led by ISPRA, IRSA-CNR, in collaboration with DPC, Istat, CREA, the RBD Authorities and MASE); 3. technical notes for water crises under drought conditions (activity led by Utilitalia in collaboration with ISPRA, MASE, DPC, IRSA-CNR, Istat, ISS-Italian National Institute of Health, University of Catania, water utilities and the RBD Authority of Po river); 4. focus on the application and calculation of water stress indicators (e.g. WEI+) at the national and RBD levels, also in relation to the disaggregation of SGD indicator 6.4.2 at the RBD level and to EEA indicators for use of freshwater resources (activity led by ISPRA in collaboration

with Istat, IRSA-CNR, the RBD Authorities and CREA); and 5. providing common references for drought management, including how to present results of the Observatories' activities (e.g. bulletins, RBD and national website) to uniform activities at the national level (activity led by MASE in collaboration with ISPRA, DPC, and the RBD Authorities).

- LU: A **Working group on Water Scarcity and Droughts** has been established in April 2022 for Water Scarcity and Droughts, with members of the environmental ministry and the water administration, which is in charge to start the planning process of drought management; the mandate is yet not published.
- PT: An **Interministerial Permanent Commission on Droughts** is in place, supported by a technical working group involving various public administration entities, sector representatives and NGOs.
- MT: Even though there is no formal mechanism set up for drought management, there is a regular exchange between the relevant management bodies. The implementation of the RBMP is coordinated by MEEE/EWA through an inter-ministerial committee which sees the involvement of other sectoral ministries, regulatory authorities and utility operators.
- NL: In case of drought, the national water distribution committee (LCW) is set up to determine freshwater allocation and distribution. Under normal circumstances, policy matters and implementation of measures are coordinated via working groups under the Delta Program Freshwater and the Administrative Platform Freshwater and the regular drought management is carried out by the program Smart Watermanagement (a cooperation between the Ministry, *Rijkwaterstaat* and the Waterboards)
- RO: In Romania, there are three levels of drought-relevant coordination bodies: 1) **National Committee for Mitigating Droughts and Combating Land Degradation and Desertification**. The establishment, organisation and functioning of the committee are appointed by order no 474/2004 of the Ministry of Agriculture and Rural Development. The Committee is responsible for the elaboration of drought strategies and action plans necessary for combating land degradation and desertification in Romania. There are 46 members of this committee, state secretaries from the ministries with responsibilities in drought management, representatives of national authorities for water, forests, land improvements, academia and research institutions. 2) **River Basin Committees** approve the restriction plans for water use during droughts. 3) **General Inspectorate for Emergency Situations** commands in an integrated way the intervention actions in case of soil-relevant droughts or associated dangerous meteorological phenomena (drought included).
- The Swedish Agency for Marine and Water Management leads a working group on water supply that consists of nine other authorities. The working group is responsible for working towards several ambitions, including enough water to produce drinking water without affecting water supply to agriculture, industry, and without negative effects on the environment. The working group also works on strengthening the protection of ground- and surface water supplies. The working group is one of three working groups under the national coordination group for drinking water.³²⁶ Municipalities (290 *kommunerna*) are part of the working group, represented by Svenskt Vatten och SKR.³²⁷, which was set up by the municipalities in 1962 to assist with technical, economic and administrative issues and to represent the interests of the municipalities in negotiations with authorities and other organisations on regulations.

4. MEMBER STATE DROUGHT MANAGEMENT PLANS: APPROACHES AND KEY ELEMENTS

4.1. Drought management approaches

Most EU MS follow more than one overall drought management approach, such as *water resource management* and *risk management* being applied in many EU MS, whilst *climate adaptation* and *ecosystem conservation* have a lower presence. Several EU MS (e.g. ES, FR) implement RBMPs to addressing permanent overabstraction of water whilst DMPs address temporary drought events.

Regarding sector-focused management, most EU MS address irrigation agriculture, followed by rainfed agriculture. Other sectors are only focused on in very few EU MS, and not in all those where the corresponding sectors are relevant (e.g. navigation and transport by shipping).

Table 9 Main drought management approaches followed in the different EU MS

	Member State
Water resource management, e.g. to ensure adequate distribution of resources e.g. water supply guarantees are provided during drought events	AT ³²⁸ , BE-FL, BE-WL, BG, CY, CZ, DE, EE, EL, ES, FI, FR, IE, IT, MT, NL, PL, PT, RO, SI, SK
Ecosystem conservation strategies, aiming for the protection of ecosystems, habitats or species (e.g. those protected under EU legislation) and/or ecosystem services	BE-FL, BE-WL, BG, CY, DE, EE, EL, ES, FR, (IE), IT, LT ³²⁹ , MT, NL, RO, SE
Risk management focuses on the stepwise application of preparedness, mitigation, relief and restoration measures during a drought event, and/or addressing the hazard, exposure and vulnerability	BE-FL, BE-WL, CY, CZ, EL, ES, FI, FR, HR, IT, LV, NL, PT, RO, SE, SK
Climate adaptation, with droughts as one component of such strategies, addressing possibly also heat waves and wildfires	AT, BE-FL, BE-WL, BG, CY, DE, EE, EL, ES, FR, IT, LU, MT, NL, SE, SK
Sector management	
irrigation agriculture	AT ³³⁰ , BE-FL, BG, CY, EL, FR, HR, PT, RO, SI, SK
rainfed agriculture	DK, LT, PT
livestock	PT
energy/hydropower	EL, PT
inland navigation	BE-FL, DE
urban water management	DE, EL, PT, SE
other	CY (tourism), EL (forestry, industry)

Further additional information is provided for some EU MS:

- BE-FL: The drought management plan for Flanders for 2022 – 2027, as integrated into the draft RBMP 2022 – 2027, first of all, entails an approach to water resource management, preventing water scarcity through an analysis of the region and sector-specific water scarcity and drought risks and stimulating adapted water use, production processes and harvesting processes.³³¹ Furthermore, as part of the aim to stimulate achievement of the good ecological status of water bodies, ecological repair of waterways (meanders, riparian zones) is planned, which is meant to also create synergies with drought and climate adaptation.³³² The RBMP furthermore makes use of a 'prevention, protection, relief' approach³³³ in its drought management plan with the interaction of climate adaptation, water infrastructure improvements, enhanced water distribution and use reduction measures and a coordinated crisis management approach, which also includes the decision-making framework for prioritising water use during drought and water scarcity. The Flemish Climate Adaptation Plan moreover aims to mitigate and adapt to the consequences of climate change, particularly taking into consideration of a heightened chance of heat waves and longer periods of drought.³³⁴ The draft Flemish Climate Adaptation Plan for the period 2021 – 2030 includes planning to address risks of water shortage, enhancing water networks, disaster risk reduction strategies, heat wave preparedness, impact reduction of droughts (biodiversity, drinking water, agriculture and transport) and an integrated, cross-

sectoral approach including all areas and levels of government involved. Moreover, via the platform Climate Innovation Window (CIW), all stakeholders involved in water policy preparation, management and crisis response are involved in integrated water policy, with a set of concrete actions against water scarcity and drought brought together by the Flemish Government's Blue Deal.³³⁵ A high-level task force has been set up to coordinate the Blue Deal, existing also of key players in water infrastructure and the Ministry of Agriculture. The Flemish RBMP refers to the Department of Mobility and Public Works, the Flemish Waterway nameless partnership (NV), the Agency for Maritime Services and Coast, the Agency for Roads and Traffic and the Department for Agriculture and Fisheries as being involved and having competencies in integrated water policymaking, while the CIW as an umbrella organisation brings the different areas and levels of government involved in Flanders' integrated water policy together.³³⁶

- CY: During drought events, strict measures have been imposed in the past on agriculture and households to guarantee water supply. Also, reservoirs play a key role in water resource management for storing water and guaranteeing supply in times of drought. One of the measures proposed under the RBMP and DMP on water abstractions from reservoirs aims to ensure a minimum volume of water in large dams for the conservation of lake ecosystems. Risk management is a key component of the Cypriot DMP, which includes a risk assessment of the future increase of water scarcity and drought phenomena and identifies and classifies vulnerability zones. The national climate adaptation strategy proposes key actions to address droughts both related to the management of crops (water reuse, irrigation efficiency, promotion of less water-intensive or dry crops) and forests (heat-resistant species, wildfires).
- DK: If any broader approach can be selected for DK, it is (Interreg³³⁷ and research³³⁸) project-based and addresses threats to rainfed agriculture.
- EL: The main objectives of the Drought and Water Scarcity Management Plans are to quantify drought and water scarcity in the River Basin Districts of Greece, examine possible methodologies for forecasting future phenomena and propose mitigation measures for different levels of drought and water scarcity risk. Further, since the DMPs are an integral part of the RBMPs, a main objective of the DMPs remains the management of drought in such a way that the objectives of the WFD on the protection of water bodies are met. The actions for water resources of the National Climate Adaptation Strategy (2017) include actions for water-saving, efficient use of water and reduction of groundwater abstractions, mainly concerning areas where there is a risk of water shortage. Further relevant actions of the National Climate Adaptation Strategy target the development of activities and land uses that are compatible with locally available water resources, e.g. developing adaptation options for activities that consume large quantities of water in areas facing shortages, developing efficient agricultural activities, and promoting soil water infiltration. Further actions target the phenomenon of desertification as well as reducing wildfires in forests.
- ES: The Spanish approach combines in a coordinated manner the RBMPs which include preparedness measures to solve recurrent imbalances between water resources and demands that affect adequate service coverage (new reservoirs, water reuse, water use efficiency improvements) and the DMPs which address drought event management (e.g. awareness campaigns, transitory restrictions, mobilization of alternative water resources). Drought management does not have a sectoral focus but an integrated one, providing a joint response to all sectors and the environmental needs through both RBMPs and DMPs, according to the legal priorities for water resource allocation. These planning tools do not take into account drought impacts outside the scope of the use of water (e.g. rainfed agriculture, forest management or heat waves).
- FI: Regarding water resource management, FI has an agri-environment payment scheme in place; residents, farmers or other persons can also apply for financial aid to undertake projects concerned with the use and state of waters and aquatic environments and restoration of field and forest ditches. Regarding risk management, the Finnish Environment Institute (SYKE) deals with different modelling applications for water regulation, flood and drought forecasting and risk management, as well as river basin management planning.
- FR: the French approach to managing water scarcity and droughts is built on two pillars: 1) Drought crisis management establishes thresholds for water levels in rivers, wetlands and groundwater (taking into account the needs of ecosystems, in particular, protected ones).

Different threshold levels are established to account for the level of urgency/crisis: vigilance, alert, reinforced alert and crisis levels, with increasing use restrictions attached to each level. A priority use scale is applied that guarantees certain levels of supplies during droughts. Furthermore, some *arrêté-cadre* may adopt exceptional measures to preserve drinking water supply or aquatic ecosystems when implementing the pre-defined set of restrictions will not achieve so. 2) Management of structural water deficits based on RBMPs, catchment management plans and specific management plans for managing water resources/structural deficits (*Projet de Territoire pour la Gestion de l'Eau*). They implement several types of measures to manage scarcity including water allocation, reduction of abstraction, water savings, natural water retention measures, the building of reservoirs, etc. There is a national adaptation plan, but water agencies also develop specific adaptation plans³³⁹ for their river basin, with a focus on the management of water scarcity rather than droughts. There may be specific arrangements for specific sectors. For instance, offline reservoirs can be created (outside the riverbed and filled when sufficient flows are available in the winter period) for which no restrictions apply during drought conditions. Overall, the French approach follows, if not informally, a risk management approach, with instruments and tools to prepare, mitigate, and provide relief to droughts³⁴⁰.

- HR: In 2005, the National Irrigation Plan for Croatia³⁴¹ was prepared and later updated in 2021. It includes a plan for efficiency improvements for drought preparedness.
- IE: The approach to drought management is described in the National Water Resource Plan (NWRP)³⁴² as the following: a) Define the triggers that will indicate drought is developing, b) Identify the plausible drought management options and assign these to escalation points, c) Monitor current conditions and operations against those escalation points on a routine basis, d) As drought develops implement actions in line with the Framework Plan, e) Reduce system demands – voluntary, then mandatory customer restrictions, enhanced leakage management, f) Increase outputs – recommission dormant sources, alter licence constraints, reduce compensation flows, introduce emergency sources. The ecosystem approach is likely to become more important in the future.
- IT: The main strategic tools and bodies to manage drought are the RBD Permanent Observatories for water resource uses, whose focus is monitoring and sustainable managing water resources at the RBD level and adopting actions and measures in order to satisfy water needs by different sectors, especially during water scarcity and droughts and under a changing climate. Different levels of drought/water scarcity severity trigger actions and measures that will be adopted by the local competent authorities. The Permanent Observatories for water uses identify 4 levels of severity concerning drought/water shortage (normality and three levels of severity, from low to high and depending on the level of severity, different measures and authorities get activated (e.g. high severity can lead to emergency actions). Moreover, there is general awareness about the need to prepare for drought through structural and non-structural measures, leading to the adoption of preparedness, mitigation, relief and restoration measures, from short- to long-term, and/or addressing the hazard, exposure and vulnerability that are based on the regional decrees that absorbed the guideline of the RBD Observatories.
- MT: Water scarcity, drought and aridity approaches are combined in Malta, with a major focus on the increase of water supply (e.g. desalination, wastewater reuse) and water use efficiency, aiming to reduce the increasing impacts of climate change (temperature, precipitation). No operational drought management is in place, and a country-specific drought indicator set is planned to be developed. Specific ecosystem action is taking place for the small rivers and lagoons with protected species, partly by ex-situ conservation but also by improved monitoring.
- NL: "The overarching goal of the Delta Programme Freshwater is to ensure that by 2050 the Netherlands is resilient to water shortages. The task is to maintain and promote a healthy and balanced groundwater system, to protect crucial utilization functions and to use the available freshwater effectively and economically".³⁴³ Regarding risk management, the Policytable Droughts has been created after the severe droughts in the Netherlands in 2018 and 2019. The recommendations that have come out of this Policytable have been assigned to different levels of government and bodies. These recommendations are built upon risk management: "the spring, summer and autumn of 2018 were exceptionally dry and the inflow from the major rivers was low. As a result, damage occurred in agriculture, shipping, recreational boating, other economic sectors and nature reserves. In built-up and rural areas, there were water quality problems and additional subsidence due to low

groundwater levels, which affected buildings. Shipping had serious problems due to shallow draughts and restrictions on locks. This also led to bottlenecks in the supply of raw materials for the construction and supply of petrol stations. Salinisation was more severe than expected in some areas."³⁴⁴ Regarding climate adaptation, the RBMP links expected climate change impacts to dry summers and extreme rainfalls. Also, the National Adaptation Strategy³⁴⁵ addresses climate change as one of the main reasons for drought. And the Deltaplan mentions climate change and changing and increasing demand for fresh water as the main reason for the drought. Regarding ecosystem services, the importance of safety and the prevention of irreversible damage puts nature in the highest category in the prioritisation ranking.

- PL: Article 10 of the Water Law outlines water management priorities: 'The management of water resources has the objective to meet the needs of the population and the economy and to protect the waters and the environment associated with these resources, in particular: 1) ensuring adequate quantity and quality of water for the population; 2) protection against flooding and drought; 3) protection of water resources against pollution and improper or excessive exploitation.
- PT: The drought policy is mainly focused on mitigating impacts and prioritizing uses, i.e. applying a water management approach. However, it does include a risk management component with different sets of measures being applied under different levels of alert, which can be classified as preparedness, mitigation and relief (measures. It also includes specific measures and impact assessments for the most affected sectors, namely irrigation agriculture, dryland farming, livestock, hydropower production, and urban water management. For example, the management of reservoirs with various uses requires guaranteeing storage for 2 years for public supply and ecological flows. Following the 2022 drought and in the most vulnerable places in terms of public supply, measures are being defined to create resilience and guarantee alternatives that allow to have a strategic reserve. Also, as a result of the last droughts, various measures are being implemented to use treated urban wastewater for non-potable uses, namely in the irrigation of golf courses, urban uses and agricultural irrigation. Both for public supply systems and for agricultural associations, contingency plans were drawn up to face drought problems. Several measures aimed at improving efficiency and reducing losses in urban and agricultural systems are underway, including the installation of water meters.³⁴⁶ The Drought Commission has a technical support group that includes decision-makers in terms of administration with the possibility to listen to the main water users. This working group evaluate all the information (non-public documents) which is then sent to be approved by the Drought Commission.³⁴⁷ Monthly public assessment reports of the meteorological and hydrological drought situation and measures taken are prepared.³⁴⁸ At the same time, the Reservoir Management Committee, coordinated by the Portuguese Environment Agency, particularly in the early stages of the drought, holds national and regional meetings to assess with users the situation of its evolution (scenarios for the evolution of availabilities are presented, namely for the worst cases scenarios, and measures are defined for the best way of implementing them, thus ensuring better user adherence.³⁴⁹
- SE: Sweden's climate adaptation site³⁵⁰ also includes the issue of drought and provides examples of ways in which the effects of droughts both can and have to be tackled. Examples of adaptation measures from the island of Gotland include e.g. working with information campaigns to make the residents aware of the water shortage and how they can help, cultivating cereal that can survive during drought occurrences, investing in drought-resistant quinoa cultivation by farmers, irrigation ponds for agriculture that have better opportunities to irrigate the crops and give the animals water, as well as water project collaboration such as the excavation of ditches and wetlands to improve water collection and delaying outflow to the Baltic Sea.
- SI: The RBMP for Slovenia predicts that regular water management and maintenance services will implement measures to ensure sufficient water quantities given predicted climate change. No further details are given, but rivers are being regulated and large artificial retention lakes established. Since there is no drought management, the only nationally regulated condition is linked to the 2009 Decree on criteria for determination and the mode of monitoring and reporting of ecologically acceptable flow³⁵¹. By issuing water permits, the government obliges itself to ensure the water to the rights holders, while the right holders are obliged to respect the ecological flow set in the permit. There is an exemption in the decree that for irrigation purposes, the ecological flow can be overcharged by 7%. However, in practice ecologically acceptable flows are neither monitored.

4.2. Drought management relief and response measures

The following specific drought management relief and response measures are implemented by the EU MS. Whilst operational demand and supply measures are being used by 22 and 19 EU MS respectively; economic impact compensation measures (12 EU MS), increased control and enforcement measures (13 EU MS), operational measures for the environment (14 EU MS) and organizational measures (12 EU MS) are only being used in half of the EU MS.

On the lower end, follow-up measures (6 EU MS) and recovery measures (2 EU MS) are only used by a few EU MS. Given the gaps and weaknesses in governance and monitoring, further information shall be shared by EU MS implementing such measures successfully.

No such measures have been identified for 3 EU MS (EE³⁵², LV, PL³⁵³).

Table 10 Relief and response measures planned to be taken during the occurrence of drought in the different EU MS

	Member State
Operational demand measures (such as voluntary water savings, temporary restrictions or banning of non-essential uses)	AT, BE-FL, BE-WL, BG, CY, CZ, DE, DK, EL, ES, FI, FR, HU, IE, IT, LT, LU, MT, NL, PT, RO, SI, SK
Operational supply measures (such as mobilization of fall-back water resources, drilling new boreholes, water rights exchange)	BE-FL, BE-WL, CY, CZ, DE, EL, ES, FI, FR, HR, HU, IE, IT, MT, NL, PT, RO, SE, SI, SK
Economic impact compensation measures (such as specific subsidies or discounts from fees or tariffs of water users)	AT, EL, ES, FR, HR, HU, IT, LT, MT, PT, RO, SI
Increased control and enforcement measures (e.g. on illegal water abstractions, water pollution, etc.)	BE-WL, BG, CY, CZ, EL, ES, FR, IT, LT, PT, SE, SI, SK
Operational measures for the environment (such as avoiding water intake from vulnerable ecosystems, increase or adaptation of ecological flows, intensified monitoring, or preservation of endangered fauna)	BE-FL, BE-WL, BG, CY, DE, ES, FR, HU, IE, IT, LT ³⁵⁴ , (MT ³⁵⁵), NL, PT, RO
Organizational measures: establishing public participation activities to inform and promote collaboration to ensure DMP measures effectiveness	AT, BG, CY, CZ, DE, ES, FR, IT, NL, RO, SE, SI
Follow-up measures: establishment of follow-up indicators (evolution, effects, and efficiency) and/or review of the DMP (post-drought audit and upgrade when needed)	BE-FL, CZ, ES, FR, IT, RO
Recovery measures: activation of corrective measures to recover affected ecosystems, habitats, species	BG, ES

Specific measures across the eight measure types are discussed in the following sections.

4.2.1. Operational demand measures

Operational demand measures are included in the portfolio of possible actions in several EU MS, including both voluntary and mandatory measures, often in a stepwise approach following the severity of drought and the need to take additional measures.

Table 11 Operational demand measures to be taken during the occurrence of drought in the different EU MS

	Specific measures and MS where applied
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Voluntary measures	Awareness raising and water consumption reduction (urban): AT, EL, ES, IE, LU, MT, NL, SI Awareness-raising (irrigation): BG, IT, MT Installation of water-saving devices: EL, MT Leakage repair in urban water supply networks: AT, EL, IE, IT, MT Industrial water use efficiency agreements: BG
Mandatory measures	Urban/domestic water use restrictions (filing of pools, garden watering, car or street wash): AT, BE-FL, BE-WL, CY, DK, EL, IT, SI, PT Irrigation water use restrictions: AT (Burgenland), EL (deficit irrigation, drastic reduction of irrigation abstractions from water storage reservoirs to first ensure the coverage of urban water supply needs), ES, IT, PT Hydropower water use restrictions: BE-WL, BG, IT, PT Recreational water use restrictions: ES, IT, PT Prohibition of tree felling: BG Discontinued water supply: EL Increase in urban water prices: EL

Further information on such measures in the different EU MS is provided below:

- AT: The federal states, together with water supply companies created community-related and regional/national water supply concepts. Based on these concepts, various measures are taken to ensure water supply. For short-term adjustment measures, a one-month forecasting tool is applied, aiming for the early planning and implementation of short-term necessary adjustment measures, such as a temporal staggering of spring pool fills or temporary reductions in garden watering in summer. A reduction in peak consumption can also be achieved by changes in water pricing (average water consumption versus peak consumption). Further measures in the area of drinking water supply are the reduction of water losses through maintenance of the existing infrastructure and the promotion of conscious use of water. In schools, using the so-called drinking pass, children and young people are already aware of the importance of resource water clarified. In order to prevent the groundwater levels from falling below critical levels, the Burgenland region has set up a monitoring system to ensure continuous monitoring of the groundwater situation in the district of Neusiedel am See. When falling below defined groundwater levels, crop-specific restrictions on irrigation are planned. In regions where there is potentially a shortage and related water use conflicts, the existing permits and new permits can be revised.
- BE-FL: Operational demand measures, including household water savings (e.g. garden irrigation prohibitions and non-essential household use), are part of the measures included in the Decision Making Framework.
- BE-WL: If necessary, the Drought Unit of the Walloon Regional Crisis Centre proposes management measures to the authorities, such as limitations on domestic water use, filling swimming pools, car washing, banning the use of watering, prohibition of hydroelectric exploitation on all non-navigable watercourses' rivers, the obligation to group boats together at locks. Finally, the unit provides information to various authorities (Walloon government, governors, federal crisis centre and the Flemish Region) and communicates with the population. The municipalities have the power to impose temporary restrictions.

- BG: Measures include the following: Introduction of water-saving technologies and circulating water supply; Prohibition on issuing permits for water abstraction for hydropower plants in the areas for the protection of economically valuable species of fish and other aquatic organisms; Prohibition of felling, except for sanitary and cultivation felling, in the catchment area of surface water intended for domestic drinking water supply; Conduct campaigns to promote the use of irrigation methods that reduce water consumption. The following measure is likely also included in the third cycle RBMP: Water efficiency - Voluntary agreements with industry to reduce water use.
- CY: Operational demand measures can include temporary use restrictions, e.g. prohibiting car washing, watering the lawn and filling private pools³⁵⁶. Drinking water pricing is also used as a tool to minimize consumption of water (water operators use rising block tariffs (set by regulation) with a very high levy for the consumption that exceeds the approved amount).
- DE: In Germany several measures exist for dealing with droughts and their effects. Depending on their focus, these measures are implemented in a decentralised manner within the framework of the low water strategies of the federal states or in regional water supply concepts. The umbrella for drought adaptation measures is the National Water Strategy, subject to its adoption. In general, it should be noted that in Germany, water resources are managed in an integrated way across different extreme events such as floods, heavy precipitation and droughts. A drought-only approach is not established.
- DK: The Danish executive order on water supply § 52 state, that the individual water suppliers can take decision to limit the water use in their supply zone, if the water resource is under pressure, for instance due to a longer period of draught. As an example of limitation on water use, the law specifically state prohibiting garden watering. Also, all water extraction needs a permit, stating the purpose of the extraction and the permitted extractable water per year. Under the 2018 drought, unsuccessful attempts were made to receive exceptions and flexibility to the existing irrigation systems extraction limits. As a result, regulations were changed, so short term irrigation permits can be given during extraordinary weather e.g. prolonged periods of drought. To promote a general reduction in the use of water, water from public water suppliers is taxed with a fee of 6.37DKR = 0.86 EUR/m³. As a result, the amount of groundwater extracted by public water suppliers has dropped 37 % since 1990.
- EL: The Drought Management Plan of Crete RBD (EL13) includes a detailed list of measures to be taken during incidents of alarm or emergency conditions, such as public information campaigns, water-saving devices, limits on non-essential water uses, prohibition of certain water uses, maximum consumption limit/water pricing under drought conditions, intensified controls etc., and improvements in water system efficiency (at source, water distribution networks etc.).
- ES: Measures include raising public awareness, reduction of supply allocations, restrictions on uses (certain crops, irrigation methods, recreational uses), penalties for excessive consumption
- IE: National information campaigns to inform about the risk of drought are planned (during a drought event). Reparation of visible leaks during a drought event is to be prioritised so they do not undermine communication efforts encouraging people to save water.
- LT: Operational demand measures can be enforced if the flow is lower than the established environmental flow or water level.
- LU: There are recommendations³⁵⁷ on the household level for restricting water use in times of drought. Households are not obliged to comply with the requirements.
- NL: The prioritisation ranking series gives a clear direction for setting priorities and is applied in the case of regional and supra-regional water shortages.
- SI: Measures in the event of water shortage in water supply systems include: calls/communication for economical use of water by water suppliers, calls/communication to prohibit the use of water from a water supply systems for filling swimming pools, washing cars, watering gardens and greenery, polishing and washing of roads and yards.

4.2.2. Operational supply measures

Whilst many of the plans include preparedness measures to increase water supply (e.g. improved soil and groundwater storage, construction of small ponds, the building of new reservoirs, desalination plants or water transfer pipelines), the list of operational supply measures to increase water supply in an agile way during a drought event is not extensively explored in many plans. Operational supply measures include:

- Rainwater harvesting: BE-FL (households, planned), MT (households, in process)
- Drilling and use of emergency boreholes: EL, ES, IT
- Increasing desalination production: CY, MT
- Water reuse (of treated urban wastewater): (BE-FL, planned), BE-WL, CY, DK, MT
- Greywater recycling (within urban dwellings): MT (under assessment)
- Water reallocation: EL, ES, IT, PT
- Water transfers (e.g. inter-basin): EL, IT, PT
- Tank water supply: SI, IT
- Lowering of pressures in the distribution network: IT
- Not specified: DE

In Denmark, reuse of treated wastewater for agricultural purposes is not extended due to a sufficient amount of rain and groundwater resources. There is a couple of research and development projects at minor isles where the groundwater resource may be challenged by intrusion of seawater. DK has plans to use treated wastewater for power to X production.

4.2.3. Economic impact compensation measures

The measures foreseen in some of the EU MS include different forms of economic compensation:

- Economic compensation or complementary financing: BE-FL (planned), FR (drought conditions can lead to the designation of the agricultural calamity which triggers a compensation of losses during droughts through the national guarantee for agricultural calamity, funded through a fee on agricultural insurance contracts), HU, IT (only if there is a declaration of national calamity)
- Exemptions from (water supply, employment...) fees or taxes: ES, HU

The following complementary information can be provided:

- BE-FL: Economic incentives in the form of subsidies and financing are used, but more to stimulate preventive action in the form of area-based management and financing for achieving good status of water bodies, than as a crisis-response measure.
- ES: The declaration of an exceptional situation due to extraordinary drought includes economic compensations for affected water users, such as exemptions from taxes or employment/social security contributions.
- HR: The Ministry of Agriculture and Ministry of Finance evaluates yield and economic losses due to drought, respectively, and decides if a natural disaster will be proclaimed. If so, economic compensation is provided. Regarding droughts, a natural disaster is proclaimed if the yields are reduced by more than 30% per ha with respect to the three-year average. Furthermore, the total value of damages must be larger than 20% of the local-government budget for the previous year and the damage values are evaluated and confirmed by the Commission for Damage Assessments (CDA).

- HU: Act VLII of 1995 on Water Management³⁵⁸ establishes that the water user does not have to pay a water supply contribution fee after the amount of water used for irrigation, fisheries and rice production during the period of permanent water shortage. During the period of permanent water shortage (declared by the minister responsible for water management), agricultural water users have the possibility to apply for additional irrigation water without applying for water permit. Consent of the regional Water Directorate is needed based on the available water resources. This exceptional water use has the following conditions: can be applied for only once in the water shortage period, for max. one month, for max. 100 hectares and 120 mm/hectare irrigation water, water withdrawal with provisional pumps. Act CXIII of 2019 on irrigation management³⁵⁹ regulates general rules on compensation for restrictions.

4.2.4. Increased control and enforcement measures

Explicit references to increased control during droughts have been identified in ES regarding water use and water quality and in SI to identify illegal water use via "river controllers".

4.2.5. Operational measures for the environment

Several MS implement operational measures to safeguard the environment, in particular protected species. Most detailed references to such measures have been found for IE and NL. Further, available information is provided for some EU MS:

- BE-WL: Prohibition of fishing, driving in forests or the banning of fires in forests.
- BG: Provision of water quantities in connection with the achievement of favourable conservation status in Natura 2000 protected areas; and other measures to preserve and improve the structure and functions of aquatic ecosystems.
- ES: Short-term actions for environmental protection, aimed at safeguarding aquatic ecosystems and vulnerable species
- IE: The following 'generic' environmental mitigation measures would 'be considered': Fish rescues; Fish ladders regularly checked; Increased presence to restrict poaching and protect spawning reeds; Habitat restoration; Reductions of abstractions, if possible; Freshet releases; Flow augmentation structures to enhance water depth/flow velocity; Ensure adequate post-drought monitoring. Measures for avoiding water intake from vulnerable ecosystems is likely to be an outcome of the NWRP regional reports.
- IT: in 2017 the ecosystems of Lake Bracciano were impacted by the persistence of drought. To prevent further impacts, in the framework of the Observatory of the Central Apennines RBD (where the lake is located), it was decided as a measure to interrupt water abstraction from the lake. This measure was adopted by the ACEA water utility. The question was also personally followed by the Minister of Environment, who requested that ISPRA prepare a specific dossier³⁶⁰. A technical group was established to verify the situation and possible future impacts on lake ecosystems and to decide when to allow the water supply from the lake again.
- NL: The Policytable Droughts itself was a project with stakeholders from different sectors. Also, it advises provinces to map groundwater withdrawals near vulnerable groundwater-dependent ecosystems and determine whether measures are needed to prevent irreversible damage. This is a tailor-made approach and requires administrative consideration at the regional level, taking into account the responsibilities and legal obligations of the administrative bodies involved.

4.2.6. Organisational measures

The following information has been compiled regarding organisational measures:

- CY: TV spots are used to raise awareness of citizens/consumers on minimising water consumption when droughts occur.³⁶¹

- ES: Drought management includes the establishment of the administrative structure, responsibilities and organisation for the implementation and monitoring of the DMP, as well as the coordination between administrations and public or private entities.
- HR: Monthly bulletins on the current state of precipitation and hydrological conditions are published online by the Croatian Meteorological and Hydrological Service (DHMZ) and sectoral institutions (Croatian Waters, HEP Group). Agrometeorologists provide an agrometeorological forecast on TV and other media services, including explanations of drought evolution and agronomic advice. The Advisory Service for Agriculture has branch offices in each municipality and its employees advise farmers on necessary actions due to drought conditions. The Ministry for Agriculture, Croatian Waters, Advisory Service for Agriculture and State Directorate on Rescue and Protection are responsible for preparing all needed measures and prevention steps to act in case of drought in Croatia.
- NL: The Policytable Droughts advises the Administrative Platform for Freshwater, the Steering Group for Spatial Adaptation and the OnsWater Platform to continue to organise good coordination of communication about water (availability) and drought, and thus increase water awareness.

4.2.7. Follow-up and recovery measures

For the following EU MS, further details regarding follow-up and recovery measures have been compiled:

- BE-FL: Follow-up of indicators, evaluation of drought events and subsequent analysis and review of the drought management plan, if needed, is done based on input from experts in the Drought Advisory Group and members of the groundwater working group.
- IT: After the issuing of a state of emergency for water crisis by the President of the Council of Ministers, one of the follow-up measure adopted is the post-event monitoring to define when interventions for drought condition emergency can be stopped. In fact, this is also in the hands of the Observatories through the declaration of the state of water severity.
- ES: Recovery aims at mitigating the negative effects, both in terms of environmental impacts and the recovery of strategic reserves that may have been depleted. The drafting of a post-drought report is also required.

4.3. Priority water allocation

Water allocation priorities under droughts are in place for 16 EU MS (AT, BE-FL, BG, CY, CZ, DE, DK, EL, ES, FI, FR, HU, IT, NL, PT, RO), whilst none are in place for 11 EU MS (EE, HR, IE³⁶², LT, LU, LV, MT, PL³⁶³, SE, SI, SK); in MT such prioritisation is established for desalinated and reclaimed treated wastewater, for municipal supply and agricultural irrigation respectively.

4.3.1. Where are priorities set?

In 12 EU MS, a priority order for water allocation in case of drought is in place at the MS level. Where such priorities are in place at the MS level, there might be complementary or changing priorities in place at a lower level, e.g. the RBDs (e.g. ES, NL). For example, in NL, the four main categories are established at the national level, but within levels 3 and 4, the regions can prioritise themselves.

Table 12 Level of governance that determines the priority order for water allocation in case of drought established in the different EU MS

	Member State	RBD(s)	Region(s)	Other area
Priority order established	BG, CY, DE, DK, EL, ES, FI, FR, HU, IT, NL, PT	BG, CZ, FR, RO	BE-FL, FR, NL	AT, FR

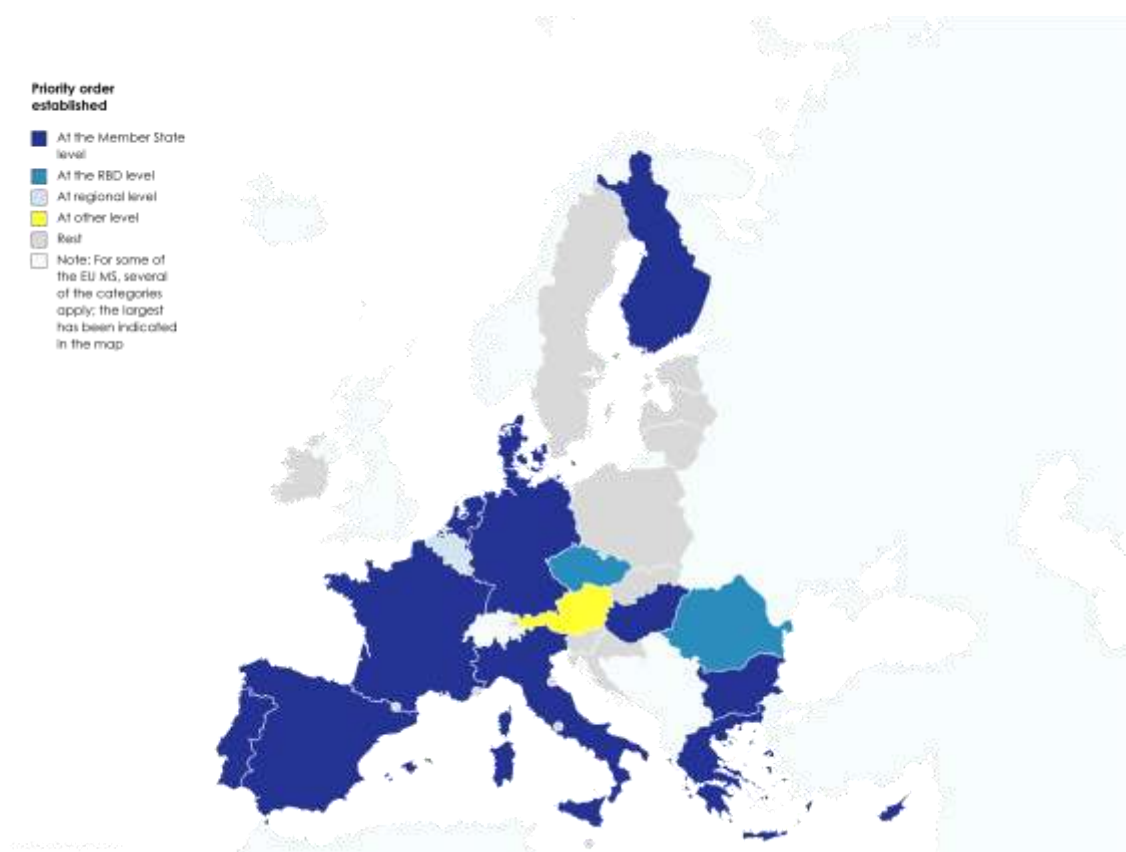


Figure 4: Priority order established

In AT, the priority order is established at the community level, in BE-FL on the basis of the Water Scarcity and Drought Playbook, and in BG depending on the competent body for issuing the water abstraction permit, so either at the MS level (Minister of Environment and Water) or the RBD level (director of the respective Basin Directorate).

Table 13 Type of legal/policy document that sets the priority order for water allocation in case of drought established in the different EU MS

	Law or regulation	RBMP	DMP	Other
Priority order established	AT ³⁶⁴ , BG ³⁶⁵ , DE ³⁶⁶ , DK ³⁶⁷ , EL ³⁶⁸ , ES ³⁶⁹ , FI ³⁷⁰ , FR, HU ³⁷¹ , IT ³⁷² , NL ³⁷³ , PT ³⁷⁴	CY, RO	CY, FR	BE-FL, CZ

Usually, the priority order is established in an EU MS law or other regulation, a concept which can also cover the RBMPs and DMPs and provides a legal backing for administrative decisions which can affect economic actors, societal wellbeing and ecosystems. In BE-FL, the priority order is set out in the Water Scarcity and Drought Playbook³⁷⁵, a comprehensive manual designed to ensure coordinated decision-making and targeted response by all actors involved in case of situations of water scarcity and drought. The Flemish RBMP refers to the playbook for drought indicators (chapter 3 on targets and assessments). CZ priority system is also based on a guidance document³⁷⁶. In BE-WL, there are plans to develop a law; the order of priority will be based on essential and non-essential uses.

4.3.2. Criteria for defining priorities

Table 14 lists the elements and criteria that were identified for defining priorities for water allocation.

Table 14 Elements and criteria for defining the priority order for water allocation in case of drought established in the different EU MS

	EU MS
Allocation is based on (recent) water accounts/balances for the RBD	BE-FL ³⁷⁷ , CY ³⁷⁸ , ES ³⁷⁹ ,

level	FR ³⁸⁰ , IT ³⁸¹ , RO ³⁸²
Priority order is absolute by type of use (e.g., irrigation is always above the industry or vice versa)	BE-FL, (BE-WL), BG, CY, CZ, DE, DK, EL, ES, HU, IT, NL, PT, RO
Priority order also considers specific criteria – e.g. within each type (e.g. economic or social dimension, age of water entitlement, differential profitability, location...)	BE-FL, (CY), ES, FI, FR, NL, (PT), RO
Allocation during drought includes changes to the ecological/environmental flows	AT/unclear, CY ³⁸³ , ES, FR ³⁸⁴ , IT ³⁸⁵ , RO, SI

Out of the 15 EU MS with a priority water allocation schema, six of them base the allocation on recent water accounts for the RBD, which improves the accountability and transparency of administrative action.

4.3.3. Who has priority?

The EU MS assign priorities to types of uses, with more or less complexity and detail – as can be seen in the next table. The level of complexity and detail might be related to the severity of droughts in the different MS and possible water use restrictions, affecting more than the principal water use sectors.

In most of the systems, the primary priorities are assigned to critical infrastructures (like dykes, and hospitals), drinking water (which is sometimes aggregated as/to domestic or urban water uses – which might include smaller industries; as well as livestock holding) and in some MS to the environment. If considered, and this is not the case in all EU MS where such activities are relevant, navigation and sports/recreation go least in the priority setting.

Some EU MS include other/complementary criteria for assigning water use priorities; such for example the type of crops. For example, in Portugal, irrigation agriculture of permanent crops such as olive or fruit trees shows up much higher in the ranking than other annual crops. Though this is supported by economic aspects (e.g. investment loss), it is unclear if such crop changes are subject to ex-ante risk assessments including water availability. Further available information from the EU MS is shared in this section.

Regarding the priority ranking of the environment/ecosystems, often considered as ecological flows, the situation is very different across the EU. In addition, there are at least 6 EU MS (CY, ES, FR, IT, RO, SI) where ecological minimum flows can be reduced during droughts; e.g. in RO by up to 50%. It might be subject to further assessment if and how such decisions bear in mind the reversibility of deterioration, especially if they are taken at a local level or by administrations which are not responsible for ecosystem protection.

Table 15 Simplified overview of the prioritisation of water use during droughts in EU MS

	1	2	3	4	5	6	7	8	9
AT	Criteria established at the local level								
BE-FL	Critical infrastructure (dykes)	Environment; Navigation	Other essential uses	Non-essential uses					
(BE-WL)	Human and animal food, physiological needs, energy, protection of biodiversity	Industry, Agriculture	Recreation						
BG	(Environment)	Drinking; Households	Mineral water	Agriculture	Industry; Hydropower; Recreation				
CY	Drinking	Recharge	Drinking (+2 years)	Environment	Agriculture				
CZ	Critical infrastructure e.g. medical facilities	Drinking, food, hygiene	Livestock and aquaculture; Ecosystems; Agriculture	Irrigation; Forestry; Mining; Food production; Textile & paper industry	Sports; Recreation				
DE	Public water supply								
DK	Domestic	Environment	Agriculture; Industry; Energy; National						

			security						
EL	Drinking	(different in RBDs)							
ES	Urban and small industry	Environment	Irrigation agriculture	Energy	Industry	Aquaculture	Recreation	Navigation	Other
FI	Local households	Local community	Local industry or external households	Other external uses					
FR	Public health; drinking; critical infrastructure (e.g. nuclear power plants)	Environment	Agriculture; Energy; Industry; Other						
HU	Drinking	Critical infrastructure (medical and residential)	Livestock; aquaculture	Environment	Irrigation	Economy	Recreation		
IT	Environment	Domestic	Irrigation						
NL	Flood defence	Security of settlements	(Environment)	Drinking	Energy	Other (region-specific)			
PT	Urban, eflows	Agriculture (permanent); Livestock	Environment	Energy	Industry	Agriculture (other)	Other		
RO	Population; Livestock	Industry; (Irrigation)							

In the above table, the priority ranking of the environmental or ecosystem requirements is marked in green; in dark green in those cases where the regulation does not foresee a reduction of water allocation for the environment or ecosystems during droughts; and in light green where such reduction is foreseen or only the preservation of irreversible damage is considered in such position.

The following complementary information can be provided for some EU MS:

- BE-FL: The priority order is based on a set of principles: 1) first non-essential water use is prohibited, then certain types of essential water use. Non-essential water use is defined as (i) cleaning vehicles, filling swimming pools, ponds and supplying fountains; (ii) cleaning streets, footpaths, terraces, lanes and squares; (iii) irrigating fields, parks and gardens; (iv) humidifying and cleaning roofs and tents, etc. 2) own preparedness efforts are rewarded by only prohibiting the use of 'public' water, not own reservoirs of rainwater; 3) avoiding danger for human health – no measures are taken with an impact on drinking water. Furthermore, the priority order is based on a set of limitations which are an absolute priority in the determination of an order: (i) not endangering the stability of dikes and quay walls and ensuring the security of navigation by securing minimum water levels with maximum efforts; (ii) avoiding irreversible damage, i.e. not transgressing minimum ecological flows, water levels along vulnerable waterways and minimum groundwater levels with dependent terrestrial ecosystems.
- In BE-WL, there are plans to develop a law; the order of priority will be based on essential and non-essential uses.
- BG: The priority order ranking is 1. for drinking and household purposes; 2. treatment and prevention - only for mineral waters; 3. for agricultural purposes; 4. other purposes, including industrial purposes, recreation, and hydropower. The priorities shall be applied in compliance with the requirements for environmental protection.
- CY: The priority order is absolute by type of use as follows: (1) drinking water supply, (2) recharge of reservoirs, (3) next two years' absolute needs and (4) irrigation. Water supply is the most important human consumption and is the priority in the case of competing uses in Cyprus. Irrigation is a lower priority compared to water supply and the environment. The crops to be irrigated are given priority as follows: permanent crops, greenhouses, seasonal crops, forage, and green areas.
- CZ: The uses of water are determined gradually from the most important to the less important as follows: a) ensuring the functionality of critical infrastructure in accordance with the regulations governing crisis management and other facilities providing essential services (e.g. medical facilities), b) supply of the population with drinking water (for drinking purposes, to ensure food and hygiene), c) livestock production, fish and aquaculture, such as agricultural production and ecological function of water, d) economic uses not falling under points (a) to (c) and other local uses of employment (agricultural crop production, industry and non-critical energy) infrastructure, such as irrigation, forestry, mining and mineral processing, food production and beverages, textile and related production, wood processing, paper industry, production chemical substances, non - metallic mineral products, e) (e) other uses (especially sports and recreational).
- DK: The priority of allocation is: 1. Domestic. 2. Environment. 3. Agriculture, industrial, energy production, transfer to the sea or another system and national security.
- EL: Drinking water has priority over all other uses. The priority order for the other types of water use is different in the 14 RBDs of the country (e.g. between the islands and the RBDs of the northern part of the country) depending on the specific water demands.
- ES: Any concession is subject to compulsory expropriation, in accordance with the provisions of the general legislation on the subject, in favour of another use that precedes it according to the order of preference established in the RBMP. In the absence of such order of preference, the following shall generally apply 1. Water supply for the population, including the necessary supply for industries with low water consumption located in population centres and connected to the municipal network. 2. Irrigation and agricultural uses. 3. Industrial uses to produce electricity. 4. Other industrial uses not included in the previous sections. 5. Aquaculture. 6. Recreational uses. 7. Navigation and aquatic transport. 8. Other uses. The order of priorities that may be established specifically in the River Basin Management Plans, shall in any case respect the supremacy of urban water supply. Within each of the eight classes, older entitlements have preference over new ones. Moreover, in the event of incompatibility of uses, preference shall also consider greater public or general utility, or the introduction of technical improvements resulting in lower water consumption or in the maintenance or improvement of water quality.³⁸⁶ Ecological flows³⁸⁷ are considered a previous restriction but are scheduled below urban water supply and may be reduced during droughts unless Natura 2000 or Ramsar sites are affected:

During a prolonged drought they must ensure only a minimum of 25% of the maximum useful potential habitat, in comparison to the normal 50-80% habitat range.

- FI: There is no clear prioritization for drought specifically, but the water act (chapter 4 section 5) clearly states in "Section 5 – Coordinating the different needs for water abstraction": "When deciding on a permit matter concerning abstracting water, the various needs for water abstraction from a water body shall be coordinated. If there is not enough water to meet the needs of all users, the following order of precedence shall apply: 1) abstraction of water for use in the proximity of the abstraction site for ordinary household use of real estates; 2) abstraction of water for the water supply of the local community; 3) abstraction of water for the use of local industry or otherwise for use in the locality and abstraction of water serving the water supply of a community outside the locality; 4) abstraction of water to be conducted or transported for use elsewhere for a purpose other than supplying water to a community."³⁸⁸ Moreover, in FI, authorities can restrict the water intake to secure water supply, and water supply companies can prioritise how they allocate water to their customers.
- FR: The *Code de l'Environnement* in its article L211-1 sets out the following principle: water management should first satisfy the needs of health-related issues and public health, Furthermore, it should conciliate biological functioning of water systems, conservation and unconstrained runoff of water and flood protection, and needs of sectors including agriculture, fishing, industry, energy production, transport, tourism, protected areas, recreation and any other legal human activities. This prioritisation is further specified in the *arrêtés d'orientation de bassin* and the *arrêtés-cadre départementaux et interdépartementaux* and implemented through the *arrêtés départementaux de restriction temporaire*. Each of these documents may set out a specific order of priority, but they should be coherent with each other, the higher-level prioritisation taking precedence. In any case, the crisis level limits the non-priority uses in order to guarantee the priority uses of health-related issues, public health and safety. The restrictions that apply to uses may take into account different types of sub-uses, for example in terms of irrigation, their level of dependence on irrigation, the type of irrigation method used (e.g. efficient drip irrigation) and the socio-economic impact of restricting water use (e.g. high value crop production or livestock farming may be prioritised over lower value production). They can also differentiate between limitations for individuals, companies, the community and farmers. However, national guidance on restriction measures during droughts³⁸⁹ states that less stringent restrictive measures must comply with a set of conditions (limited to a maximum of 10% of the cumulative irrigated Utilised Agricultural Area (UAA) within the alert zone and which cannot represent more than a certain percentage of the cumulative abstraction rates for surface water or volumes withdrawn for groundwater).
- HU: The priority order ranks a) drinking and public health, disaster relief, b) activities of production and services for medical and residential purposes, c) animal husbandry, fish production, d) nature conservation, e) irrigation, f) economic, g) other (e.g. for sports, recreation, leisure, swimming, tourism) water use.
- NL: The priority ranking considers the following categories (1) Ensuring safety against flooding; preventing irreversible damage (a. The stability of flood defences; b. Preventing compaction and settlements; c. Nature (prevention of irreversible damage, otherwise cat. 4)); (2) Utilities (a. Drinking Water Supply (for ensuring the security of supply, otherwise cat. 4); b. Energy supply (only if the security of supply is threatened, otherwise cat. 4)); (3) (according to the example of the region of Amstelland): Small-scale high-value use (temporary irrigation of capital-intensive crops; the processing of industrial process water); (4) (example of region Amstelland): Other needs (shipping; agriculture; nature (no irreversible damage); industry; water recreation; inland fishing; drinking water supply (other than cat 2); energy supply (other than cat 2); other interests). The prioritisation ranking consists of four categories. In the distribution of water, category 1 is given the highest priority, then 2, then 3 and then 4. Within categories 1 and 2 of the water shortage series, the Water Decree gives a priority order considering social interests. For categories 3 and 4, the Water Decree does not contain a priority order. For the interests within these categories, it is up to the water manager to establish a further priority order in a concrete case, whereby the economic and social damage must be kept to a minimum.³⁹⁰ The interest in safety and the prevention of irreversible damage is included as the highest category in the prioritisation ranking. In the Netherlands, especially in areas with a lot of peat in the subsoil, safety can also be at stake due to drought, e.g. the collapse of the peat dike near Wilnis in 2003. Irreversible damage can also occur due to peat oxidation and clink.³⁹¹

- PT: The Water Law only establishes the principle of priority for water abstractions supplying public uses, followed by vital agricultural, livestock and industrial uses; under scarcity conditions; the priority order of other water uses may be changed by the national and/or river basin authority. Despite the vague definition of water use priorities in the legal framework, the Drought Management Plan establishes³⁹²: 1. Urban supply; 2. Livestock and permanent crops 3. Ecological flows, 4. Energy peak production, 5. Industry, 6. Other crops (temporary) 7. Other uses. Preference is given to uses that "ensure an economically more sustainable, rational and balanced water use".
- RO: The priority order for water allocation during drought is depending on the socio-economic impact and the consensus of affected stakeholders and differs on the sizes of hydrological drought: normal phase, attention/waring phase and restriction phase. Population and livestock are considered generally a priority above some industries and irrigation of some crops. The temporary reduction with a maximum of up to 50% of the minimum flow rate for ecological flow is considered during prolonged droughts as part of the restriction plans.
- SI: The paragraph 3 under article 10 of the national Directive on ecologically acceptable flows states that "water for irrigation can be taken in such a quantity, that the sum of withdrawals does not exceed 7% of the mean low discharge (sQnp) during periods when actual discharge at the withdrawal point is lower than ecologically acceptable discharge set by this directive."

4.4. Drought indicators in place

4.4.1. Types of indicators

Overall, there is a huge variety in the drought indicators being used across the EU MS. Sometimes (e.g. IT) there are differences between the regions or RBDs within the MS to take into account distinct environmental, climatological, hydrological and topographic conditions that are crucial to inform the operational scale. 20 EU MS use the Standardized Precipitation Index (SPI), which is thereby the most used drought indicator across the EU. It is followed by the Standardized Precipitation Evapotranspiration Index (SPEI) with 10 EU MS, the Low-Flow Index (7 EU MS) and the Standardized Runoff Index (SRI) (5 EU MS). The GRACE Total Water Storage (TWS) Anomaly Indicator is not used by any EU MS. No drought indicators are in place in LU³⁹³ and SE.

Table 16 Drought indicators and their geographical scope in the different EU MS

	Member State	RBD(s)	Region(s)	Other area	Similar indicators
Heat and Cold Wave Index (HCWI)	HR			SK ³⁹⁴	
Indicator for Forecasting Extreme Wet and Dry Conditions	IT ³⁹⁵ , RO		IT ³⁹⁶		
Standardized Precipitation Index (SPI)	BG, CY, CZ, DE, FI ³⁹⁷ , FR, HR, IE, IT, LT, LV, MT, NL ³⁹⁸ , PT, RO ³⁹⁹ , SI	EL ⁴⁰⁰ , IT ⁴⁰¹	BE-FL, BE-WL, IT	ES ⁴⁰² , SK	EL ⁴⁰³ , ES, MT
Standardized Precipitation Evapotranspiration Index (SPEI)	BG, CZ, DE, FI, HR, NL, SI	IT	BE-FL, IT	SK	
Soil Moisture Anomaly (SMA)	CZ, DE, FI			SK	DE, DK ⁴⁰⁴ , FR, SI
Vegetation Productivity (fAPAR) Anomaly	CZ, (IT ⁴⁰⁵)				SI

Low-Flow Index	BG, CZ, RO	BG, DE ⁴⁰⁶	BE-FL, DE ⁴⁰⁷	SK	FR, LT, SE
Standardized Runoff Index (SRI)	BG, CZ, FI, IT	EL ⁴⁰⁸ , IT ⁴⁰⁹		ES ⁴¹⁰	CY, ES, FR
GRACE Total Water Storage (TWS) Anomaly					CY, FR, IE
Supply-Demand Drought Index (SDDI)	CZ, RO				SI
Combined Drought Indicator (CDI)	CZ				
	Policy	Planning	Management	Data, information and knowledge	
Water Exploitation Index + (WEI+)	BG, CY, CZ, DE, EE, IT, MT, RO ⁴¹¹	AT ⁴¹² , EL, ES ⁴¹³		ES, SK, IT	EL ⁴¹⁴
Other indicators	BG, CY, DE, HR, HU, IE, IT ⁴¹⁵ LU, PL, PT, RO ⁴¹⁶	CY ⁴¹⁷ , IT ⁴¹⁸	BE-FL ⁴¹⁹ , IT	BE-FL ⁴²⁰	

For some EU MS, explicit information has been identified that justifies the use of different indicators from those being presented at the EU level by EDO.

- CY: The SPI usefulness in terms of actions for prevention and immediate response to water scarcity problems resulting from drought events is limited because in the case of Cyprus it is only reliable for periods of completed hydrological years.⁴²¹
- MT: The SPI "does not fully consider the impact of evapotranspiration losses to the effective rainfall"⁴²², and therefore is not appropriate for MT.

Further drought indicators and indexes are used in many cases, as indicated in Table 16 and listed below:

- BE-FL: 1) Phreatic groundwater indicator, 2) Salinity indicator, 3) Drinking water supply indicator. Flanders is also preparing indicators related to proactive drought management policy in the context of climate adaptation, to measure the implementation and impact of drought policy in Flanders. This is part of the follow-up of the Blue Deal and is currently in preparation.
- BG: 1) Risk of soil-atmospheric drought has been used as an indicator to assess drought trends in the second cycle RBMPs. Most of the indicators specified above have been used to assess drought trends in the second cycle RBMPs, except for SPEI and WEI+, which are considered in the SWMI reports within the 3rd RBMPs elaboration. None of the indicators are listed in the legislation.
- CY: 1) Wet Period Runoff Index; 2) Hydrological Year Runoff Index; 3) Monthly Regime Index; 4) Dam Storage Index; 5) Groundwater Bodies Monitoring Index. The indicators are

mentioned in the 2016 DMP and on the webpage of the Water Development Department⁴²³.

- DE: 1) The Soil Moisture Viewer of the German National Meteorological Service (DWD) includes the AMBAV evapotranspiration and soil moisture model. The AMBAV model is a soil-vegetation-atmosphere-transfer model developed by the DWD. It uses DWD's meteorological and phenological observations to calculate plant available water (PAW) in the root zone, takes the real soil ('BÜK1000') into account and is run on a 1 km x 1 km grid. The model is crop specific in terms of plant physiology, phenology and rooting depth and currently parameterised for all major agricultural crops in Germany. It is continuously calibrated and validated at selected locations by use of in-situ observations of actual evapotranspiration, actual rooting depth of agricultural crops and soil moisture measurements in distinct soil layers within the root zone by various measurement techniques. The results in terms of Germany-wide maps of PAW displayed in 10 cm layers down to a depth of 2 m as well as SMA in the root zone for the previous 365 days are freely available through the 'Soil Moisture Viewer' at the DWD homepage. In addition, forecasts for the following 7 days of these parameters are being sent to the responsible ministries at state and federal level, as well as presented on a web portal called ISABEL, which is restricted to professional users from the agricultural sector. The model is also used to estimate the changing water availability of agricultural crops due to climate change. In cooperation with the research department of the Federal Ministry of Agriculture, the effects on future yields are examined. 2) The UFZ Drought Monitor includes a) The Global Precipitation Climatology Centre Drought Index (GPCC-DI) is calculated by DWD. It combines SPI and SPEI in a matter to assess drought conditions in near-real time on a global scale based on freely available gridded in-situ observations. Whether SPI nor SPEI can be calculated without any 'tricks' on the global scale. The GPCC-DI overcome this by combining both indices keeping their advantages as for example assessing multiple aggregation periods. The data are monthly updated and freely available via DWDs OpenData-server. B) The meso-scale hydrological model mHM. The scientific base underlying the UFZ Drought Monitor is the hydrological model system mHM, which was developed at the UFZ. This "smart" environmental system model is able to mathematically describe ecosystem processes on a landscape-scale and works not only with an extremely good spatial resolution and with high precision but also integrates uncertainties in prediction into its calculations. The model system is not only deployed in the UFZ Drought Monitor but also, to name two examples, in the Earth system models of the US-based National Center for Atmospheric Research (NCAR) and in the water quality models of the University of Waterloo in Canada. The UFZ mHM team received the 2017 UFZ research award. The Drought Monitor is updated every night. For this purpose, it uses data from around 2500 weather stations operated by the German Meteorological Service (DWD), which is then quality tested and interpolated to the 4 km grid. An external drift kriging approach is applied in this context that uses geographical altitude as additional information. This data is used to drive the mHM hydrological model that simulates soil moisture and other parameters. By comparing the soil moisture with the value expected from long-term data, it is possible to calculate the soil moisture index (SMI) and determine the drought status. 3) Under the umbrella of the EU's Copernicus Programme, the EDgE project laid the data foundations for research into future droughts in Europe. Evaluations of hydrological and agricultural droughts for Germany and the federal states are available.
- EL: 1) aSPI (Agricultural Standardised Precipitation Index) used in the 2021 DMP of Crete; 2) Rex (to identify river basins most vulnerable to water scarcity)
- ES: The Spanish regulation introduces two indicators: 1) Prolonged drought: The elementary variables that help to explain this situation are precipitation records in rain gauges and inflow records in gauging stations or in other types of facilities that can provide indirect quantitative information on circulating flows, such as production in power plants or others that are appropriate. SPI and SRI or similar indicators are used. 2) Scarcity: based on the relationship between the availability of resources and demands, with the aim of identifying foreseeable deficit situations in each territorial unit. For both indicators, the variables can be combined and weighted to configure two normalized (ranging from 0 to 1) status index: prolonged drought index and temporary water scarcity index. Spanish DMPs focus on water resources management and do not consider agronomic drought indicators such SMA, nor does there seem to be any specific monitoring of this indicator by the Ministry of Agriculture Fisheries and Food (MAPA) or the Regional Departments of Agriculture). The geographical viewer of the MAPA⁴²⁴ presents Normalized Difference Vegetation Index NDVI maps (similar to fAPAR) but only for the period 2005 - 2009 (January to June). The Laboratory of Climatology and Climate Services of the CSIC has a

national viewer⁴²⁵ but the data series ends in 2015. Low flow Index LFI is not used in the DMPs nor in the RBMPs. However, ecological flows are established at the water body level in the RBMPs, and yearly monitoring reports are published in the interregional RBDs⁴²⁶. Forecasting indicators are not used in the DMPs but in ES91-Ebro which includes EDO maps in the drought monitoring report. It must be noted that a seasonal forecast is produced by the national meteorological service AEMET⁴²⁷ for the following three months, providing probabilistic information on temperature and precipitation, expressed in the form of terciles. Even though it is not used in the framework of DMPs, the Laboratory of Climatology and Climate Services of the CSIC⁴²⁸ provides maps and monthly series (1961-2021) of SPEI distributed data, under different cumulative periods (from 1 to 48 months). SDDI and CDI are not used. However, it must be noted that the so-called temporary water scarcity index may integrate information on a variety of elements of the water supply system including water resources (from different sources), storage capacity, exploitation rules of reservoirs and distribution infrastructure, water demands (and the allocation priorities) and environmental needs. Finally, WEI+ is used as a general water scarcity indicator in the framework of RBMP reporting.

- FR: 1) Indicators of the national weather service Meteo France: a) Standardized Soil Wetness Index (SSWI) (based on ISBA model); b) Standardized Flow Index (SFI) (based on MODCOU model), including indicators presented at the national hydrological monitoring committee as c) Monthly precipitation of the preceding month, d) Monthly precipitation of the preceding month compared to average precipitation 1981-2010, e) Cumulative precipitation since the start of the hydrological year (start each Sept) compared to average conditions (1981-2010), d) Cumulative effective precipitation since the start of the hydrological year, f) Cumulative effective precipitation since the start of the hydrological year compared to average conditions (1981-2010), g) Soil moisture index (Soil wetness index) on first day of month, h) Soil moisture index compared to average conditions (1981-2010), i) Soil drought indicator (soil moisture index over last 3 months compared to average conditions 1981-2010); 2) Indicators of the Geological and Mining Research Bureau (BRGM) a) Groundwater levels on first day of month and evolution in the preceding two months, b) Groundwater levels on first day of month compared to average conditions; 3) Indicators of the national hydrometric monitoring network a) Hydraulicity: monthly river flow of the preceding month over average condition (taking into account all available data years), b) VCN3: Minimum daily river flow observed over 3 days of the preceding month compared to average conditions (taking into account all available data years); 4) Indicators of reservoirs managers : Reservoir levels on the first day of the month (%) and capacity (million m³); 5) Indicators of the National Observatory of Low Flows: a) Monthly visual appreciation of the existence or not of a flow in the river done between May and September – done weekly in sensitive areas.
- HR: The De Martonne indicator is used for agricultural droughts.
- HU: 1) The water sector (under the direction of the Ministry of Interior) uses the Hungarian Drought Index (HDI⁴²⁹) as a drought indicator. The HDI is used in drought-related planning, e.g. in the RBMPs. The drought indicator of Hungary (HDI) is also being used for monitoring (main purpose of the system), forecast (10 days) and assessment/planning purposes. It has also a key role in activating measures as drought stages are determined by the thresholds of the indicator. Based on the drought stage (and other factors) the Water Director announce the drought alert level (I, II. or III.) in which different measures can be taken. 2) The National Meteorological Service uses the Daily Drought Index (NLA⁴³⁰).
- IE: Target Operating Curve for Reservoirs; are produced for each reservoir. Data is also available on river flows on the website of the Irish EPA.
- IT: Other indicators include: 1) Spring Anomaly Index (SAI); 2) Standardized SnowPack Index (SSAI) 3) SFI-Standardized Flow Index, 4) Standardized Continuous Dry Days Index – SCCDI, 5) STI-Standardized Temperature Index, 6) Snow Water Equivalent, 7) SVI-Standardized Volume Index (non-comprehensive list). There is a national Guidance Document⁴³¹ that was conceived to support the calculation of a common set of indicators by the RBD Observatories. It was produced by a Working Group of the National Committee and published in June 2018. The Guidance recommends calculating the following indices: SPI, SRI, SSPI, SPEI, WEI+, fAPAR⁴³², SAI. It acknowledges that specific indices can be developed at RBD level in order to take into account its specificities but that there was a need to have a common set of indicators to provide a national overview. To date, most of the recommended indicators are not calculated at the national or RBD levels. A monthly

national Drought Bulletin.⁴³³ is produced by ISPRA. It includes SPI 3, 6, 12 and 24 by resampling at 2.5° the data provided by the National Centers for Environmental Prediction (NCEP). The SPI is provided as maps for four different spatial levels: Italy, the Mediterranean region, Europe and Adriatic-Danubian Region. The Observatory of each RBD can have specific drought indicators. For instance, in the Drought Bulletin of the Po RBD in March 2022, the following indicators are used to describe the status of the system: SFI-Standardized Flow Index, SPI Standardized Precipitation Index 1 and 3, Standardized Continuous Dry Days Index – SCCDI, STI-Standardized Temperature Index 1 and 3 month, SPEI – Standardised Precipitation-Evapotranspiration Index 1 month, Snow Water Equivalent, SVI-Standardized Volume Index. In the Bulletin of the Observatory of the Central Apennine RBD, the SPI (at 1, 3, 6, 9, 12, and 24 months), the Standardized Runoff Index (at 1, 3, 6, 12 months and percentage) and the SAI-Spring Anomaly Index are currently used to monitor drought conditions. The SSPI-Standardized Snow Precipitation Index, fAPAR and SPEI indicator, recommended by the national Guidance document, will be tested in the framework of the initiative promoted and funded by the Environment Operational Plan (POA-*Piano Operativo Ambiente*), as measures of the second update of the RBMP. Moreover, also the other RBD Observatories adopts other indicators in addition to the traditional ones (e.g. SPI and SPEI) and tools to better reflect the RBD climate and the hydrological, hydro-geological and hydromorphological characteristics of their river basins and evaluate the drought and water scarcity severity. For instance, information on water availability in lakes and reservoirs are considered. The Eastern Alpine RBD Observatory also analysis the groundwater level, which brings information about the impact of wells' withdrawal on groundwater resources. The Southern Apennine RBD evaluates for some of its main sources the trend of the water availability with respect to the historical average and the residual volumes expected for the reservoirs. Monthly status indicators for drought monitoring are instead used in the Sardinia RBD, whereas for the Northern Apennine RBD an application, named SIDIAS, has been developed to assess the water severity class over specific areas through the analysis and combination of indicators and available parameters. For some of the main sources, an evaluation of the trend of availability is reported with respect to the historical averages, for the sources, and the residual volumes expected for the reservoirs.)

- LT: 1) TPI (Temperature Precipitation Index), 2) Nature Preserving Discharge, 3) Complex Forest Fire Indicator, 4) Water Level.⁴³⁴
- MT: Malta uses the SPI, in conjunction with the Reconnaissance Drought Index (RDI). During the second cycle RBMP, the following measure was planned: "MDM7: Development of a water scarcity and drought monitoring and assessment platform... The development of Malta-specific indicators which take into account semi-arid conditions can lead to a better understanding of the hydrological cycle at the local level and possibly improve predictions on water availability... Lead: Sustainable Energy and Water Conservation Unit (SEWCU)". The second cycle RBMP⁴³⁵ includes the Reconnaissance Drought Index (RDI) which is calculated using an equation which requires both rainfall and potential evapotranspiration data and is, therefore, more suited to regions where natural losses due to evapotranspiration are significant. „A first assessment on the use of the RDI for the Maltese Water Catchment District was undertaken under the EU-funded PRODIM Project, using climatic data from 1947-2005. These studies have shown a trend towards an increased number of dry years and therefore towards less water availability.“
- PL: Climatic Water Balance (KBW) is used in monitoring of agricultural drought (within the Agricultural Drought Monitoring System administrated by the Institute of Soil Science and Plant Cultivation – State Research Institute).
- PT: Both indicators 1) SPI and 2) Palmer Drought Severity Index PDSI are referred to in the national DMP, the methodology clearly described, as well as the trigger values for the different alert levels. The Plan also considers the 3) reservoir levels, and the 4) "*Estado das Culturas e Previsão das Colheitas*" (ECPC), an agricultural assessment of crops' state and production forecast.
- SE: For assessing the risk of surface water shortage, Sweden uses the indicator "daily average water flow < Q95 during a four-week continuous period". Q95 refers to the 95th percentile of daily mean discharge based on a historical 30-year period, i.e. discharge has been below this level only 5% of the time.
- SI: 1) Meteorological water balance in percentiles (whole MS, calculations from ground measurement data, monitoring); 2) Share of cumulative precipitation amount in

comparison to reference period (whole MS, calculations from ground measurement data, monitoring); 3) Decadal index of drought stress (DISS) in percentiles (whole MS, calculations from ground measurement data and reported phenological data, monitoring); 4) Standardized groundwater index (SGI) to improve groundwater monitoring is in process of preparation and establishment (whole MS, calculations from ground measurement data, monitoring); 5) Meteorological water balance (whole MS, calculations from ground measurement data, monitoring); 6) SWI - Soil Water Index (geographical area: -10.50W, 30.40E, 41.2S, 51.2N (Europe), source: Global Land Service of Copernicus; The product is based on MetOp/ASCAT surface soil moisture distributed by EUMETSAT, use: climate change assessment); 7) NDVI - Normalized Difference Vegetation Index anomalies (geographical area: -10.58W, 30.50E, 41.12S, -51.15N (Europe), source: Global Land Service of Copernicus; the product is based on VEGETATION and PROBA-V data provided by CNES and distributed by VITO NV., use: monitoring); 8) DDI - Evaporative Demand Drought Index (whole MS, calculations from ground measurement data, monitoring); 9) The water balance model mGROWA provides SWD - Soil Water Deficit index. (whole MS, source: ARSO, water balance model mGROWA outputs, use: monitoring).⁴³⁶

- RO: 1) Bagnouls-Gausson Ombrothermic Aridity Index⁴³⁷, 2) Environmentally Sensitive Area to Desertification Index (ESAI)⁴³⁸, 3) Gauge hydrological data from the monitoring river sections are used to define restrictions of water use according to the restriction pre-plans for river stretches and water allocation in case of drought. National hydrological data for ungauged river sections are provided by the National Institute for Hydrology and Water Management and meteorological data are provided by the National Meteorological Administration.

4.4.2. How indicators are used

Most of the drought indicators are used to monitor drought evolution and less for forecasting and assessing drought status or informing plans. Only for 8 EU MS (BE-FL, CZ, EL, ES, IT, PT, RO, SK) information has been compiled on which indicators are used in drought management to trigger the activation of specific measures according to the drought severity levels. Most references for the activation of measures are made to the Standardized Precipitation Index (SPI) (6 EU MS), the Standardized Precipitation Evapotranspiration Index (SPEI) (4 EU MS) and the Standardized Runoff Index (SRI) (3 EU MS). In SI, an insurance company uses SPI index as a base for insurance premiums for crops; these data are not freely available.

Table 17 Drought indicators and their use in the different EU MS (note this information has not been compiled for all EU MS)

	Monitor	Forecast	Assess/Plan	Activate measures	Other
Heat and Cold Wave Index (HCWI)	SK	HR, SK	SK		
Indicator for Forecasting Extreme Wet and Dry Conditions	CZ, IT	CZ, RO	CZ	CZ, RO	
Standardized Precipitation Index (SPI)	BE-FL, BE-WL, CY, CZ, DE, EL, ES, FR, IT, MT, NL, PT, RO, SK	BE-FL, BE-WL, BG, CZ, DE, EL, NL, RO, SK	BE-WL, BG, CY, CZ, EL, HR, IT, NL, PT, RO, SK	BE-FL, CZ, EL, ES, PT	SI
Standardized Precipitation Evapotranspiration Index (SPEI)	BE-FL, CZ, HR, IT, NL, SI, SK	CZ, NL, SK	BG, CZ, NL, SK	BE-FL, CZ, SK	
Soil Moisture Anomaly (SMA)	CZ, SK	CZ, SK	CZ, SK	CZ	
Vegetation Productivity (fAPAR) Anomaly	CZ	CZ	CZ	CZ	
Low-Flow Index	BE-FL, CZ, DE,	BG, CZ, DE,	CZ, DE ⁴³⁹ ,	BE-FL, CZ	

	RO, SK	RO, SK	RO, SK		
Standardized Runoff Index (SRI)	CZ, EL, ES, IT	BG, CZ, EL	CZ, EL	CZ, EL, ES ⁴⁴⁰	
GRACE Total Water Storage (TWS) Anomaly					
Supply–Demand Drought Index (SDDI)	CZ	CZ, RO	CZ	CZ, RO	
Combined Drought Indicator (CDI)	CZ	CZ	CZ	CZ	
Water Exploitation Index + (WEI+)	AT, CZ, DE, ES, IT, MT, SK	CZ, RO, SK	AT, BG, CY ⁴⁴¹ , CZ, DE, EL, ES ⁴⁴² , RO, SK	CZ, EL	EE ⁴⁴³
Other indicators	BE-FL, CY, DE, ES ⁴⁴⁴ , FR, HU, IT, MT ⁴⁴⁵ , PL, PT ⁴⁴⁶	BE-FL, CY ⁴⁴⁷ , HU, IT, PT, SE	BE-FL, CY, DE, HU, MT, PT	BE-FL, ES ⁴⁴⁸ , HU, IT ⁴⁴⁹ , RO, PT	

4.4.3. Data sources for drought indicators

The primary source of datasets used for the calculation of drought indicators is national data, jointly with regional or site-specific measurements.

Table 18 Sources of datasets used for the calculation of drought indicators in the different EU MS

	CEMS	National ⁴⁵⁰	Other
Heat and Cold Wave Index (HCWI)		SK	
Indicator for Forecasting Extreme Wet and Dry Conditions		CZ, IT	IT
Standardized Precipitation Index (SPI)		BE-FL, BE-WL, BG, CY, CZ, DE, EL, ES, FR, IE, IT, LT, LV, MT, NL ⁴⁵¹ , PT, SI, SK	DE ⁴⁵² , FI ⁴⁵³ , IT
Standardized Precipitation Evapotranspiration Index (SPEI)		BE-FL, CZ, DE, IT, NL, SI, SK	BG ⁴⁵⁴ , DE ⁴⁵⁵ , FI
Soil Moisture Anomaly (SMA)		CZ, SK	FI ⁴⁵⁶
Vegetation Productivity (fAPAR) Anomaly		CZ	
Low-Flow Index		BG, CZ, DE, SK	BE-FL
Standardized Runoff Index (SRI)		BG, CZ, EL, IT	ES, IT
GRACE Total Water Storage (TWS) Anomaly			
Supply–Demand Drought Index (SDDI)		CZ	
Combined Drought Indicator (CDI)		CZ	

Water Exploitation Index + (WEI+)		AT ⁴⁵⁷ , BG, CY, CZ, DE, EE, EL, ES, IT, MT, SK	EE ⁴⁵⁸ , ES ⁴⁵⁹ , IT
Other indicators	SI	FR, HU, IE, IT, LT, MT, PL, SE	BE-FL, IT, SI

5. WFD EXEMPTIONS DUE TO 'PROLONGED DROUGHT' (ART.4(6)): FRAMEWORK, DEFINITIONS, USAGE AND JUSTIFICATION

WFD Art.4 allows MS to apply under certain conditions exemptions to the achievement of the environmental objectives, and one of its specifications (Art.4(6)) regulates such exemptions caused by natural cause or force majeure, including prolonged droughts.

5.1. National regulatory references to Art. 4(6) exemptions

According to a brief analysis of corresponding MS regulation carried out by the consultants, transposition of the provisions of WFD Art. 4(6) focused specifically on droughts into national legislation shows (sometimes minor) gaps in 12 EU MS (AT, BE-FL, BE-WL, BG, DK, ES, FI, HR, IE, IT, LT, SE, SI). Besides the non-inclusion in national law (listed in Table 19 as "overall"), other gaps (listed in Table 19 rows as "text pieces" of WFD Art.4(6)) detected for several EU MS refer to the validation of exemptions by appropriate indicators (5 EU MS), the inclusion of measures into the RBMP (4 EU MS) and the inclusion of a summary of drought effects and measures into the RBMP (3 EU MS).

No transposition gaps have been identified for CY⁴⁶⁰, CZ⁴⁶¹, DE⁴⁶², EL⁴⁶³, FR⁴⁶⁴, HU⁴⁶⁵, LU⁴⁶⁶, LV⁴⁶⁷, MT⁴⁶⁸, PL⁴⁶⁹, PT⁴⁷⁰, RO⁴⁷¹ and SK⁴⁷². Regarding NL⁴⁷³, the specific transposition does not refer to several of the specific conditions for Art.4(6) exemptions but does refer to those claiming that "all" of the conditions established in the WFD shall be fulfilled.

Table 19 Legal transposition gaps of the WFD justification elements for Art.4(6) exemptions in the different EU MS

Exemption conditions	Existing transposition gaps
Overall	BE-WL, FI ⁴⁷⁴ , IE ⁴⁷⁵ , LT, SE
the deterioration is the "result of circumstances of natural cause or force majeure" (Art.4(6))	
the drought events are "exceptional or could not reasonably have been foreseen" (Art.4(6))	HR ⁴⁷⁶ , SI ⁴⁷⁷
the exceptional character is validated by "appropriate indicators [which] are stated in the river basin management plan" (Art.4(6)b)	BE-FL ⁴⁷⁸ , BG ⁴⁷⁹ , DK ⁴⁸⁰ , HR, SI
"all practicable steps are taken to prevent further deterioration in status and in order not to compromise the achievement of the objectives of this Directive in other bodies of water not affected" by the drought (Art.4(6)a)	ES ⁴⁸¹
these "measures to be taken under such exceptional circumstances are included in the programme of measures" of the RBMP (Art.4(6)c)	BE-FL, DK, IT ⁴⁸² , (SI ⁴⁸³)
"all practicable measures are taken with the aim of restoring the body of water to its status prior to the effects of those circumstances as soon as reasonably practicable" (Art.4(6)d)	DK, HR, SI
"a summary of the effects of the [drought] and of such measures taken or to be taken ... are included in the ... [third	AT ⁴⁸⁴ , BE-FL, SI

cycle] river basin management plan" (2022-2027)	
No gaps	CY ⁴⁸⁵ , CZ ⁴⁸⁶ , DE, EE ⁴⁸⁷ , EL ⁴⁸⁸ , FR ⁴⁸⁹ , HU ⁴⁹⁰ , LU ⁴⁹¹ , LV ⁴⁹² , MT ⁴⁹³ , NL ⁴⁹⁴ , PL ⁴⁹⁵ , PT ⁴⁹⁶ , RO ⁴⁹⁷ and SK ⁴⁹⁸

5.2. Use of Art. 4(6) exemptions caused by droughts in the RBMPs

The use of Art. 4(6) exemptions has been assessed by the consultants on the basis of the draft or final 3rd River Basin Management Plans available, with Table 25 in Annex 1: Methodological note indicating the specific plans and their status as assessed for this report. Possible exemptions under Art.4(6) of the second cycle RBMPs have only been assessed for those EU MS, for which such exemptions had been listed in the 5th Implementation Report (EC, 2019).

Use of Art.4(6) exemptions caused by droughts in the RBMPs

Yes
No



Figure 5: Use of Art.4(6) exemptions caused by droughts in the RBMPs

5.2.1. Use of Art.4(6) exemptions caused by droughts in the second cycle RBMP (2016-2021)

Within the second cycle RBMPs, only NL has applied explicitly Art.4(6) exemptions caused by drought to 18 water bodies.

In addition, the following situation has been found in the second-cycle plans, providing clarification beyond the information included in the 5th Implementation Report (EC, 2019):

- ES: The ES20-Duero and ES50-Guadalquivir RBMPs report situations of deterioration or possible deterioration, 4 and 125 respectively, which are not translated into status assessments as worse than good and, therefore, into genuine exemptions.

- HU: Art.4(6) exemptions have not been used in the second cycle RBMP of Hungary.
- PT: No exemptions have been applied according to the RBMPs – but nationwide most water bodies were subject to drought events (particularly in 2017-18 and 2020-22), especially in southern regions, and the Drought Plan foresees such exemption under the emergency alert level.

5.2.2. Use of Art.4(6) exemptions caused by droughts in the third cycle RBMP (2022-2027)

The following 3 EU MS have included Art.4(6) exemptions caused by droughts in the assessed third cycle RBMPs: HU, NL, PT.

According to the RBMPs assessed, Art.4(6) exemptions due to drought will be applied to overall 286 water bodies. This number is distributed across HU (23), NL (78) and PT (185).

- HU: In the third cycle RBMP (2022-2027) of Hungary, 11 river water bodies, 4 lake water bodies and 8 groundwater bodies are subject to Art.4(6) exemptions.
- NL: 87 water bodies are subject to article 4(6) because of natural causes, mainly due to dry summers in 2018, 2019 and 2020; and droughts specifically affected 78 out of these water bodies. Article 4.6 has been invoked mostly directly because of the supporting element temperature. In hindsight, sometimes the use of the exemption was unnecessary. In many of those cases, no appeal to 4.6 would have been necessary, because there is no actual deterioration. Where drought/showers are mentioned as grounds, in most cases this concerns an effect on physico-chemical parameters; the supporting parameters. In only a few cases, biological quality elements are affected. This should therefore mainly be seen as an early warning, rather than as an actual decline.
- PT: According to the draft third cycle RBMP documents,⁴⁹⁹ Portugal will apply article 4(6) exemptions (related with drought situations and forest fires) to the following number of surface water bodies: RH1 – Minho e Lima: 1 (forest fires), RH2 – Cávado, Ave e Leça: 3 (forest fires), RH3 – Douro: 49(38 for drought and 11 forest fires), RH4 – Vouga, Mondego e Lis: 29 (1 for drought and 28 forest fires), RH5 – Tejo e Oeste: 39 (28 for drought and 11 forest fires), RH6 – Sado e Mira: 22 (drought), RH7 – Guadiana: 31 (drought) and RH8 – Ribeiras do Algarve: 11 (9 for drought and 2 forest fires); resulting in overall 129 water bodies due to drought situation and 56 with forest fires. No information was available in May 2022 regarding exemptions for groundwater bodies; nor any justification.

In addition, in ES, temporary deteriorations due to drought were recorded in at least 3 RBDs: ES20-Duero (2 episodes affecting multiple surface water bodies); ES60-Segura (5 groundwater bodies); and ES70-Jucar (24 episodes affecting a total of 24 bodies). In no case did they result in exemptions from compliance with environmental objectives.

Whilst no justification is provided yet by PT in the draft documents, Part 2B (Chapter 4.1.1) of the final RBMPs provides a generic statement regarding the decrease in rainfall and increase in air temperatures. ES and HU include in the plans a generic ex-ante exemption, in case such exemptions might be used during the 2022-2027 period for further water bodies, ES includes also generic ex-post exemptions, for large areas or numbers of water bodies during the 2016-2021 period, providing a general statement. Regarding NL, surface and groundwater body factsheets contain information on the application of Article 4.6 exemptions for each affected water body, elements affected (e.g. phytoplankton, specific pollutants, physico-chemical parameters), justification of the reasons, measures planned and anticipated impact of the measures.

Table 20 Overall approach to the WFD justification for Art.4(6) exemptions in the assessed RBMPs of the different EU MS

	Justification approach
as (generic) ex-ante exemptions, in case such exemptions might be used during the 2022-2027 period	ES, HU
as (generic) ex-post exemptions, for large areas (or number of water bodies) during the 2016-2021 period, providing a general statement	ES, PT

as specific ex-post exemptions, referring to individual water bodies and providing justification data and details for each specific water body	NL

The following specific statements have been found in the third cycle RBMPs:

- ES: Ex-ante conditions for exemptions that might happen during the coming period are stated in the inter-regional RBMPs. Only in ES20-Duero, a detailed ex-post justification of two prolonged drought episodes is provided, via two different structures: 1) Prolonged drought declared by Royal Decree 684/2017: It encompasses all surface water bodies declared in a state of alert or emergency in the DMP. For the justification of its deterioration, a factsheet (8 pages) is presented in the Annex to the RBMP under the following structure: Code and name of the WBs, Category, Type, Location, Justification of the area or grouping adopted, Period, Description of the circumstances causing the temporary deterioration, Objectives and indicators, Gap, Measures adopted. 2) Prolonged drought and extraordinary drought declared by Resolution of the Presidency of the River Basin Agency dated 19/6/2019 covering the entire basin except for the Tamega and Alto Duero Drought Territorial Units. For the description and justification of this deterioration, instead of the factsheet, a post-drought report (19 pages) is presented in the Annex structured, according to the content marked by the DMP, under the following headings: Location, Duration, Intensity, Environmental impacts generated by the prolonged drought, Socio-economic impacts caused by cyclical shortages, Measures adopted, Degree of compliance with the DMP. In any case, it must be noted that temporary deterioration has not led to Article 4(6) exemptions.
- CZ: According to the Elbe, Danube and Oder third cycle RBMPs' Chapter IV.6, for the third cycle planning period, the application of the temporary deterioration exemption would be possible due to the fact that approx. since 2014, there has been a long-term drought. On the other hand, it must be exclusively a situation where as a result of the long-term drought, the status has deteriorated, which must be documented in the long-term monitored indicators, related to specific parameters. From the available data of individual sub-basins, it was not possible to unambiguously determine in which basins there was a deterioration of the status in relation to individual evaluation indicators due to the prolonged drought. Information is missing about where the real deterioration occurred. Due to the overall complexity of the process, this exemption has not been applied in the 3rd planning period.

For the above EU MS, the following gaps have been identified in the sample of assessed RBMPs.

Table 21 Gaps of the WFD justification elements for Art.4(6) exemptions in the assessed RBMPs of the different EU MS

	Existing justification gaps
Overall gap: "a summary of the effects of the [drought] and of such measures taken or to be taken ... are included in the ... [third cycle] river basin management plan" (2022-2027)	PT ⁵⁰⁰
Specific gaps:	
<ul style="list-style-type: none"> the deterioration is the "result of circumstances of natural cause or force majeure" (Art.4(6)) 	
<ul style="list-style-type: none"> the drought events are "exceptional or could not reasonably have been foreseen" (Art.4(6)) 	
<ul style="list-style-type: none"> the exceptional character is validated by "appropriate indicators [which] are stated in the river basin management plan" (Art.4(6)b) 	HU, NL
<ul style="list-style-type: none"> "all practicable steps are taken to prevent further deterioration in status and in order not to compromise the achievement of the objectives of this Directive in other bodies of water not 	HU

affected" by the drought (Art.4(6)a)	
<ul style="list-style-type: none"> these "measures to be taken under such exceptional circumstances are included in the programme of measure" of the RBMP (Art.4(6)c) 	HU
<ul style="list-style-type: none"> "all practicable measures are taken with the aim of restoring the body of water to its status prior to the effects of those circumstances as soon as reasonably practicable" (Art.4(6)d) 	HU

In HU, if the average water flow in a watercourse decreases by 20%, it is considered an indicator that adequately reflects the exceptional situation. According to the interviews, the information about all practicable measures taken will be included in the final RBMP. In NL, in most cases, measures are already at place, such as the approach for discharge permits, taking into account the 10% driest year of the range of climatic conditions; however, it has not been assessed in this study if the measures cover all practicable steps and measures, such as requested under Art.4(6).

6. CHALLENGES AND LESSONS LEARNED BY MEMBER STATES IN DROUGHT MANAGEMENT POLICIES AND PLANNING

This section of the report has been filled based on the consultant's review of documents and the interviews carried out with authorities and stakeholders. For many MS, it does not necessarily represent the government viewpoint, firstly as the information provided in the interviews did not necessarily reflect official positions; and secondly, as government authorities and users of drought management systems have often expressed different perceptions. The list of aspects assessed was agreed with the European Commission previous to the assessment.

6.1. Strengths and Weaknesses

The information gathered from national authorities and stakeholders during the interviews as self-assessment has identified a range of areas where Member State drought management systems have strengths and weaknesses: Table 22 below provides an overview.

Table 22 Strengths and weaknesses of the drought management systems in the different EU MS

	Strength	Weakness
Focus on the most drought-prone areas or sectors	AT, BE-FL, BE-WL, CZ, EL, ES, FR, HR, HU, IT, LT, NL, PL, PT, RO, SE	PL, SI, SK
Proactive risk management approach	BE-FL, BE-WL, CY, CZ, EL, FR, MT, NL, PL,	AT, DE, DK, EE, FI, HR, HU, IE, LT, PT, SE, SI
Support of stakeholders and/or policy	AT, BE-FL, BE-WL, BG, CY, CZ, ES, FR, HU, IE, IT, LT, NL, PL, PT, RO, SE	FI
Public access to data	BE-FL, BE-WL, CY, CZ, EL, ES, FR, HR, HU, IT, LT, NL, SE, SI, SK ⁵⁰¹	IE, LU, MT, PL, RO
Trusted coordination/implementation body	AT, BE-FL, BE-WL, CY, CZ, ES, HU, IE, IT, LT, LU, NL, PT, RO, SE	PL

	Strength	Weakness
Inclusive participatory decision-making process	BE-FL, BE-WL, BG, CY, FR, IE, IT, NL, PT, RO	CY, CZ, EL, HU, MT, SI
Risk mitigation by adequate measures at the right time	BE-FL, BE-WL, BG, CY, EL, ES, FR, IT, NL, LT, RO	DK, FR, PL, SE, SI
“Buffering” by a water reserve system	AT, BG, CY, CZ, ES, HU, IT, MT, NL, PT, RO	FR, MT, SE, SI
Fostered institutional cooperation	BE-FL, BE-WL, CY, CZ, EL, FR, HU, IT, LT, MT, NL, PT, RO, SE	DK, EE, EL, HR, HU, LU, MT, SI, SK
Inclusion of rapid response actions, with immediate effects	AT, BE-FL, BE-WL, BG, CY, EL, ES, FR, IT, MT, NL, PT, RO	AT, DK ⁵⁰² , EL, FR, HR, HU, LU, PL, SE, SI
Maintenance by a designated institution for a long time with adequate resources	AT, BE-FL, BE-WL, CY, CZ, ES, LT	BG, CZ, EL, FR, HU, IT, MT, PL, PT, SE, SI, RO
Adequate monitoring	AT, BE-WL, CY, CZ, HU, IT ⁵⁰³ , NL, SK	BE-FL, BG, EE, EL, FI, FR, HR, IT ⁵⁰⁴ , LU, PL
Updated forecasts of drought event frequency and intensity	BE-FL, BE-WL, CZ, EL, HU, IT, NL, RO, SE, SK ⁵⁰⁵ , SE	BG, DE, EE, EL, FI, FR, HR, LU, MT, PL
Integration of economic sectors, environmental and social concerns	BE-FL, CZ, ES, FR, IT, NL, PL	BE-WL, CY, EE, EL, FI, FR, HU, IE, LT ⁵⁰⁶ , LU, PL, RO, SI
Focus on people and their livelihoods, including the most vulnerable and marginalised groups and individuals	CY, HU, NL, RO, SE	BE-FL, BE-WL, EL, ES, FI, PL, SK
Detection of changes in the production of ecosystem services	BE-FL, BE-WL, NL	BG, CY, EE, EL, ES, FR, HU, IE, IT, LT, SI
No deterioration of the status of water bodies	BE-FL, BE-WL, CZ, HU, LT, NL	BG, CY, PL
Subject to a periodic review (adaptive management)	BE-FL, BE-WL, CY, CZ, ES, FR, HU, LT, NL, PL, PT	EL
Transboundary cooperation	BE-WL, CZ, SI	AT, BE-FL, BG, EL, HU, NL, PL, SK
Other	DE, FR, IT	ES, IT

Overall, the number of self-recognised **strengths** is larger than the number of weaknesses, indicating that a wealth of good practice could be shared on specific topics, supporting particularly those EU MS which recognise weaknesses.

Administrations and stakeholders in CZ and NL have identified the most strengths in their drought management system; in the case of NL, the only identified weakness is regarding transboundary cooperation.

Looking across the EU, the drought system aspects that were most commonly identified as strengths are the following: focus on the most drought-prone areas or sectors; support of stakeholders and/or policy; public access to data; trusted coordination/implementation body; risk mitigation by adequate measures at the right time; fostered institutional cooperation; and inclusion of rapid response actions, with immediate effects.

The topic areas that the lowest number of MS where interviewees identified as weaknesses are: support of stakeholders and/or policy; trusted coordination/implementation body; and subject to a periodic review (adaptive management).

The areas with the largest number of EU MS whose interviewees identified **weaknesses** are the following: Proactive risk management approach, Inclusion of rapid response actions, with immediate effects, Maintenance by a designated institution for a long time with adequate resources, Adequate monitoring, Updated forecasts of drought event frequency and intensity, Integration of economic sectors, environmental and social concerns, Focus on people and their livelihoods, including the most vulnerable and marginalised groups and individuals, Detection of changes in the production of ecosystem services, and Transboundary cooperation. These areas might be the most relevant ones for a **further collection and exchange of good practice**.

In particular, the **following topics might be of special interest for further strengthening and harmonisation at the EU level**, given their relevance for the achievement of WFD objectives:

- Integration of economic sectors, environmental and social concerns,
- Focus on people and their livelihoods, including the most vulnerable and marginalised groups and individuals,
- Detection of changes in the production of ecosystem services,
- No deterioration of the status of water bodies and
- Transboundary cooperation.

The interviews identified other topic areas and provided further details regarding Member State strengths and weaknesses:

- CY: Among the *weaknesses*, it seems that the drought indicators are only meant for decision-making by government water officials. Drought indicators can be found in excel sheets on the website of the Water Development Department, but there is no effort for a useful public dissemination system.
- DE: In Germany, a potential *strength* is that water resources are managed in an integrated way considering extreme events such as floods, heavy precipitation and droughts. In Germany, many regulation and management measures established are for the integrated management of water resources, which are also effective for the management of drought events. A drought-only approach is not established.
- ES: The impacts of the drought are not adequately considered for the optimization of the design of the measures and, eventually, for the establishment of equitable compensation.
- FR: Drought management is well established, having evolved over the last 30 years with now a sound legal and policy framework and well-performing tools (meteorological forecasts, hydrometry, piezometry, low flow monitoring) and restriction measures on water use that are targeted to most users (i.e. industrial use, agriculture, non-priority urban water use). The national low flow observatory (based on visual observations) allows better monitoring of low flows on small rivers and upstream rivers which often do not have monitoring stations. Amongst the weaknesses, the following ones shall be mentioned and require improvements: With the main administrative level being the *département*, there remains a lack of coordination between administrative units in the same catchment and river basin, despite various institutional measures to facilitate this coordination. The lack of adequate anticipation of crisis events with, in many cases, delay in implementing (preventive) restrictions because of political pressures to avoid restrictions when river flow and groundwater level thresholds are passed. The monitoring frequency is daily but with weekends/holidays/holidays (summer period), decisions are often taken too late (observation, reactivity of prefect). The forecast for rainfall weather is often taken into

account to delay decisions although flows may already be below the limit. The most severe restrictions in theory apply to the agricultural sector first, although the agricultural sector also receives several exemptions. At the same time, some sectors are regulated through specific drought plans (e.g. golf courses, industries) or are hardly affected by restrictions (households) questioning the legitimacy of the management plan and raising issues of equity. The exemptions to use restrictions during droughts are very varied and rarely shared publicly. The monitoring stations of river flows have a double function for both low flow and flood monitoring – thus their selection is not optimal for low flow surveillance; furthermore, the associated catchments can be very large (above 40km²). There is a need for harmonisation in the way thresholds are defined, sometimes reference stations are poorly chosen, and often thresholds are defined in a standardised/arbitrary manner without taking into account the specificity of the watercourse - e.g. when the station is located in a part of the watercourse that has been heavily modified and therefore the flows are not representative of the vulnerable parts of the watercourse/basin. The management zones do not always include groundwater bodies linked to the regulated surface water bodies, although some water abstractions from the groundwater body may impact low flows. There is a lack of penalties when infringement is reported. The effectiveness of responses is not evaluated properly due to a lack of knowledge on all abstraction and real water savings from water use restrictions. There is still a frequent implementation of restrictions in several areas (sometimes every year) while structural water quantity management (dealing with structural water deficits) should lead to less frequent restrictions (in theory 4 years out of 5). The decisions (*arrêté-cadre*) are not subject to environmental assessments.

- IT: Amongst the strengths of the drought management system, the following are highlighted: the existence of the RDB Permanent Observatories for water resource uses that provide a forum at RBD level where decisions among competent drought management authorities can be discussed and agreed upon; the RBD perspective that is provided with both by the Permanent Observatories and the RBAs, as it helps coordinate responses to needs occurring in territorial units that fall under different administrative competences; the effectiveness and high quality of DPC in water emergency situations. The main weaknesses include the administrative fragmentation, and gaps in the monitoring of water withdrawals especially for irrigation and industry and for groundwater, while in general, domestic water supply is well regulated and controlled. Gaps can be also pointed out in the detection of changes in the production of ecosystem services.
- NL: The interviews have not indicated any weaknesses, except the somewhat limited integration with the other Member States, although in some interviews reference has been made to regional agreements within the large river basins (Rhine, Maas, Scheldt, Ems). There is an existing drought management plan for the Maas and a process in place for the Rhine. However, efforts are mainly focused on knowledge and monitoring, and less on better-coordinated water management. Joint measures are not yet in place.
- PT: Portugal has a mature drought management system, focused on particular sectors (urban supply, agriculture and hydropower) and economic aspects (compensation of losses), and significant efforts have been made to improve water use efficiency and reduce supply network losses to improve preparedness. It fosters institutional cooperation by bringing together the various governmental agencies affected. The effects of droughts on water uses are “buffered” by water reserves in the larger supply systems, and the management structure is evolving from a reactive and individual response to a preventive/resilience and collective approach. Still, the most proactive measure for the reduction of risks has consisted in interconnecting different water bodies through channels and pipes, with potential negative effects on water body status. Measures to promote water efficiency have been implemented, though the often-associated rebound effect limits their effectiveness in risk reduction. Ecological flows are ensured below some of the dams, as well as for some permanent rivers, and limits to groundwater abstraction below the annual recharge value have been fixed.
- SI: While there is no official drought management system, the Slovenian Environment Agency (ARSO), the network of regional institutes for agriculture and universities are developing a drought management system based on project funding. The DRIDanube project established the Strategy for drought management in the Danube basin, coordinated across all countries and with IPCDR aiming for its implementation. ARSO hosts the Drought Management Center for South Eastern Europe (DMC SEE) and participates in several EU projects on droughts.

6.2. Past and planned steps at the MS level

Most EU MS have been improving their drought management system. Notably, five EU MS (AT, DE, HR, LU, SI) where no system was in place recently implemented changes. Table 23 below provides an overview of the past and planned changes. Most EU MS action has been oriented towards the improvement of the technical background (e.g. indicators) and adding information on exposure and vulnerability. Only 4 EU MS (BE-WL, CZ, NL, SI) have improved transboundary drought cooperation recently.

Regarding the plans for future improvements of the drought management systems, 16 EU MS aim to extend the temporal forecast; many of those have already made investments in the past. Other technical aspects are addressed by a group of 10-12 EU MS, and the engagement of media and dissemination as well as fostering transboundary cooperation rank lowest according to the number of interested EU MS. No further changes are planned by EE, HR, LU, and LV.

Table 23 Past and planned changes in the drought management system in EU MS

	Past	Planned
Improve technical background, like e.g. drought indicators	BE-FL, BE-WL, BG, CY, CZ, EL, ES, FI, HR, HU, IT, LT, LV ⁵⁰⁷ , MT, NL, PT, RO, SE, SK	BE-FL, BG, CY, DE, DK, FI, HU, IT, MT, NL, PT, RO, SI, SK
Improve the spatial resolution of forecasts	BE-FL, CZ, EL, ES, FI, FR, HU, LT, NL, PT, RO, SE	CZ, EL, FI, FR, HU, IT, LT ⁵⁰⁸ , NL, PT, RO, SE, SI, SK
Extend the temporal forecast	BE-FL, CZ, EL, FI, FR, HU, NL, RO, SE, SK	AT, BE-FL, CZ, DK, EL, ES, FI, FR, HU, LT ⁵⁰⁹ , NL, PT, RO, SE, SI, SK
Adding information on exposure and/or vulnerability/future scenarios	BE-FL, BE-WL, BG, CY, CZ, DK, EL, ES, HU, MT, NL, SE, SK	CY, CZ, DE, ES, FI, FR, HU, IT ⁵¹⁰ , LT, NL, PT, RO, SE, SI
	Past	Planned
Foster accessibility and usability	BE-FL, CY, CZ, DK, EL, FR, HU, LT, NL, RO, SE	BE-FL, FI, FR, HU, LT, MT, NL, PT, RO, SE, SI, SK
Engage media and dissemination	BE-FL, CY, CZ, DK, FR, IT ⁵¹¹ , LT, MT, NL, SE, SK	BE-FL, CZ, HU, MT, NL, RO, PT, SK
Foster transboundary cooperation	BE-WL, CZ, NL, SI	BE-FL, CZ, ES, IE, NL, SI, SK
Other	DK, FR	CZ, IE, LT, MT, PT, SK

Other details regarding changes made to the drought management system in the past or planned for the next future in some EU MS are provided below:

- BE-WL: The Region started to implement a drought strategy 10 years ago and fostered collaboration with the French Water agencies.
- CY: Before the first DMP was adopted in 2010 (as part of the first cycle RBMP), drought mitigation plans were prepared by the Water Development Department of the Ministry of Agriculture, Natural Resources and the Environment (in the 1990s and early 2000s). The **first DMP** mainly introduced the following: 1) Analysis and Review of the Drought Indices and the Prolonged Drought Indices for every Hydrologic Region that leads to the process of the exemption under WFD Article 4(6), 2) Review of the historical periods for every Hydrologic Region where the impact of the drought phenomena affected the achievement of the environmental objectives according to WFD Article 4 and the determination and record of the hydrologic systems that will not achieve the objectives, 3) Review, analysis

and revision of the Drought Management Plans that are referring to the Governmental Hydraulic Systems (such as the South Conveyor Project and the Paphos Project). The **second DMP** revised the previous and introduced the following: 4) Determination of the Water Scarcity Index for the Republic of Cyprus as defined by the Water Exploitation Index (WEI+), not only for the whole of Cyprus under control of the Republic of Cyprus but also for every Hydrologic Region (as defined in the DMP) and for every main sub-catchment area. In general, it is estimated that in Cyprus, there is a significant stress on the sustainable water resources except for two Hydrologic Regions (Regions 2 and 3) with non-significant stress, 5) Determination of the vulnerability to drought and water scarcity taking into consideration social, economic and environmental factors, considering the water supply, irrigation and the environment. In the framework of the review and update of the second cycle RBMP that will produce the **third cycle** RBMP, the DMP will also be updated, modified and improved as deemed necessary. For this purpose, the following actions are foreseen: i) Assessment of the risk of future increase in water scarcity and drought (from natural or manmade causes) and their potential impact. Identification and classification of drought vulnerability zones, ii) Assessment of the potential impact of water scarcity and drought on the achievement of the environmental objectives set out in WFD Article 4 and identification and recording of water systems which, as a result, may not be able to achieve the objectives, iii) Evaluation of existing drought monitoring indicators and their assessment frequency; possible revision if deemed necessary, iv) Determination of water scarcity index/indices for each hydrological area but also for the RBD as a whole, which will be the threshold value for determining the occurrence of water scarcity, v) Link to climate change, measures to take account of the impact of climate change and to test their ability to remain effective under climate change.

- CZ: Drought management planning is in place since 2014, with the development of a national drought plan foreseen for January 2024, and of regional drought plans by January 2023.
- DE: Drought should be dealt with in an integrated water resources management system rather than in a system that is only focused on droughts. The draft of the National Water Strategy also follows this integrated approach. The draft contains drought-relevant goals and actions for improved data collection and forecasting of the future development of the water balance, for more efficient water use, for the development of further prioritization of water uses, for improved planning bases through uniform standards for water use concepts, and through the establishment of intersectoral cooperation bodies at the local level. Furthermore, proposals for improved water retention in rural and urban regions will be developed.
- DK: A special fire hazard index has been developed⁵¹² and equipment to tackle e.g. fires has also been upgraded.
- EL: The improvements listed refer mainly to the DMP of Crete RBD (EL13), whilst there might be also further improvements to the system in the coming period.
- FR: The recent 2021 reform will drive the following changes: 1) Further harmonisation of thresholds, Streamlining and greater public scrutiny to exemptions to restrictions, 3) More equitable implementation with measures on a broader set of water uses, 4) Transformation of the Drought Monitoring Committee into a Hydrological Monitoring and Anticipation Committee together with forecasting tools (PREMYCE and AQUI-FR), 5) Reduction of the time between observing the crossing of thresholds and taking decisions - basin coordinating *préfécets* have a defined maximum delay (previously sometimes up to a week), 6) Improved participation: a better-defined framework with a minimum number of meetings to be organised, 7) Improved communication of restrictions: whilst now an unprecise pdf map was used, the new website will guide users through a series of questions that lead to the right place for information on restrictions relevant to them.
- IE: Regarding transboundary cooperation, there is engagement with Northern Ireland and funding available. Leakages will be addressed in conjunction with action on the Drinking Water Directive.
- IT: Several milestones can be identified in the improvement of the drought management system in the past few years: the establishing of the RBD Permanent Observatories for water resource uses as a measure under RBMPs; the 2016 Po DMP⁴⁶⁷; the 2018 Guidelines for the development and use of drought indicators⁵¹³ at the national and RBD levels; the 2020 technical notes for water crisis management, and the other documents, tools and

procedures developed in the framework of the Observatories. In all the Italian RBDs, it is planned to put in place a methodology for the assessment of drought impacts and there is interest in having models to assess the effects of potential drought measures in order to prioritise them. Moreover, several specific measures are foreseen in the third cycle of the RBMPs aimed at strengthening the effectiveness of the Observatories' actions.

- LT: Planned developments include the assessment of drought impacts and related losses.
- MT: The main actions are focused on increasing the resilience of the water supply system by the diversification of the water supply-base through investments in extending water production capacities, as well as maintaining a high level of water use efficiency in all sectors. The following actions are envisaged: increasing the production capacity of sea-water desalination, continued extension of the water reuse programme, increase in rainwater harvesting capacity at the municipal and local level and the introduction of grey-water recycling at the local scale. Furthermore, planned modelling of water demand development will enable the identification of future key measures to ensure a pro-active water management programme which ensures water security.
- PT: The most significant change in the past was the approval of the 2017 Drought Plan, which includes clearer thresholds and alert levels, although the triggers for measures to be implemented remain unclear and subjective. Climate change projections and their impacts on water availability have been modelled at a sub-basin level. Although it does not extend the temporal forecast for each drought event, it raises awareness about the trends regarding the frequency and severity of droughts and supports decisions about adaptation measures to be implemented. For the coming period, it is planned to adopt Drought Management Plans at the river basin scale. Further action aims to clarify measures and actions to be implemented according to different alert levels, territorial scales and affected sectors, in the frame of a dynamic risk-based approach, Impact assessment and reporting, and Increasing water efficiency by the main users (especially *Águas de Portugal*, AdP), and to improve the implementation of preparedness and preventive measures.
- SI: There are no official activities to develop a drought management system. However, the Slovenian Environment Agency, the network of regional institutes for agriculture and universities are developing a system based on project-based funding.

6.3. Existing and planned use of EDO services

According to the information found, the use of the European Drought Observatory (EDO) services is limited at this stage; however, organisations in many EU MS plan to make greater use of EDO.

Table 24 Existing and planned use of EDO services in the different EU MS

	Existing	Planned
Reports or dashboard	LT, PT	BG, CY, HR, PL, SK
Maps	HU, IT, LT, PT, SE	BE-WL, BG, CY, ES, MT, PL
Evolution, trends	PT, SE	BE-WL, BG, CY, HU, LT, MT, PL, SK
Sectoral risk assessment		CY
Agriculture	LT, PT	
Public water supply	PT	BG, PL
Energy production	PT	BG, PL
Forecasting	PT, SE	BE-WL, BG, CY, ES, HU, MT, PL, SI, SK
Impact reporting		BG, CY, HU, LT, SK

Use of GDO (Global Drought Observatory) services, beyond EDO	PT, SI	HU, SK
References: Definition or calculation of indicators	PT	BG, HU, PL, SK
Other		

As shown in the table, only six EU MS (HU, IT, LT, PT, SE and SI) currently make use of the different EDO services, none of them using its impact reporting. The areas where significantly more use is planned are for the service of evolution identification and trends, as well as forecasting. Current and planned sector risk assessments address agriculture, public water supply and the energy sector – these are however not the only sectors or areas impacted by droughts. It might be obvious that within the EU, the use of the Global Drought Observatory (GDO) appeals less attractive. In addition to those EU MS with clear plans, there are six EU MS (AT, EL, FI, IE, LU, RO) where the future use of EDO is either unclear or under discussion.

Criticism to EDO was raised ad-hoc by interviewees: one noted that more accurate data was available at the national level; another mentioned the insufficiently professional and accessible presentation and the lack of a clear target group of EDO.

7. CONCLUSIONS

This stock-taking exercise shows that drought perception, relevance and management is very different in the various EU Member States, though it has gained relevance over the past decade, primarily driven by the increased frequency and intensity of recent drought events.

In 2023, twelve EU Member States (Belgium, Cyprus, Germany, Greece, Spain, France, Hungary, Ireland, Netherlands, Portugal, Romania and Sweden) have Drought Management Plans in place, and six others (including Czechia, Finland, Croatia, Luxemburg and Slovenia) are in the process of preparing them. Other Member States have integrated droughts in other decision-making processes (Italy), strategies or plans, such as on climate adaptation, river basin or water resources management.

Many regulation, planning and governance frameworks are focused on ensuring water supply to the main users. However, water allocation priorities are only established for 16 EU Member States (Austria, Belgium-Flanders, Bulgaria, Cyprus, Germany, Denmark, Greece, Spain, Finland, France, Hungary, Italy, Netherlands, Portugal, Romania), usually with priority given to the maintenance/functioning of critical infrastructure (like dikes and hospitals) and drinking water (sometimes aggregated as/to domestic or urban water uses) followed by other economic sectors. The allocation systems usually do not apply criteria of sustainability, efficiency and/or equity of water use.

Water security for the environment/ecosystems is not always considered in such priority allocation systems. In addition, several Member States which do consider such allocations (Cyprus, Spain, France, Italy, Romania, Slovenia) also allow for reducing the ecological minimum flows during droughts. This is concerning because drought periods often overlap with increases of other pressures such as water abstractions and more concentrated pollution levels. As a result, WFD Art.4(6) temporary exemptions for not achieving good status of water bodies because of prolonged droughts have been applied in the assessed third cycle (draft) RBMPs for three EU MS (Hungary, Netherlands, Portugal) to overall 286 water bodies. However, the justifications of such exemptions remain poor or are not included in the River Basin Management Plans.

Preparedness for drought can be significantly improved in the EU. The coordination with sector policies is still weak and often relies on emergency actions and not addressing transformational adaptation - e.g. crop changes, reduced irrigation areas, low-water-optimised ships for river navigation – even if the climate scenarios forecast more intense drought situations in a wide area of Europe.

Furthermore, the engagement of stakeholders in preparedness planning is vital to ensuring fair and effective drought management. However, such engagement is often limited to water consumers only and ignores other water-dependent interests. In particular, non-consumptive uses such as navigation, water-dependent tourism, and both formal and informal recreation are important in

some river basins from an economic and/or health and wellbeing perspective. In such situations, engagement with local or national stakeholders from these sectors will help ensure a better balance in the governance of the drought management planning process. Finally, transboundary drought management faces significant challenges, including the differences of indicators, priorities for water use and governance setups.

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9. ANNEXES

9.1. Annex 1: Methodological note

The information of this report has been compiled by a group of consultants and individual experts in the frame of the service contract ENV/2021/OP/0009 for the European Commission. The consultant team has been led by Guido Schmidt (also MT), with contributions from Afonso do Ó (PT), Agnieszka Markowska (PL), Carlos Benítez-Sanz (ES), Cristian Tetelea (RO), Edvinas Stonevičius (LT), Eleftheria Kampa (CY, EL), Isa Vroom (NL), János Fehér (HU), Josselin Rouillard (FR), Katrin Väljataga (EE), Leila Navas (BE-WL), Liga Blanka (LV), Lucia De Stefano (IT), Matthew Jones (IE), Merel Dekker (BE-FL), Oskar Gustafsson (DK, FI, SE), Per Lundberg (FI, SE), Polona Pengal (HR, SI), Teresa Geidel (LU), Thomas Dworak (AT, DE), Zuzana Lukacova and Daniela Cinova (CZ, SK) and the quality review carried out by Tony Zamparutti.

The compilation was made during April-June 2022 based on available (draft) documents (including a sample of RBMPs) and 70 expert interviews, as reflected in the following overview:

Table 25 RBMP documents available and assessed and number of interviews carried out in the different EU MS (April 2022)

	second cycle reported	third cycle SWMI	third cycle draft for consultation	third cycle other draft	third cycle adopted	third cycle reported	Interviews (number)
AT			x				2
BE			x				4
BG	x	x					1
CY	x						3
CZ						x	3
DE					x		2
DK	x						1
EE			x				1
EL	x						3
ES				x			4
FI						x	2
FR					x		4
HR			x				1
HU					x		6
IE			x				1
IT			x				7
LT			x				3
LU			x				2
LV			x				1
MT	x	x					4
NL						x	3
PL			x				2
PT	x		x				4
RO			x				1
SE			x				1
SI			x				3
SK			x				1

In EU MS with more than one RBD/RBMP, the following plans have been assessed: BG: Danube RBD, Black Sea RBD, East Aegean RBD, West Aegean RBD; DE: North-Rhine Westphalia, Bavaria, Elbe, additional written comments were received from the national authorities. EE: Western Estonia RBD; EL: RBMP/DMP EL08 Thessalia, RBMP/DMP EL07 East Sterea Ellada; RBMP/DMP EL03 East Peloponnese; ES: ES010 Miño-Sil, ES014 Galicia-Coast, ES017 Eastern Cantabrian, ES018 Western Cantabrian, ES020 Duero, ES030 Tagus, ES040 Guadiana, ES050 Guadalquivir, ES070 Segura, ES080 Jucar, ES091 Ebro; FI: all. FR: RBMP Loire Bretagne⁵¹⁴; RBMP Rhone-Mediterranée-Corse⁵¹⁵; IT: Po. LV: Daugava RBMP, Gauja RBMP, Lielupe RBMP and Venta RBMP; PL: Vistula; RO: Olt River Basin. Jiu River Basin. Dobrogea - Litoral River Basin. Buzau – Ialomita; SE: Bothnian sea, Gulf of Bothnia, North Baltic, Southern Baltic, North Sea. SK: Danube and Vistula.

During the review process, comments on the draft report were received from DE, DK, FI, HU, IT, NL, PT, SE, SK and NAVI-TF, and subsequently incorporated in the document, including the review of complementary sources and further interviews. The additional information from PT refers to the adopted third cycle RBMPs, which had not been assessed in the frame of this study.

Belgium has been assessed for both Flanders and Wallonia, with significantly different results, which have been reflected in the text and overview tables. When sums have been made reflecting the number of EU Member States, Belgium has only been accounted once, usually according to the more advanced position (e.g. if legislation is in place in only one of the two regions, BE has been considered as having legislation in place).

9.2. Annex 2: Member State-specific summaries

The following summary can be provided for drought policy and management in each of the 27 EU Member States.

9.2.1. Austria

Austria is in general a water-rich country with only local problems in certain summers related to droughts. In consequence, no specific drought management plan exists and there is also no specific legislation. However, there is a chapter in the national RBMP addressing the issues. Also, the national adaptation strategy for climate change addresses the issue. The third cycle draft RBMP⁵¹⁶ states that the development of DMPs is recommended for regions with low rainfall and high water exploitation indexes, though not for the whole country.

In the case of water shortages or droughts, communities can set priorities for use. The federal states, together with water supply companies created community-related and regional/national water supply concepts. Based on these concepts, various demand measures are taken to ensure water supply. In dry areas, the implementation of a state-of-the-art appropriate water-saving irrigation technology is requested. Especially in regions where there is potentially a shortage and related conflicts of use can arise, if necessary, the existing permits and new permits will be reviewed.

The procedure for exemptions under Art.4(6) Measures are included in the RBMP (Chapters 5 and 8.1), but no exemptions are applied yet. An important aspect for the future is a better early warning system and better data availability for water balances, in particular abstraction data.

9.2.2. Belgium-Flanders

The legal basis for integrated water policy more in general in Flanders is the Decree of 18 July 2003 regarding integral water policy (the Water Act or *Waterwetboek*), which implements the Water Framework Directive and the EU Floods Directive into Flemish legislation. It provides the basis for the organisation, planning and governance structures for water policy in Flanders, but it does not mention droughts explicitly.

Drought management is still in an early stage in Flanders. An exceptionally dry summer in 2018 provided the impetus for the Flemish government to develop a more proactive set of policy measures on drought, which has resulted in the Action Plan Drought and Flooding '19 and '20 and a Blue Deal, formulating a set of concrete measures and connecting the various strategies and plans on Drought in Flanders. Furthermore, the drought policy was already included in the Climate Action Plan 2013 – 2020 and will be integrated into the next Climate Action Plan, still under amendment by the Flemish government. The third cycle RBMP 2022 – 2027 for the Flemish region will incorporate the measures of the Action Plan '19 – '21 and the Blue Deal, however, the final version of the new RBMP is not available yet. In the draft plans, no use is made of Art.4(6) exemptions.

Monitoring, international and inter-institutional cooperation regarding droughts, monetary estimation of drought impacts and follow-up regarding the impact of measures are also still under development and in an early phase, while crisis management tools (in the form of a decision-making framework for prioritising water use during drought and water scarcity) and coordination platforms (the Coordination Commission Integral Water Policy, connecting the various departments and levels of government involved in drought management, and the 'high-level taskforce on droughts', erected by the Blue Deal and existing of various government departments and stakeholders in water governance') illustrates the commitment of Flanders to address drought and drought-related challenges proactively, and the use of indicators is well established.

9.2.3. Belgium-Wallonia

Wallonia's water resources remain largely sufficient to meet their needs, those of Brussels and to contribute to those of Flanders. However, they have locally become insufficient at times and in places (Famenne-Ardenne) due to a lack of sufficient storage (aquifers or reservoirs, cisterns, etc.). Wallonia does not have a clear and structured Drought Management Plan; however, more recently and following the 2017 drought, the region has decided to increase its efforts to mitigate the impact of droughts.

To limit the effects of droughts on water resources, the Administration and the public operators of the water sector have drawn up a drought strategy, approved by the Walloon Government in 2021. It is based on the Drought Plan for Wallonia (DSW), which integrates measures relating to resilience and demand management and on the Regional Water Resources Plan (SRRE), which includes measures to secure water supply and the sustainable exploitation of water resources.

9.2.4. Bulgaria

In Bulgaria, the drought management policy is integrated into the water policy and the policy for adaptation to climate change. The main relevant pieces of legislation are the Water Act and the Climate Change Limitation Act. The latter sets out the requirements for integrating climate change mitigation policy into relevant sectoral and integrated policies in the fields of transport, energy, construction, agriculture and forestry, tourism, industry, regional development, health and cultural heritage, education, and science, finance and management of European funds, labour, and social policy, defence, and internal and external affairs. The Minister of Environment and Water is the competent body for the overall implementation of the state policy on climate change mitigation and its consequences, in particular droughts and floods.

The main strategic documents considering droughts are the National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria, the RBMPs, and the National Climate Change Adaptation Strategy and Action Plan until 2030. The draft 3rd RBMPs are still under development.

The Water Act stipulates priorities of satisfaction of requests when permitting water abstraction in the case of water shortage or droughts.

The most relevant measures for better adaptation of water use and the environment to drought are preparedness and related to monthly regime schedules for water use of the largest dams, reducing the losses of the water supply networks, ensuring minimum ecological outflow in the sections after surface water abstraction facilities and/or flow regulation facilities, measures to limit water use (awareness measures, Introduction of water-saving technologies and circulating water supply), the interaction between responsible institutions regarding activities, related to the operation, construction, reconstruction and modernization of water management systems and facilities.

Work is underway to incorporate the necessary measures to strengthen the drought management policy in the third cycle RBMPs, incl. for improving the methodological basis for assessments and forecasts related to the impact of drought processes, operational measures, and interaction between institutions. Given that work on the development of the RBMPs is still ongoing, the present analysis takes into account the views expressed in the public consultation on the significant water management issues (SWMI), as well as working papers such as the updated catalogue of measures.

9.2.5. Croatia

There is no drought management system in Croatia, but some policies in the areas of climate change, spatial planning, agriculture and water management at the national and regional/municipal

levels recognize drought as one of the natural risks (besides floods, wildfires etc.). However, these policies do not contain any specific measures for adaptation or mitigation of droughts in the future, except for a general reference to nature-based solutions, urban regreen, etc. The reactive measures for mitigating drought impacts and recovery after a drought event are based on the Disaster Risk Assessment for the Republic of Croatia.

The only drought mitigation plan is the 2021 National Irrigation and Agricultural Land and Water Management Project, which predicts the development of irrigation for agriculture as an adaptation measure but has not been implemented. Monitoring is well developed and developing further.

9.2.6. Cyprus

Water scarcity is one of the most serious problems facing Cyprus over time. Drought management is regulated at the national level based on the Drought Management Plan (DMP) which is an integral part of the River Basin Management Plan (RBMP) and is approved by the Council of Ministers, according to the 2004 Law for the Protection and Management of Water. Droughts are explicitly considered in the RBMP which identifies links and synergies of the Programme of Measures with the DMP. The 2nd DMP (2016) is currently under implementation. The main objective of the DMP is the establishment of a system for detecting the presence of droughts in time to take the management measures needed in each supply system to limit the adverse effects of droughts, based on six indicators.

The main measures and approaches to cope with droughts include the early warning system for droughts (using the DMP indicators), control of water supply from large storage dams managed by the government, use of water from desalination plants (drinking water) and water reuse for irrigation, measures to increase more efficient water use and awareness measures for the public. Additional powerful instruments in the Cyprus water policy include the annual evaluation of the water balance and the optimal allocation of available water resources for all uses, as well as the promotion of a water pricing policy providing incentives for efficient use of water resources.

As part of preparing the third cycle RBMP, the DMP will also be updated and the final ratified version is expected for September 2023. Planned actions in this context include the assessment of the risk of future increase in water scarcity and drought and potential impact, assessment of possible exemptions under WFD, evaluation of the existing drought monitoring indicators and water scarcity index/indices and definition of measures to take account of the impact of climate change.

In addition, drought management is explicitly addressed in the National Adaptation Strategy (2017) and the recent Strategic Study for Water and Drought Management (2019) which includes medium- and long-term measures, measures to increase preparedness during exceptional and persistent droughts and builds on the DMP, RBMP and National Adaptation Strategy.

Information on the use of WFD Art.4(6) exemptions is not available as the 3rd RBMP will go to consultation in late 2022.

9.2.7. Czech Republic

The Czech Republic has experienced severe drought periods since 2014 that prompted national authorities and institutions to act and start considering the issue of drought more seriously and comprehensively. In 2014, the *VODA-SUCHO* (Water – Drought) Interdepartmental Commission between the Ministry of Agriculture and the Ministry of Environment was established. The task of this commission was to develop a Concept for the protection against the consequences of drought for the territory of the Czech Republic, which was approved by the Government of the Czech Republic on 24 July 2017. The concept complements and further elaborates the measures proposed in the National Action Plan for the adaptation to climate change. In 2020, the amendment to Act No. 544/2020 (Water Act) introduced Title X Drought and water scarcity management, which aims to set up operational management to manage drought and water scarcity. The change in the law allowed for the creation of commissions in individual regions, which will be able to declare a "water scarcity" regime and apply certain restrictions on the use of water, such as watering restrictions for the public, based on newly acquired drought and water scarcity management plans. The amendment introduced plans for drought and water scarcity management at the national and regional levels. They are developed in cooperation with the relevant river basin authorities and the Meteorological Institute. The plans are to be developed by 1 January 2023 and will serve as a risk-preparedness plan for the next years.

Drought forecasting is provided by the Czech Hydrometeorological Institute in cooperation with the administrators of the river basin districts, assessing the magnitude, intensity and duration of drought in terms of water resources.

Every RBMP includes in its PoM a chapter entitled "IV.5 Objectives to reduce the adverse effects of hydrological drought" that describes applicable legislation and policy for the management of droughts. No Art. 4(6) exemptions have been applied in the third cycle.

The Action Plan on Adaptation to Climate Change is focused on addressing all major impacts of climate change which include prolonged drought periods. The CAP Strategi Plan for 2021-2027 refers to drought as an issue in several Needs and Objectives sections and also lists relevant policy documents addressing droughts. It also refers to the National Recovery Plan which will also provide funding to projects aimed at reducing the impact of agricultural drought, and protecting agricultural land from erosion or flooding.

9.2.8. Denmark

There are no specific drought policies, planning or management in place at present. However, drought and water shortages are included in a number of regulations and areas. For example, a national climate programme was published in 2020, in which the need for new investments to be based on future climate scenarios such as the increased risk of droughts is mentioned.

In Denmark drinking water and water for irrigation, are generally sourced from groundwater. All water extraction needs a permit, stating the purpose of the extraction and the permitted extractable water per year. The Danish drinking water structure are highly decentralized, with around 2,200 public water suppliers. The Danish executive order on water supply § 52 state, that the individual water suppliers can take decision to limit the water use in their supply zone, if the water resource is under pressure, for instance due to a longer period of drought. As an example of limitation on water use, the law specifically state prohibiting garden watering. To promote a general reduction in the use of water, water from public water suppliers, are taxed with a fee of 0.86 EUR/m³. As a result, the amount of ground water extracted by public water suppliers has dropped 37 % since 1990.

The Danish River Basin Management Plans' programs of measures include restoration measures (watercourse restoration, re-establishment of lakes, wetlands and river valleys) in combination with extensification of farming activities on low-lying land. The measures will help to mitigate the effects of floods and droughts. It is the municipalities that locally plan and implement the measures within the municipal territory. The Danish Ministry of Environment will initiate a Water-Collaboration Plan to ensure sustainable extraction of the water resource, and thereby support the achievement of good quantitative status. The Water-Collaboration Plan aims at creating dialogue and cooperation between Municipalities, Public Water Suppliers and The Environmental Protection Agency in order to assess and administrate the water resource sustainably across municipal boundaries.

Further drought related initiatives are being addressed within the areas of agriculture and forest management.

No exemptions under Art.4(6) have been applied to the first and second cycle RBMPs.

9.2.9. Estonia

Droughts are not considered as important environmental issue in Estonia. This explains the lack of specific regulations and coordinated system. Drought incidents are managed ad hoc and reactively, no information is available about risk assessments. Information about drought impacts and trends are not available. No indicators are used for evaluating risks, impacts and trends domestically, whilst WEI+ is only used for international reporting. Historically, droughts have not been a significant problem in Estonia and the society is used to a surplus of water resources.

Although there is no explicit strategy or action plan to combat and mitigate droughts, droughts are somehow addressed in the Estonian national climate change adaption development plan for up to year 2030⁵¹⁷. Drought-related measures aim to improving the ability to detect and fight forest fires, and to update systems for meteorological predictions (including heat waves), but do not address water management.

Droughts and their impacts are mentioned in the action plan for mitigating impacts of climate change in agriculture (2012-2020).⁵¹⁸ This plan mentions impacts of expected increase in meteorological and hydrological extremities including droughts - wider spread of pests, decrease in soil humidity and fertility, adverse effects on crops, cattle and pollinators. Measures address introducing new more resistant crop varieties and more research about impacts on pollinators and resistance of crop varieties, but do not address water management.

The Nature Protection Development Plan 2020⁵¹⁹ mentions under impacts of the climate change only changes in the dispersal range of species. The corresponding action plan⁵²⁰ lists several measures to improve resilience of ecosystems to droughts, like restoring wetlands and rivers, developing guidance for city planning, research for clarifying impacts of climate change on biodiversity, protection of forest ecosystems. Still, main measures related to managing drought risks and impacts is presented in River Basin Management Plans and the respective Measure Plan⁵²¹. RBMP measures are aimed at increasing efficiency of water systems and water use by better calculation of water supplies, reusing wastewater, renovating and optimising water supply systems and thus decreasing water losses, also in irrigation. Other measures include buffer strips in riparian zones and keeping agricultural land under cover of vegetation.

9.2.10. Finland

While Finland does possess various water management and climate change adaptation plans, drought is not considered a threat and therefore tends to be focused on less than e.g. flooding. Drought tends to only be mentioned in such policy documents.

There are currently no drought management plans in place in Finnish legislation; however, documents exist regarding the preparedness for drought risk and the preparation of a drought management plan. The Finnish Environment Institute (SYKE) is currently responsible for a pilot on disaster resilience, which includes a multi-hazard framework for the risk assessment of e.g. droughts at the regional and national level. Drought risks are generally higher in south and southwestern areas of Finland, than in the north.

The Government has approved seven regional water management plans and a marine management plan as part of its RBMP for 2022–2027. Droughts are not a focal point in these; however, they mention that the potential for water storage in catchments should be further explored as a means of preventing the damage of drought. The plans also propose a groundwater measure, which covers climate change in groundwater basins where floods or droughts pose a risk to the functioning of water supplies and may cause problems with water quality or quantity if they occur. They furthermore acknowledge that drought risks are increasing due to climate change and that drought risks are thereby being prepared for. No WFD Art.4(6) exemptions are being applied in the third cycle RBMP.

9.2.11. France

In France, drought management is mainly regulated through secondary legislation at the national level (decrees and guidance), at the river basin level, through the establishment of an *arrêté d'orientation de niveau bassin* and framework decrees (*arrêtés-cadre*) at the *département* level. High heterogeneity of thresholds (river flows, groundwater levels) and restriction measures on water use have resulted which is now being addressed through additional framework decrees taken at catchment and basin levels. It is worth noting that none of the decrees is recognised as plans or strategies and hence no environmental impact assessments are required for their adoption.

RBMPs set thresholds for minimum water flows at key nodes of the river basin. These are further specified at key nodes of sub-basin/catchments in the relevant plans, when existent. The drought plans must respect those and can establish additional ones in defined management zones. The French system is therefore a nested system from the river basin to the management zones.

France has a well-accepted drought management system whose main characteristic is to implement gradually stricter restrictions on water use according to thresholds. Ongoing developments to improve the system includes further harmonisation of thresholds within river basins and sub-basins, improved anticipation of the crisis through forecasting and coordination, increased reactivity to taking restrictions when thresholds are reached, increasing public scrutiny to exemptions to restrictions that specific users benefit from, and more equitable implementation of restrictions.

9.2.12. Germany

So far there is no explicit regulation in Germany that comprehensively deals with the drought issue. However, there are far-reaching regulations on integrated water resource management, also addressing dryness and droughts. The decisive national law relating to water resource management legislates a regulated management of surface and groundwater.

The Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection is responsible for regulating requirements for integrated water management. The Federal Ministry on Food and Agriculture responsible for economic instruments for subsidisation of crops resistant to heat. The Federal Ministry for Digital and Transport responsible to ensure safe and smooth navigation on federal waterways and reliably calculable transport conditions, even in the event of frequent climate change-related extreme low-water periods.

The Federal States and the Federal Government share responsibility for the implementation of integrated water resource management in Germany, with the regions (*Länder*) implementing and financing a large proportion of the total volume of measures. The German Working Group on Water Issues of the Federal States and the Federal Government (LAWA) is the central platform for the coordination of all related activities. The Working Groups of the LAWA have elaborated numerous strategic documents relating to drought and water scarcity. In 2020 the Group of Experts on "Impacts of Climate Change on Water Management"⁵²² and the Permanent Committee "Climate Change" (LAWA AK) published a strategic report on Impacts of Climate Change on Water Management Stocktaking, scope for action and strategic fields of action based on a previous Review and Policy Recommendations.⁵²³

All uses of water are defined and subject to official authorisation according to certain conditions, apart from a few exceptions. In Germany the lower water authorities are competent for granting the water abstraction rights. This instrument is used to control water withdrawals while taking specific local conditions into account, and can be applied during droughts.

Strategies for dealing with low-water exist at the level of some regions. Others are preparing water supply plans to secure it even under the conditions of climate change. Dealing with drought and water scarcity is central to the draft National Water Strategy.

An example of the initiation of adaptation measures in the area of inland navigation is the action plan for low water on the Rhine⁵²⁴. In the action plan effective options for action have been identified in the fields of action "Provision of information", "Transport and logistics", "Infrastructure" and "Long-term solution approaches", which are intended to ensure reliably calculable transport conditions on the Rhine even in the event of frequent climate change-related extreme low-water periods.

Germany is using a wide range of drought indicators such as Standardized Precipitation Index (SPI), Soil Moisture Anomaly (SMA), Low-Flow Index, Standardized Precipitation Evapotranspiration Index (SPEI), Water Exploitation Index + and others.

Art 4.6 WFD is transposed to the national law. No application has yet been identified.

In Germany exist a number of measures dealing with droughts and their effects. The catalogue of 177 water management measures also contains information whether the specific measure supports the adaptation on climate change. But no measures are directly linked to the trigger "drought". Depending on their focus, these measures are implemented in a decentralised manner within the framework of the low-water strategies of the federal states or in regional water supply concepts. The umbrella for drought adaptation measures is the National Water Strategy, subject to its adoption. In general, it should be noted that in Germany water resources are managed in an integrated way considering extreme events such as floods, heavy precipitation and droughts. A drought-only approach is not established.

9.2.13. Greece

Drought Management Plans were published for 12 of 14 RBDs (in 2013/2014) and included as an integral part of the first River Basin Management Plans. The DMPs defined indicators to be used for the early diagnosis of drought in order to minimize adverse effects. The results and conclusions of the DMPs were used in the second cycle RBMP management cycle to determine the program of measures and the process of assessing the periods of prolonged drought during which the exemptions under Article 4(6) are activated.

All RBMPs including their DMPs were approved at the national level by Ministerial Decisions, while the overall Drought Management within each RBD is carried out by the competent Regional Water Directorates. The RBDs with pending DMPs included EL13 Crete and EL14 Aegean Islands. For RBD EL13 Crete, the DMP was published in 2021 as a measure foreseen in the second cycle RBMP.

In addition to the DMPs and RBMPs, drought management is explicitly addressed in the National Adaptation Strategy (2017) and in Regional Plans for Adaptation which are under development. Also, the draft CAP Strategic Plan includes actions relevant to addressing droughts in the agriculture and forestry sectors. The National Action Plan to Combat Desertification of 2001 had a strong link to droughts but the actions it defined were not implemented and the National Committee to combat desertification is not active anymore.

The main measures and approaches to cope with droughts in the DMPs include the establishment of early warning systems for droughts, reduction of leakage losses in water supply and irrigation networks, and measures to increase the efficiency of water use in irrigation, water pricing and cost recovery. The DMPs also propose construction works to store and distribute water resources (dams and reservoirs, water transfer and distribution works) and strategic planning for backup reserves, e.g. water drills constructed where pumping will take place in case of extreme droughts. Furthermore, drought event management actions are also clearly outlined in some DMPs, e.g. of Crete and Sterea Ellada, while other DMPs make more brief references to potential drought management actions, e.g. of Thessalia.

Overall, the recommendations of the DMPs (steps, processes, data analysis to support forecasting, measures etc) are so far implemented on an ad hoc basis, indicating that the drought management system is not yet fully functional.

Information on the use of WFD Art.4(6) exemptions in the 3rd RBMPs was not available at the time of this assessment, as the 3rd draft RBMPs were not yet available (state of play May 2022). In the second cycle RBMPs, a measure is included (in the PoMs), to review, update, harmonize and extend the DMPs. Steps planned to further develop the existing drought management system focus on improving the spatial resolution of forecasts and extending the temporal forecast.

9.2.14. Hungary

Drought is regulated at the national level by law and for its implementation, several governmental and ministerial decrees are in force. The implementing regulations cover the definitions related to drought management, the indicator used and its monitoring, the definition of the responsible organizations, and the manner and extent of compensation for the damage caused by drought. Hungary operates a financial compensation procedure to alleviate the drought damage to farmers on the basis of a regulated legal framework.

The so-called Hungarian Drought Index is used to assess, monitor (in real time) and forecast the severity of the drought. In addition to meteorological parameters, the moisture status of the given soil in 6 depth (0-80 cm) is also taken into account when calculating the index.

Several drought strategy documents have been prepared at the national level, taking into account the priorities of environmental protection, climate change and river basin management. Based on various drought strategy documents, drought management plans have been recently developed, such as river basin management plans (national and 4 regional) and 12 district water scarcity/drought management plans, and 84 detailed plans (for each water scarcity/drought district) which are scheduled for the end of 2022.

The third cycle RBMP provides a detailed analysis of the drought situation throughout Hungary and lists the planned measures to mitigate the damage caused by the drought. Based on detailed analyses, the third cycle RBMP includes exemptions for some river, lake, and groundwater bodies based on WFD Art.4(6) due to drought effects that may occur in the future.

9.2.15. Ireland

Drought is not covered in legislation in Ireland. Recently there have been efforts to centralise and formalise procedures relating to drought. This has come through the National Water Resources Plan (NWRP), published by Irish Water, the water supplier. An appendix to this document focuses uniquely on drought planning and is the principal document on drought planning in Ireland. The NWRP procedure is still ongoing; an initial summary Framework Plan has been published and regional plans providing greater detail on regional specificities and differences are still being

completed. Previously drought management was undertaken by local water suppliers or local authorities. The last four years have seen several hosepipe bans imposed, which had previously been unusual.

Increased risk of drought has been connected to climate adaptation. There is a recognition that a changing climate is likely to increase the frequency of drought in Ireland. The recent NWRP sets out potential measures to be taken in the case of drought, but measures remain primarily reactive rather than risk-based. The special water sector report within the National Adaptation Plan sets out potential drought scenarios and potential measures that could be used to prevent them, but these measures have not yet been selected and implemented.

No Art.4(6) exemptions have been applied so far.

9.2.16. Italy

Drought management legislation is quite scattered and complex, due to the existence of several competent authorities, laws, and plans etc. at the national and local levels, but important advances were made during the past few years. A major advance was the creation of a Permanent Observatory for water resource uses in each of the seven Italian RBDs, where the RBA and key governmental and non-governmental stakeholders meet to discuss the drought situation and agree upon measures that then are approved and implemented by the corresponding authorities.

The functioning of the Observatories and the associated drought management policy varies depending on the RBD and the associated environmental, climatological, hydrological and topographic conditions. The Po RBD is a pioneer in Italy in terms of the functioning of the Observatory. The Po RBD Observatory provides online significant information about drought management while for other RBDs there is less information available. The spectrum of development of the Observatories is quite broad. The Ministry of Environment and Energy Security and ISPRA, its associated research body, make efforts to homogenize drought management practices across RBDs through studies and guidelines e.g. drought monitoring and dissemination. The Civil Protection Department is very effective in managing the highest level of drought emergency to support the domestic supply. Water management is decentralized due to competence assigned by law at the national and the local levels. Droughts are considered in RBMPs through measures to address water scarcity and, in the case of Po RBD, there is also a specific annex about drought management. Each RBD Permanent Observatory has implemented a drought indicator system to define the severity of drought and based on that the Observatory members discuss possible interventions and measures. For domestic use, interconnectivity of water systems is a key issue that needs to be addressed, also to reduce water losses. The Italian National Plan for Recovery and Resilience takes on this issue.

No Art.4(6) exemptions have been identified in the draft RBMP assessed.

9.2.17. Latvia

Drought is not considered a relevant management issue at the moment for Latvia. In the legal acts, drought is covered by the National Civil Protection Plan. It includes a definition of droughts, assesses the drought risk, and defines responsible authorities in the event of drought. There is no specific mention of droughts in the RBMPs or the Climate Adaptation Plan. The Water Management Act includes the national regulatory reference to WFD Art.4(6) exemptions, which have not been applied so far.

There is no drought management plan in Latvia. The Latvian Environmental, Geology and Meteorology Centre (LEGMC), responsible institution for the development of RBMPs, is planning to address drought issues after 2027.

9.2.18. Lithuania

The main legal document for drought management is the Management Plan for Extreme Situations Order No. 1503 of 20 October 2010 of the Government of Lithuania. It establishes a governance system of droughts. According to this order, the main institution for drought management is the Ministry of Agriculture and the main supporting institution is the Ministry of Environment. Both institutions cooperate on drought policy and planning.

Drought policy, planning and management are the same on a national level. The relief and response measures are applied on the municipality level only in affected municipalities. Other legal

documents published in the Register of Legal Acts establish instructions on drought detection, rules for reimbursement of crop and plant insurance premiums and limitations on water abstraction from surface WB and operation of ponds.

The sectorial drought management approach is applied with the main focus on agriculture. The impact on this sector is largest, but not easily attributable to droughts. Other sectors in consideration are wildfires and ecosystem protection. There are no DMP and strategies or other plans, which address drought management explicitly. The WFD Art.4(6) exemptions are not applied in the 3rd (draft) RBMPs. The long-term drought impact on the ecological status of WB is not likely due to the humid continental climate with short droughts.

Currently, a new indicator for hydrological drought is under development. A lot of reactive and proactive soft and nature-based drought management measures are included in the National Energy and Climate Action Plan (NECP) of the Republic of Lithuania for 2021-2030. Interviews point to a need for sectorial drought vulnerability and impact assessment. This might be partly covered by the results of an ongoing national study on the sensitivity and vulnerability of Lithuanian municipalities to climate change and the preparation of the climate change adaptation plans.

9.2.19. Luxembourg

In Luxembourg, both drought management and drought planning are still in the beginning. Drought only recently became more prominent on the policy agenda of Luxembourg, due to the impact it had mainly on agricultural production in 2020.

The issue of severe, more frequent and longer-lasting droughts is acknowledged and seen as exacerbated by climate change. The National Adaptation Plan, the Document of Sensitizing Water Usage and the third cycle RBMP each mention drought a couple of times, but there is no binding legislation in place that defines and manages (the risk of) droughts. However, a national working group on water scarcity and drought, led by the Ministry of the Environment, Climate change and Sustainable Development was created in April 2022 to take up the work on this issue. It is not clear what the function and mandate of this working group is as of yet. Also, so far there are no specifics on the involvement and the treatment of different regions and sectors.

No Art.4(6) exemptions have been applied so far.

9.2.20. Malta

Droughts are regulated in the Maltese subsidiary regulation and further elements specified within the RBMP.

Malta faces increasing aridity and water scarcity, which had led the country to undertake numerous preparedness measures over the past decades, such as investments in new water sources (desalination), reuse of treated urban wastewater in agriculture and water demand measures (efficiency increase, urban water tariff blocks, awareness campaigns), reducing drought risk. In addition, the low storage systems on the islands require a rapid response action to satisfy demands during droughts and foster inter-institutional cooperation. Most of the actions are included in the RBMP, as well as in the NAP and minor references are made in the CAP Strategic Plan. However, specific drought management plans are not in place.

No third cycle draft RBMP has been published yet, but droughts are referred to in the SWMI, and at this stage, there are no plans to apply Art.4(6) exemptions in Malta. The authorities are further developing monitoring and modelling of drought impacts, as well as enlarging and interconnecting alternative water supply systems.

9.2.21. Netherlands

The Netherlands has a long-standing history of water management. The 2018 and 2019 extremely dry summers have brought drought to the centre of attention, and in consequence, a participatory PolicytableDroughts was established in 2019, with its conclusions being implemented, most of them via the Deltaplan Freshwater.

The Netherlands drought governance involves all levels: Whilst the Ministry for Infrastructure and Water Management sets (national) frameworks and standards, provinces are responsible for strategic groundwater policy and management of abstractions, together with the Water Boards.

Municipalities are responsible for assigning functions to locations, taking into account the quality of the soil and groundwater.

The key elements of the Dutch drought management are described within the River Basin Management Plans 2022-2027, the Deltaplan Freshwater, the National Climate Adaptation Strategy 2016, and the final report of the Policytable Droughts. According to the third cycle RBMP, drought Art.4(6) exemptions are applied to 78 water bodies with a detailed justification.

The drought management plans in place and the planned developments are of high quality. There is no need for EU harmonization, beyond fostering research.

9.2.22. Poland

Droughts are considered and defined in the Polish legislation. A so-called Drought Management Plan⁵²⁵ was prepared by the National Water Management Authority Polish Waters under the supervision of the Ministry of Infrastructure and adopted with an Executive Order of the Council of Ministers in July 2021. However, the plan primarily focuses on water retention infrastructure measures; while it provides a high-level catalogue of measures including operational and organisational measures aimed at, among others, strengthening natural retention, and preparing guidelines on good agricultural practices, and education, it does not include any concrete operational, organisational or follow-up measures proper to drought event management.

No Art.4(6) exemptions due to drought are foreseen in the Vistula third cycle RBMP.

9.2.23. Portugal

Drought is the subject of a 2017 ministerial regulation that creates and delegates on an Interministerial Permanent Commission on Droughts the elaboration of the national Drought Prevention, Monitoring and Contingency Plan (DMP). This Plan has no binding legal value but sets orientations and guidelines for the Commission to manage drought events, including alert levels, monitoring parameters and mitigation measures, as well as its governance structure. The DMP closely relates to the RBMPs, the Climate Change Adaptation Strategy and other sectorial plans and strategies; however, coordination of sectorial plans and strategies needs to be improved.

Under the DMP framework, two Regional Water Efficiency Plans were established in 2020 for the southern and more drought-prone regions of Alentejo and Algarve (this one already being implemented), this time in the official Public Bulletin, hence with legal value. The Plans propose a set of measures, both on the supply and demand side, determine the budget and financing mechanisms for such measures, and predict the water volume increase delivered by each measure. Many of the national DMP measures are foreseen to be implemented through river basin-specific DMPs, currently in the process of being drafted, though no public information is yet available.

The framework for applying Art.4(6) exemptions and their justifications has been established in both the national Water Law and the RBMPs. The third cycle RBMP includes exemptions due to droughts and forest fires for 185 water bodies.

The core of drought policy in Portugal is very much focused on a water management perspective, centred on the mitigation and relief of drought impacts; but from alert levels to allocation priorities, decisions are mostly taken on a political basis, although based on a robust technical structure.

9.2.24. Romania

In Romania, different aspects of drought make the subject of several policies. The National Strategy for reducing the effects of droughts on short-, medium-, and long-term, although elaborated in 2008, is still the framework document promoting the preparation and adoption of measures aiming to reduce the impact of droughts on the population, goods and the environment. It includes clear roles for national authorities and research institutes and specific long, medium and short-term national measures without considering regional differences. Measures to combat and mitigate drought effects and interventions in the cases of prolonged droughts are detailed in the national strategy on desertification and disaster risk management plan. The General Inspectorate for Emergency Situations coordinates in an integrated way with other national entities the interventions in case of droughts events and the evaluation of post events.

The Ministry of Agriculture and Rural Development has formal leadership for drought governance. The strategic action planning and interinstitutional cooperation are coordinated by the National

Committee for Mitigating Droughts and Combating Land Degradation and Desertification, established under the Ministry of Agriculture.

RBMPs indicate the designation of restriction plans for water use in case of droughts to ensure appropriate water distribution to all users. The restriction plans are elaborated and updated yearly (usually in April or when necessary) by the river basin authorities, with detailed calendars and responsibilities of water users during drought periods. Information about drought is available in the RBMPs under the chapter dedicated to water quantity, forecast for water availability and water needs.

The third cycle draft RBMPs do not mention any Art.4(6) exemption. However, the RBMPs indicate the need for more science-based evidence of drought effects and the identification of affected areas, like groundwater bodies.

9.2.25. Slovenia

There is no legal document directly related to drought and drought management in Slovenia. However, in various plans and documents, drought is only addressed indirectly as a type of natural disaster. Apart from emergency interventions, the Environmental Agency (ARSO) is managing the Drought Management Center for South Eastern Europe (SEE) and is implementing action on a project basis (e.g. including DRIDANUBE - Drought Risk in the Danube Region and ADO - Alpine Drought Observatory) without a formal governmental mandate.

The transposition of WFD Art.4(6) is incomplete, though no exemptions have been applied so far.

9.2.26. Slovakia

In Slovakia, two policy documents directly address drought management. The 2018 Action Plan to address the consequences of drought and water shortages entitled H2ODNOTA JE VODA contains preventive and operational measures on how to fight the consequences of drought in Slovakia. It combines measures in several areas and sectors into one document (preventive measures for agriculture, forestry, water management and urban areas). It is historically the first cross-sectoral document on the issue of drought in Slovakia. In mid-2022, a new strategic document "Concept of water policy until 2030 with a vision up to 2050" was endorsed by the government. It addresses droughts explicitly and sets out measures to address drought and water scarcity.

In addition, the following conceptual and strategic documents (selection) have been endorsed: Concept of the water policy of the Slovak Republic until 2030 with a view to 2050.⁵²⁶, Water plan of Slovakia (2021 update) (RBMP).⁵²⁷, Climate change adaptation strategy of the Slovak Republic – update (2018).⁵²⁸, Action plan for the implementation of the Slovak Climate Change Adaptation Strategy (2021).⁵²⁹, an Action plan to address the consequences of drought and water scarcity.⁵³⁰ and the Strategy of the environmental policy of the Slovak republic until 2030.⁵³¹.

The Slovak Hydrometeorological Institute currently operates meteorological drought monitoring, soil drought monitoring, drought impact monitoring on agriculture, fruit growing and forestry, and hydrological drought monitoring, both in surface and underground waters.

Currently, extensive processing of hydrological characteristics aimed at assessing hydrological drought is underway at the Slovak Hydrometeorological Institute, with the aim of analyzing the currently used hydrological limits of small water bodies and at the same time setting up hydrological monitoring for operational monitoring and assessment of the hydrological regime, including hydrological drought.

For drought monitoring to be fully functional and representative, the goal is to achieve the completion of the state meteorological network and the state hydrological network so that they can monitor representative operational data for drought assessment and subsequently publish their evaluation operationally.

There is also an Adaptation Strategy of the Slovak Republic for Climate Change updated in 2018. It addresses, inter alia, the issue of droughts. It proposes multiple adaptation measures to be applied in different areas where droughts are part of the problem – e.g. water management and biodiversity. However, as assessed by the Supreme Control Authority, the Strategy has the status of a strategic framework document for climate change; it was not primarily designed for drought management and does not include a drought management strategy. Measures on drought management, set out in the Action Plan for the Implementation of the Strategy for Adaptation of

the Slovak Republic to Climate Change (2021), were not defined in such a way that their impact can be assessed to meet the strategic drought objectives.

Slovakia did not use Art. 4(6) exemptions in the third cycle draft RBMPs for Danube and Vistula RBDs.

9.2.27. Spain

The management of droughts in Spain is carried out through DMPs, in response to the obligation established in the National Hydrological Plan Law for inter-regional basins. Although it is not compulsory for intra-regional basins, many of them also draw up their respective DMPs.

The DMPs establish two differentiated systems of indicators and severity thresholds, one for prolonged drought as a natural phenomenon and the other for transitory shortages that anticipate the emergence of problems in meeting demands. For prolonged drought, rainfall indicators such as SPI or hydrometric ones such as SRI (if natural flows are not significantly disturbed) are commonly used. For temporary scarcity, ad hoc indicators are designed for each territorial unit depending on the infrastructures available to regulate and mobilize water (reservoirs, wells, pipelines, reclamation facilities, etc.), as well as the magnitude and structure of the water needs.

The diagnosis is carried out monthly for homogeneous territorial units: if indicators fall below predefined severity thresholds (pre-alert, alert, emergency), predefined management measures are triggered: reduction of water endowments, limitation or banning of non-essential uses, the introduction of support water resources, setting up of specific decision-making bodies, increase of environmental surveillance ...

If a recurrent imbalance needs to be addressed, the RBMP should intervene by programming long-term adaptation measures to increase water availability and/or reduce consumption, to effectively adjust the exploitation rates and mitigate the risk of future drought events causing damage to economic and natural systems.

Although the DMPs already prescribe the drafting of post-drought reports, there is a need for better systematization and standardization of the assessment of the environmental and socio-economic impacts of droughts to verify whether progressive mitigation is achieved.

Regarding temporary deteriorations due to drought were recorded in 3 RBDs: ES20-Duero, 2 episodes affecting multiple surface water bodies; ES60-Segura, 5 groundwater bodies; and ES70-Jucar, 24 episodes affecting a total of 24 bodies. In no case did they result in exemptions under Art.4(6) from compliance with environmental objectives. Moreover, Spanish RBMPs (at least in inter-regional RBDs) state ex-ante conditions for exemptions because of drought that might happen during the coming period.

9.2.28. Sweden

While there is no national drought policy in place, multiple relevant authorities are closely monitoring the potential risks of water access and wildfires resulting from droughts. Authorities cover different aspects of drought and are in close collaboration, however, there is not a designated body responsible for drought management in Sweden.

The drafts for a drought sub-management plan in Sweden's five river basin districts, within the RBMPs, gathered input from various stakeholders and are publicly available. The Water Authorities (*Vattenmyndigheterna*) were supposed to publish an action programme at the end of 2022, however, they withdrew. The WFD has been implemented in the following three statutes: the Environmental Code, Water Management Ordinance (2004:660), and County Administrative Boards' Instructions (2002:864). Droughts are typically overlooked in existing policies; however, the issue is progressively being covered by counties more susceptible to droughts, i.e. those in the south and the island of Öland and Gotland.

The Government's climate adaptation strategy that applies to 32 national authorities requires that each authority initiates, supports and evaluates the work with climate adaptation in their respective area of responsibility. This includes drought and water supply.

Droughts are not explicitly considered in the RBMPs, and no WFD Art.4(6) exemptions are being applied for in the 3rd (draft) RBMPs.

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END Notes:

¹ Drought contingency plans are in place or being prepared by most of the large water users (urban supply companies, irrigation facilities, hydropower producers), as determined under Section VI.5 of the National Plan

² <https://edo.jrc.ec.europa.eu/edora/php/index.php?id=201>

³ PESETA IV report <https://ec.europa.eu/jrc/en/peseta-iv/droughts>

⁴ <https://www.copernicus.eu/en/european-drought-observatory>

⁵ [https://ec.europa.eu/jrc/en/about/jrc-in-brief#:~:text=The%20Joint%20Research%20Centre%20\(JRC,and%20support%20to%20EU%20policy.](https://ec.europa.eu/jrc/en/about/jrc-in-brief#:~:text=The%20Joint%20Research%20Centre%20(JRC,and%20support%20to%20EU%20policy.)

⁶ <https://www.eea.europa.eu/data-and-maps/indicators/river-flow-drought-3/assessment>

⁷ Water Act 364/2004 in its § 1 states that its objective is, inter alia, to address the issue of floods and droughts. The Act does not contain any more details on the issue of droughts management.

⁸ So far there is no explicit regulation in Germany that comprehensively deals with the drought issue. However, there are far-reaching regulations on integrated water resource management. The decisive national law relating to water resource management is the Federal Water Act (*Wasserhaushaltsgesetz*, WHG https://www.gesetze-im-internet.de/whg_2009/BJNR258510009.html), which legislates a regulated management of surface and groundwater. All uses of water (such as the discharge of substances or the abstraction of water) are subject to official authorisation, apart from a few exceptions. This is intended to prevent impairments to the water regime and enforce a precautionary approach to water protection. All uses of water are defined and subject to official authorisation, apart from a few exceptions. The Federal Water Act § 9, Abs. 1, Nr. 1 Abstraction and drainage of water from surface waters and No. 5 the abstraction and drainage of groundwater. Dealing with drought and water scarcity is addressed in the National Water Strategy (draft, 06/08/2021, <https://www.bmu.de/en/topics/water-resources-waste/water-management/national-water-strategy>) and further developed through goals and actions for a better data management, for the establishment of principles for prioritising water use, through standards for water use concepts or for efficient water use.

⁹ Water Act, State Gazette No 67/27.07.1999, <https://www.lex.bg/laws/ldoc/2134673412> [in Bulgarian, consolidated version with all amendments]; <https://www.moew.government.bg/en/environmental-protection-act-7628/> [In English, consolidated version with amendments until 2021]

¹⁰ Water Act 254/2001 – Water Act has been amended in 2020 and a new section entitled ‘Management of droughts and water deficiency’ was added. The amended Act with the drought management section X has been in force since 1.2.2021. Weblink - <https://www.zakonyprolidi.cz/cs/2001-254>

¹¹ 1) *Real Decreto Legislativo 1/2001, de 20 de julio, por el que se aprueba el texto refundido de la Ley de Aguas* «BOE» núm. 176, de 24/07/2001 <https://www.boe.es/buscar/act.php?id=BOE-A-2001-14276> Artículo 58. Situaciones excepcionales. 2) *Ley 10/2001, de 5 de julio, del Plan Hidrológico Nacional* «BOE» núm. 161, de 6 de julio de 2001, <https://www.boe.es/buscar/doc.php?id=BOE-A-2001-13042> Artículo 27. *Gestión de las sequías*

¹² *Code de l’environnement – Partie Législative - Article L. 211-3 II 1° relatif aux mesures de limitation ou de suspension provisoire des usages de l’eau pour faire face à une menace ou aux conséquences d’accidents, de sécheresse, d’inondations ou à un risque de pénurie*. Based on the «*Loi n° 92-3 du 3 janvier 1992 sur l’eau*» and the «*Loi n° 2006-1772 du 30 décembre 2006 sur l’eau et les milieux aquatiques*». Note : the Law only establishes the possibility for the Government to issue secondary regulation to manage droughts.

¹³ Act VLII of 1995 on Water Management. (<https://njt.hu/jogszabaly/1995-57-00-00>) Arts 1, 2 and 15

¹⁴ The regulation of drought management is scattered throughout several legal and guidance documents. The Ministry of Environment and Energy Security defines the overall water management framework through a national Law (Legislative Decree 152, 2006) that defines key water regulation and also leads initiatives to homogenize approaches to drought management. Reference: Legislative Decree 152, 2006 D.lgs. 3 aprile 2006, n. 152 Available at https://www.bosettiegatti.eu/info/norme/statali/2006_0152.htm

¹⁵ “*Waterwet*” (Water law): BWBR0025458 Law dated 29 January 2009. Water scarcity is mentioned in articles 2, 4 and 7. For the full law, see: <https://wetten.overheid.nl/BWBR0025458/2021-07-01>

¹⁶ Legal regulations on counteracting the effects of drought are contained in Art. 183 - 185 of the Water Law Act. According to Art. 184 paragraph. 1 of the above Act, counteracting the effects of drought is carried out in accordance with the Plan for Counteracting the Effects of Drought (*Plan przeciwdziałania skutkom suszy*, PPSS). In this part of the Water Law Act, there are general provisions for drought management. <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20170001566/U/D20171566Lj.pdf>

¹⁷ Law no. 111/5 June 1998 for the accession of Romania to the United Nations Convention to combat desertification in the countries severely affected by droughts and/or desertification, adopted in Paris, 17 June 1994.

¹⁸ *Lag (1998:812) med särskilda bestämmelser om vattenverksamhet* – Chapter 2, paragraph 10 (Those who manage a water activity or are in control of a water supply are obliged, in the event of serious water shortages, to renounce the water which is indispensable for the general water supply or for any other general need, if the water

scarcity is caused by drought or any other comparable circumstance.). *Miljöbalk* (1998:808), which stipulates in multiple sections responsibilities over conservation of water resources. “*Miljöbalken*” is the main environmental legislation in SE. *Plan- och bygglag* (2010:900), which stipulates how municipalities must manage their water resources.

¹⁹ In Flanders, the Decree of 18 July 2003 on Integrated Water Policy states that one of the objectives is to reduce water scarcity (implicitly caused by drought): Art. 1.2.2, 6° - reducing flood risks and the risk of water scarcity: ... (b) prevent, limit or reverse desiccation. On the subject of governance for drought management, the Decree of the Flemish Government on the geographical classification of water systems and the organisation of the integrated water policy in implementation of Title I of the Decree of 18 July 2003 on Integrated Water Policy, coordinated 15 June 2018, states in Art. 6: The Coordination Commission on Integrated water policy has the task of: ... 13° organising the drought committee to coordinate and coordinate all initiatives in the event of water scarcity and drought, and providing advice thereon at the request of the Minister and other authorities competent in that matter.

²⁰ In Wallonia, there is the “*Code de l’Eau*”, (M.B. 23.09.2004), 27 May 2004. The Code is mentioning in its Article 1 that “The water policy in the Walloon Region aims to help mitigate the effects of floods and droughts”. Article 23: The basin authority draws up a programme of measures for each Walloon river basin, each programme includes at least: Point 14. Measures to help mitigate the effects of floods and droughts.

²¹ Rules of Procedure of the Ministry of Environment and Water, adopted by the Decree of the Council of Ministers № 208 dated 27.09.2017, State Gazette No 80/6.10.2017, <https://www.lex.bg/bg/laws/ldoc/2137177049> [in Bulgarian, consolidated version with all amendments]

²² The Danish executive order on water supply § 52 states that the individual water suppliers can take decision to limit the water use in their supply zone, if the water resource is under pressure, for instance due to a longer period of draught. As an example of limitation on water use, the law specifically state prohibiting garden watering.

²³ *Real Decreto 1159/2021, de 28 de diciembre, por el que se modifica el Real Decreto 907/2007, de 6 de julio, por el que se aprueba el Reglamento de la Planificación Hidrológica «BOE»* núm. 312, de 29 de diciembre de 2021, <https://www.boe.es/eli/es/rd/2021/12/28/1159> The new regulation on droughts is introduced by paragraphs two, three, thirty-one, thirty-six, thirty-nine and forty-one.

²⁴ *Code de l’environnement – Partie Règlementaire - R. 211-66 à R. 211-70. Based on Décret no 2021-795 du 23 juin 2021 relatif à la gestion quantitative de la ressource en eau et à la gestion des situations de crise liées à la sécheresse.* Also : *Décret n°94-354 du 29 avril 1994 relatif aux zones de répartition des eaux* (modified in 2003 and 2007) create priority zones where abstraction is regulated more strictly.

²⁵ 232/1996. (XII. 26.) Governmental Decree on the rules of protection against water damage (<https://njt.hu/jogszabaly/1996-232-20-22>) Points 1, 2 and 8; Act CLXVIII of 2011 on the management of weather and other natural risks affecting agricultural production (<https://njt.hu/jogszabaly/2011-168-00-00>)

²⁶ Order No. 1503 of 20 October 2010 of the Government of Lithuania on the Approval of Management Plan for Extreme Situations. (Newest wording: 31 July 2021) <https://www.e-tar.lt/portal/legalAct.html?documentId=TAR.58208DFC8958>; Order No. D1-870 of 11 November 2011 of the Minister of Environment of Lithuania on the Approval of Meteorological and Hydrological Hazard Indicators. (Newest edition: No. D1-344 of 9 June 2020) <https://www.e-tar.lt/portal/legalAct/636e4a70aa4111eab9d9cd0c85e0b745>; Order No. 3D-180 of 31 March 2008 of the Minister of Agriculture of Lithuania on the Approval of the Procedure for Recording of Extreme Meteorological Phenomena. (New wording: Order No. 3D-566 of 09 September 2021) <https://www.e-tar.lt/portal/legalAct/16900db0112e11ec9f09e7df20500045>; Order No. 3D-327 of 25 May 2016 of the Minister of Agriculture of Lithuania on the Approval of rules on the reimbursement of crop and plant insurance premiums according to Lithuanian rural development in 2014–2020 programme measure “Risk management” policy area "Crop, animal and plant insurance premiums"(New wording: 20 November 2020) <https://www.e-tar.lt/portal/legalAct/e2d3df70232f11e684adf059272c7587>; Order No. 1218 of 13 November 2007 of the Government of Lithuania on the Partial Reimbursement of Insurance Premiums for Crops Receiving Direct Payments to Agricultural Operators and Insurance Costs. (Newest wording: 26 February 2022) <https://www.e-tar.lt/portal/legalAct.html?documentId=TAR.9B89B79EB74F>; Order No. D1-664 of 12 November 2021 of the Minister of Environment of Lithuania on the Approval of the Action Plan to restore river integrity and reduce the negative impacts of hydropower <https://www.e-tar.lt/portal/legalAct/787cd7c043d711ec992fe4cdfceb5666>; Order No. D1-302 of 02 June 2008 of the Minister of Environment of Lithuania on the Approval Of The Description Of The Procedure For The Use Of Surface Water Bodies For Water Abstraction. (Newest wording: 01 November 2019) <https://www.e-tar.lt/portal/legalAct/TAR.732FA3DC0238/asr>; Order No. 109 of 25 June 1997 of the Minister of Environment of Lithuania on the Approval Of Standard Rules For The Use And Maintenance Of Ponds (LAND 2-95). (Newest wording: 01 June 2020) <https://www.e-tar.lt/portal/legalAct/TAR.5EE1B3F8F0BE/asr>.

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- ²⁷ The Subsidiary Legislation Water Policy Framework Regulations, 2015 (<http://extwprlegs1.fao.org/docs/pdf/mlt150946.pdf>) does not define or regulate drought; however, it transposes WFD and as such the Art.4(6) regulation.
- ²⁸ Water decree “Waterbesluit”: BWBR0026872 Article 2.1 describes the ranking for water shortages: <https://wetten.overheid.nl/BWBR0026872/2020-10-01>
- ²⁹ Executive order of the Minister of Infrastructure of 15 July 2021 on the adoption of the Plan for Counteracting the Effects of Drought (*Plan przeciwdziałania skutkom suszy*, PPSS), Journal of Laws 3 September 2021, item 1615. <https://dziennikustaw.gov.pl/D2021000161501.pdf>
- ³⁰ Governmental Decision 923/2007 for the approval of the National Strategy for the reduction of the effects of droughts on short-, medium-, and long-term, published in the Official Gazette no 565/2007 (available here: <https://legislatie.just.ro/Public/DetaliiDocument/84536>). Order no 9 from 6.01.2006 of the Ministry of Environment and Water Management (2006) for the approval of the methodology regarding the elaboration of the plans of restrictions and use of water in the deficient periods, published in the Official Gazette no 331/12.04.2006 (available at: <https://legislatie.just.ro/Public/DetaliiDocumentAfis/70793>)
- ³¹ The Drought Management Plan (DMP) is an integral part of the Cypriot River Basin Management Plan (RBMP) which is approved by the Council of Ministers, according to Article 22 of the Law for the Protection and Management of Water (N.13(I)/2004). The current DMP, which is the 2nd DMP compiled in Cyprus, was approved by the Council of Ministers with the Ministerial Decision No. 81.389 and date 7/10/2016, ([http://www.cm.gov.cy/cm/cm.nsf/All/3D9079E11DF97366C22583E5002A3A97/\\$file/81.389.pdf?OpenElement](http://www.cm.gov.cy/cm/cm.nsf/All/3D9079E11DF97366C22583E5002A3A97/$file/81.389.pdf?OpenElement).)
- ³² All first cycle RBMPs which included the DMPs as an integral part were published in the national gazette as a Decision of Approval of the RBMP and its content, signed by key relevant Ministers, which are members of the National Water Committee.
- ³³ *Instruction du 27 juillet 2021 relative à la gestion des situations de crise liées à la sécheresse hydrologique. Circulaire du 18 mai 2011 relative aux mesures exceptionnelles de limitation ou de suspension des usages de l'eau en période de sécheresse* (replaced by the 2021 Instruction)
- ³⁴ 10/1997. (VII. 17.) KHVM (Ministry of Transport, Communications and Water) Decree on flood and inland excess water management. After its amendment it contains drought management as well. The amended Decree is in force since 1st January 2022 (<https://njt.hu/jogszabaly/1997-10-20-6B>)
- ³⁵ *Resolução do Conselho de Ministros n.º 80/2017, Série I de 2017-06-07 (Cria a Comissão Permanente de Prevenção, Monitorização e Acompanhamento dos Efeitos da Seca)*, which obliges the delegated interministerial Permanent Commission on Droughts to elaborate the national Drought Prevention, Monitoring and Contingency Plan Ministerial Regulation: <https://data.dre.pt/eli/resolconsmin/80/2017/06/07/p/dre/pt/html>. Plan: <https://www.apambiente.pt/agua/plano-de-prevencao-monitorizacao-e-contingencia-para-situacoes-de-seca>
- ³⁶ Act on crisis management No. 240/2000. § 39. (3) If a state of emergency is declared at the time of the water shortage declared in accordance with a special legal regulation, the relevant crisis staff and the relevant drought commission shall meet together. The powers of drought commissions established by a special legal regulation (Water Act) are not affected by the declaration of a state of crisis. Weblink - <https://www.zakonyprolidi.cz/cs/2000-240>
- ³⁷ Local governments are authorised to issues general decrees to manage and limit water abstraction from ground- and surface water during drought events.
- ³⁸ In case of prolonged drought, Regulatory Decisions are issued in many cases at regional or local level.
- ³⁹ 10/2020 Order of the Director of OVF (General Directorate of Water Management) on measures relating to prolonged water scarcity periods
- ⁴⁰ Legislative Decree No. 1, 2 January 2018. <https://leap.unep.org/countries/it/national-legislation/legislative-decree-2-january-2018-n-1-civil-protection-code>
- ⁴¹ Order No. V-80 of 25 November 2020 of the Director of Lithuanian Hydrometeorological Service under the Ministry of Environment on the Approval of Dangerous Meteorological and Hydrological phenomena indicators. http://www.meteo.lt/documents/20181/245713/Kokyb%C4%97s+politika+ir+kokyb%C4%97s+principai_2020_12.pdf/0e1946ef-da89-4f84-a9ae-d833ff68cc1c
- ⁴² National Civil Protection Plan, Cabinet of Ministers Order No 476, Riga, 26 August 2020 on the National Civil Protection Plan. <https://likumi.lv/ta/id/317006-par-valsts-civilas-aizsardzibas-planu>
- ⁴³ The National Water Distribution and Drought Scenario (LDWD). This manual describes the exchange of information between the network partners involved, and the agreements on the coordination of measures and on press and public communications. The scenario does not change the existing responsibilities of the crisis partners. For the scenario to work properly, the tasks and agreements must be implemented in the crisis plans of the crisis partners involved (source: <https://www.helpdeskwater.nl/onderwerpen/waterveiligheid/crisismanagement/landelijk-draaiboek/>)
- ⁴⁴ 1) Order 97/9.04.2020 of the Ministry of Agriculture and Rural Development, and Order 63/15.04.2020 of the Ministry of Internal Affairs, regarding the approval of the regulation on the management of emergencies caused by dangerous meteorological phenomena resulting in the occurrence of pedological drought, published on

Official Gazette no 320 from 16.04.2020. Available here: <https://legislatie.just.ro/Public/DetaliuDocumentAfis/224915>

This regulation establishes the attributions of all entities involved in the prevention, response, evaluation/investigation and rehabilitation of normal state after pedological drought emergencies. The regulation is setting up the entities dedicated to the management of the pedological emergencies, responsibilities of local and central entities for technical support and for the evaluation of the effects of drought. 2) Regulation on the management of emergencies caused by floods, dangerous meteorological phenomena, accidents in hydro-technical constructions, accidental pollution on watercourses and marine pollution in the coastal area, established by common ministerial order no 459/78/2019 of the Ministry of Environment and the Ministry of Internal Affairs. (available here: <https://legislatie.just.ro/Public/DetaliuDocument/215946>). The regulation establishes the attributions of all administrative structures involved in the emergencies generated by specific risks. Hydrological droughts are considered a dangerous meteorological phenomenon. The regulation sets three characteristic sizes of water scarcity: normal phase, attention/warning phase and restriction phase. Specific actions and measures are defined by the regulation for each of these phases. The characteristic sizes for ensuring the water requirements of different uses are set by the plans of restrictions and use of water in dry periods.

⁴⁵ Water Act 364/2004 in its § 1 states that its objective is, inter alia, to address the issue of floods and droughts. The Act does not contain any more details on the issue of droughts management.

⁴⁶ Section 4.1 of the DMP on “basic concepts”

⁴⁷ Water Act 254/2001 Section X, § 87a (1) Drought and water scarcity are defined as follows: (1) For the purposes of this Section, drought means hydrological drought as a fluctuation of the hydrological cycle, which arises mainly as a result of precipitation deficit and manifests itself in a decrease in flows in watercourses and groundwater levels. (2) Water scarcity for the purposes of this Section means a temporary situation with a potential impact on basic human needs, economic activity and the environment, where, as a result of drought, water use requirements exceed available water resources, and it is necessary to limit water management and implement further measures.

⁴⁸ For water: 10/1997. (VII. 17.) KHVM (Ministry of Transport, Communications and Water) Decree on flood and inland water protection (<https://njt.hu/jogszabaly/1997-10-20-6B>); for agriculture: Act CLXVIII of 2011 on the management of weather induced and other natural risks affecting agricultural production (<https://njt.hu/jogszabaly/2011-168-00-00>)

⁴⁹ Referring to drought by using the criteria for extreme or dangerous hazard. The indicators of extreme drought are: “drought during plant vegetation season”, “drought in the forests” and “low flow in river”.

⁵⁰ National Civil Protection Plan, Cabinet of Ministers Order No 476, Riga, 26 August 2020 On the National Civil Protection Plan <https://likumi.lv/ta/id/317006-par-valsts-civilas-aisardzibas-planu>

⁵¹ DMP section 4.2.1 is on impact of drought. For the assessment of risk of drought, the potential impacts of drought in different environmental and anthropogenic systems are used. Drought risk is also linked to the assessment of vulnerability to drought and water scarcity in section 9 of the DMP. (DMP 2016)

⁵² According to the Methodology for the preparation of plans for managing drought and water scarcity, https://eagri.cz/public/web/file/679559/metodika_plan_sucho.pdf: Drought forecasting service informs drought authorities about the risks of drought and its further development. This service is provided by the Czech Hydrometeorological Institute in cooperation with the administrators of the river basin districts, assessing the magnitude, intensity and duration of drought in terms of water resources. Water sources mean surface and groundwater in accordance with the provisions of the Water Act. The evaluation is processed and published by the Czech Hydrometeorological Institute in cooperation with the Research Institute water management T. G. M. and the river basin managers on the website <https://hamr.chmi.cz/>.

⁵³ Special Water Secretariat (2014) Drought & Water Scarcity Management Plan of the RBD EL08 Thessalia, Available at: <http://wfdver.ypeka.gr/el/project/gr08-24-approved-management-hydro-gr/> Although the DMP does not provide a clear-cut definition of “drought risk”, the risk is linked to the assessment of vulnerability to drought and water scarcity in section 3 of the DMP, using concepts of exposure and coping capacity of risks.

⁵⁴ 10/1997. (VII. 17.) Ministry of Transport, Communications and Water Decree on flood and inland water protection (<https://njt.hu/jogszabaly/1997-10-20-6B>) establishes the Hungarian Drought Index which fixes different thresholds

⁵⁵ Risk assessment methodology developed by the State Fire and Rescue Service (<https://www.vugd.gov.lv/lv/media/340/download>)

⁵⁶ While the definition of the drought risk is not explicitly given, the PPSS in several instances refers to the drought risk. On page 23 it says: ‘Diagnosing areas with recurring precipitation deficit (threats of atmospheric drought) to manage the effects of other types of drought (agricultural, hydrological and hydrogeological) applies when it relates to the balance sheet approach, that is, based on the results of the climatic water balance (KBW). For this purpose, an analysis of the KBW for 1987–2018 was carried out. The analysis of the probability of exceeding the annual KBW values below -150 mm was used, which evidence rainfall supply deficits and indicates the increased need for agricultural irrigation. On a national scale, the probability of KBW value below -

150 mm ranges from 0% to 47%, which in extreme cases means a very strong atmospheric drought every 2-3 years on average". A table with KBW values and a map follow this text on p. 24 and 25.

⁵⁷ Section 2.1.5. of the second cycle RBMPs distinguishes drought as a natural phenomenon from water scarcity, which may be a result of anthropogenic impact while considering the relationship between them. Distinction between droughts and water scarcity has specified and in the SWMI reports within the third cycle RBMPs elaboration. The National Climate Change Adaptation Strategy considers water scarcity as a consequence of the drought, its impact on the various sectors of the Bulgarian economy, and the interactions between them.

⁵⁸ DMP section 4.1: "Drought" means a temporary decrease in water availability due to causes such as precipitation deficiency, whereas "Water Scarcity" means a situation in which the demand for water exceeds - in sustainability conditions - the exploitable water resources. DMP section 4.1.1 looks at the definitions of water scarcity and drought in further detail, stressing the differences between the two concepts. (DMP 2016)

⁵⁹ Water Act 254/2001 Section X, § 87a (1) Drought and water scarcity are defined as follows: (1) For the purposes of this Section, drought means hydrological drought as a fluctuation of the hydrological cycle, which arises mainly as a result of precipitation deficit and manifests itself in a decrease in flows in watercourses and groundwater levels. (2) Water scarcity for the purposes of this Section means a temporary situation with a potential impact on basic human needs, economic activity and the environment, where, as a result of drought, water use requirements exceed available water resources, and it is necessary to limit water management and implement further measures.

⁶⁰ *RD 1159/2021 Artículo 3 (...)* k bis) Scarcity: situation of lack of water resources to meet the water demands foreseen in the respective River Basin Management Plans once the previous environmental restrictions have been ensured. kb) Structural scarcity: a situation of continuous shortage that makes it impossible to comply with the guarantee supply criteria in meeting the demands acknowledged in the corresponding River Basin Management Plan. kc) Conjunctural scarcity: a situation of non-continuous shortage which, although allowing compliance with the guarantee supply criteria in meeting the demands acknowledged in the corresponding River Basin Management Plan, significantly limits the temporary supply of water.

⁶¹ A distinction is made. The French legal and regulatory framework distinguishes between drought management of river and aquifer levels ("*gestion des crises*") and scarcity management through volumetric water management ("*gestion structurelle par volumes prélevables*"). The "*Circulaire du 18 mai 2011*" highlights the confusion between droughts and structural deficit, and how the French approach tackles these two issues separately. It underlines that drought management measures should only be taken due to meteorological drought conditions, and that measures addressing structural deficits should reduce the likelihood of using drought management measures.

⁶² Both terms are defined in the second cycle RBMP, as well as aridity. Water scarcity is considered as insufficient availability to address demand, whilst drought is a natural phenomenon. MT in addition, considers that aridity shall be taken into account as "a natural permanent imbalance in the water availability consisting in low average annual precipitation, with high spatial and temporal variability resulting in overall low moisture and low carrying capacity of the ecosystem" (small rivers and lagoons, dependent on shallow aquifers/saturation zone)

⁶³ The Deltaplan Freshwater acknowledges the fact that there will be water scarcity in the future and provides a preferred sequence of (regional) water management is therefore included to ensure the availability of water and to prevent flooding. Structural measures in the water system and more water awareness in water use are needed to make the Netherlands resilient to water shortages. This requires all water managers to change their thinking from rapidly draining water to retaining water by buffering and infiltrating more, taking into account a good balance between water shortage and flooding.

⁶⁴ Provision in a regional programme: Sub-action programme against drought and water scarcity 2022-2027 in the Southern Baltic Sea. *Vattenmyndigheten Södra Östersjön* (2022), *Delåtgärdsprogram mot torka och vattenbrist 2022-2027 Södra Östersjön*, Available at: <https://www.vattenmyndigheterna.se/tjanster/publikationer/2022/atgardsprogram/delatgardsprogram-mot-torka-och-vattenbrist-2022-2027-sodra-ostersjon.html>

⁶⁵ The National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria (Water Strategy) identifies as one of the threats to the water sector that the global climate change and the country's fall into a drought zone pose a risk in the process of providing water for the country's population and economy. The National Climate Change Adaptation Strategy presents that climate change scenarios for Bulgaria show an increased incidence of adverse climatic events, such as longer droughts, heat waves, heavy rainfall and floods. Section 2.1.5. of the second cycle RBMPs refers that climate change affects water more than any other natural resource, leading to intense changes in the hydrological cycle, resulting in dry seasons becoming even drier globally and rainy seasons even wetter, increasing the risk of larger and more frequent floods and droughts.

⁶⁶ An extended section of the DMP (section 4.3) is on impact of climate change, drawing relevant conclusions on the relationship between droughts and climate change. Based on simulation results, droughts in Cyprus are expected to become more frequent in both the near and distant future. The SPI allows the rarity, intensity, duration and geographical range of the drought to be determined. It is noted that in terms of actions for

prevention and immediate response to water scarcity problems resulting from drought events, the usefulness of the indicator is limited due to the fact that in the case of Cyprus the SPI is only reliable for periods of completed hydrological years. (DMP 2016)

⁶⁷ The DMP clearly links droughts with climate change and includes two annexes on the impact of climate change on meteorological parameters rainfall, temperature and evapotranspiration at the RBD level and the impacts of climate change on crops and needs for irrigation water at the RBD level. (2014 DMP EL08 Thessalia, section 8) Special Water Secretariat (2014) Drought & Water Scarcity Management Plan of the RBD EL08 Thessalia, Available at: <http://wfdver.ypeka.gr/el/project/gr08-24-approved-management-hydro-gr/>

⁶⁸ RD 1159/2021 Artículo 4bis. 3. The specific study of adaptation to the effects of climate change of each demarcation shall include, at least, the following contents: (...) h) Evaluation of the risks associated with climate change derived from: variations in hydrological regimes and in the available resources of aquifers, the increase in the frequency and intensity of extreme phenomena, the increase in water temperature and the rise in sea level, assessing their effect on aquatic and terrestrial ecosystems dependent on water, as well as on the water requirements of economic activities. (i) Adaptation measures, which make it possible to reduce exposure and vulnerability and increase resilience, helping to preserve the good status of water bodies, to increase security of water supply and to cope with extreme events.

⁶⁹ The 2021 Instruction specifies the necessity to improve drought management in view of the impacts of climate change

⁷⁰ Fire and Rescue Department (2021) National Risk Analysis. Available at: https://pagd.lrv.lt/uploads/pagd/documents/files/Civilin%C4%97%20sauga/Nacionalin%C4%97%20analiz%C4%97/NRA_2021-09-30.docx

⁷¹ The National Climate Adaptation Plan 2018-2023 establishes the relationship with respect to the unpredictability of climate change effects. („Der Klimawandel zu nichtlinearen Veränderungen führt, die ebenfalls einen unberechenbaren Einfluss auf die Entwicklung der Gewässer haben können (z. B. Starkregenereignisse, Trockenheit und Dürren, Niedrigwasser“). Ministry of Environment (2018): National Climate Adaptation Plan 2018-2023, https://environnement.public.lu/content/dam/environnement/documents/klima_an_energie/Strategie-Adaptation-Changeement-climatique-Clean.pdfhttps://environnement.public.lu/content/dam/environnement/documents/klima_an_energie/Strategie-Adaptation-Changeement-climatique-Clean.pdf

⁷² The second cycle RBMP includes a description of the links between climate change and drought, e.g. page 524: “Overall, the Maltese Islands are almost likely to be subject to an increase in temperature coupled to an overall decrease in precipitation; hence the possibility of drought periods. Given that trends in temperature and precipitation are already evident from observational data, such changes in climate are expected to take place in the short/medium term.”; and page 526 regarding the effects of climate change: „Freshwater resources in Malta are already limited and an increase in the frequency of drought periods will exacerbate the situation and result in further deterioration of the quantitative and qualitative status of inland surface and ground waters.“

⁷³ Explicitly mentioned in the National Climate Adaptation Strategy 2016 as a prominent point. (p. 5). The Deltaplan Fresh Water mentions climate change as a main driver for drought. (p. 7). The dry summers of 2018 and 2019, which are linked to climate change, are mentioned in the RBMP and are the direct cause for the establishment of the Policy Table Drought. (p. 2).

⁷⁴ The PPSS on p. 8 notes that while extreme meteorological and hydrological phenomena including drought have always been observed on the Polish territory, in recent years their frequency has increased. These changes are convergent with the direction of changes indicated in climate change projections. Analysis of climate change scenarios (RCP4.5 - GHG emission stabilization scenario and RCP8.5 – very high emissions) carried out for the needs of the PPSS indicate a possible increase, in the perspective of up to 2100, of the frequency of droughts in Poland.

⁷⁵ The National Strategy for reduction of the effects of droughts on the short-, medium-, and long-term, recognises the need for more non-structural measures to be included in the river basin management planning based on modelling of water availability in the arid and other zones in Romania affected by droughts and using the most recent global climate change scenarios and variables specific for Romania. The National Strategy recognises the need for further correlation between the national action plan for the reduction of the effects of drought and for combating desertification with the national plan for climate change as one of the responsibilities of the Ministry of Environment.

⁷⁶ The Resolution on the Slovenian climate long-term strategy 2050 (2021) recognizes drought as a long-term climate risk along with floods, wildfires and other natural hazards. Resolution on the Slovenian climate long-term strategy 2050 (2021) Pursuant to Article 109 of the Rules of Procedure of the National Assembly (Official Gazette of the Republic of Slovenia [Uradni list RS], Nos. 92/07– official consolidated text, 105/10, 80/13, 38/17, 46/20 and 105/21 – Constitutional Court Decision), the National Assembly adopted at its session on 13 July 2021. Available at: <https://unfccc.int/documents/302702>

⁷⁷ The Coordination Commission Integral Water Policy (CIW) was established in March 2004. The CIW is responsible for the preparation, planning and the monitoring of integrated water policy in the Flemish Region, it oversees the functioning of the integrated water management on the level of the sub-basins and is responsible for the implementation of the decisions on integrated water policy of the Flemish government. Among its tasks, the CIW organises a drought committee to coordinate and coordinate all initiatives in the event of water scarcity and drought.

⁷⁸ Under the Code of Law: Article 23: The basin authority draws up a programme of measures for each Walloon river basin, each programme includes at least: Point 14. Measures to help mitigate the effects of floods and droughts. The basin authority should consult the municipalities of the Walloon river basin, AQUAWAL, the Walloon Environment Council for Sustainable Development, the Public Water Management Company, the Water Consultative Commission, the Regional Planning Commission, the relevant Conservation Commission, the Water Control Committee.

⁷⁹ Climate Change Limitation Act, Art. 3. (2) The Minister of Environment and Waters is the competent body for the overall implementation of the state policy on limiting climate change. Art. 41a, p. 17 of the Rules of Procedure of the Ministry of Environment and Water stipulates that the National Coordination Centre Directorate participates in the operational management of surface waters in the event of flood or drought emergencies. Water Act, Art. 171 (6) p. 17 stipulates that the National Institute of Meteorology and Hydrology carries out scientific and applied research, operational activities and development of technologies in the field of water quantity monitoring, including the forecasting of floods and droughts on the territory of the country.

⁸⁰ The DMP does not explicitly define a competent drought management authority but it does clarify that the major water government projects are managed by the Water Development Department (WDD). The Water Development Department (WDD) of the Ministry of Agriculture, Rural Development and Environment is responsible for the implementation of the general water resources management policy, which includes the drought management policy.

⁸¹ §87 of Water Act

⁸² In Germany the lower water authorities are competent for granting the water abstraction rights. This instrument is used to control water withdrawals while taking specific local conditions into account.

⁸³ 1) The Ministry of the Environment, for inter-community basins (those affecting more than one Autonomous Community), will establish a global system of hydrological indicators that will make it possible to foresee these situations. 2) The inter-community RBAs will draw up Special Action Plans for Drought Alert and Potential Drought Situations (DMPs), including the rules of operation of the systems and the measures to be applied in relation to the use of the public water domain. The plans must specify the administrative organisation measures in drought situations. 3) The water administration of the Autonomous Community, in the case of intra-community basins, may adopt similar measures (system of indicators and DMP). 4) The public administrations responsible for urban supply systems that serve, individually or jointly, a population equal to or greater than 20,000 inhabitants must have an Emergency Plan for drought situations. 5) In circumstances of extraordinary drought, the Government, by means of a Decree agreed by the Council of Ministers, after hearing the basin organisation, may adopt, to overcome such situations, the necessary measures in relation to the use of the public water domain.

⁸⁴ The main competent authority to manage droughts is the State through its representative (i.e. *Préfet*) in each “*département*” (i.e. district/county). This is the competent authority to establish the rules to be implemented during droughts (i.e. through an “*arrêté-cadre départemental*” or “*interdépartementaux*” when implemented across several “*départements*”) and actually impose restrictions during droughts (i.e. though “*arrêtés départementaux*”). To coordinate between several counties in the same river basin, the State representative responsible for supervising river basin management (i.e. *Préfet coordonnateur de bassin*) is required to develop general principles to be implemented in all “*arrêtés-cadre*” of the river basin (“*arrêtés d’orientation de niveau bassin*”).

⁸⁵ 10/1997. (VII. 17.) Ministry of Transport, Communications and Water Decree on flood and inland water protection (<https://njt.hu/jogszabaly/1997-10-20-6B>)

⁸⁶ The Italian legislation defines Ministries, agencies/institutes and services/offices that are competent drought management authorities and, more in general, those responsible for the water governance, both at the national and local scales. In addition, the acts establishing the Permanent RBD Observatories for water resource uses clearly define those national and local competent authorities and also the non-governmental stakeholders (i.e. water utilities, land reclamation and irrigation authorities, hydroelectric companies) that are relevant for the water governance at RBD level. All the RBD Permanent Observatories are participatory bodies at RBD level that act as “control room” (“*cabina di regia*”) during water scarcity and droughts. The decisions agreed upon in the Observatories are approved and implemented at the local level by the competent authorities. Moreover, the National Committee for Technical Coordination of the RBD Observatories, led by the Italian Ministry for the Environment and Energy Security (MASE, former MiTE - *Ministero della Transizione Ecologica*), provides guidelines to uniform the activities of the Observatories at the national level.

⁸⁷ in the 8th paragraph of 2nd Annex to Order No. 1503 of 20 October 2010 of the Government of Lithuania on the Approval of Management Plan for Extreme Situations (newest wording: 31 July 2021)

⁸⁸ Counteracting the effects of drought is the task of the government administration authorities and local government administration bodies and the Water Management Authority Polish Waters (art. 183 of the Water Law).

⁸⁹ Specific roles in drought management are listed in the National Strategy for reduction of the effects of droughts under point (ii) for twelve national authorities. These authorities include the Ministry of Agriculture and Rural Development, the Ministry of Environment, the Ministry of Transportation, the Ministry of Development, Public Works and Administration, the Ministry of Internal Affairs, the Ministry of Economy, the Ministry of Health, National Meteorological Administration, National Forestry Administration and several national research institutes for land improvement, forestry and soil. The Ministry of Agriculture and Rural Development elaborates, coordinates and implements the national strategy for the reduction of the effects of droughts and, coordinates, substantiates, elaborates and updates the National Action Plan for the reduction of the effects of droughts and desertification.

⁹⁰ The DMP (section 10) proposes measures to address droughts and establishes links with measures included in the RBMP. (DMP 2016)

⁹¹ Reducing water abstractions - including a ban on withdrawals - is possible. The permit or authorisation to water abstraction is subject to conditions. According to the WHG Law, the content and ancillary provisions of a permit can also be ordered later so that water is used sparingly with regard to the water balance and to avoid adverse changes to water bodies due to water withdrawals. (WHG § 13, Abs. 2, Nr. 2)

⁹² Special Water Secretariat (2014) Drought & Water Scarcity Management Plan of the RBD EL08 Thessalia, Available at: <http://wfdver.ypeka.gr/el/project/gr08-24-approved-management-hydro-gr/> The DMP section 6 discusses in a generic way reactive measures that could be used to address the impacts of droughts. Section 6 summarises the basic and supplementary measures related to droughts and water scarcity (proactive long term measures) that were part of the PoM of the first cycle RBMP which was accompanied by the DMP.

⁹³ The *Code de l'Environnement* (articles R211-66 to R211-70) focuses on the restriction of water uses during droughts. It outlines the steps which the “*préfets*” must go through to establish the “*arrêtés-cadre*” and their content (e.g. management zones, thresholds for implementation of restrictions, type of restrictions, etc.). Other measures (permitting regime, water allocation, water savings, etc) are planned measures planned to deal with water scarcity/structural deficits.

⁹⁴ 10/1997. (VII. 17.) Ministry of Transport, Communications and Water Decree on flood and inland water protection (<https://njt.hu/jogszabaly/1997-10-20-6B>) The drought management actions are specified for the regional Water Directorates in the III/B section of this Decree from § 23/G. to § 23/J. and § 24

⁹⁵ In the sphere of the action “adaptation to dryness [dryness (*Trockenheit*) in German is used as a subordinate term for drought and water scarcity; many of the measures relate to drought, but most of them are also relevant for water scarcity]” in the document on climate adaptation by the Environmental Ministry (2012) drought and water scarcity, and measures to reduce their impacts are described. The strategy sets the tone for a prioritization approach in times of drought to put drinking water needs and processing water (*Brauchwasser*) before other uses of water. The analysis shows that sewage systems should be advanced to reduce standing water. It also prescribes the use of adapted supply infrastructures, the reduction of water consumption through water-saving behaviours and more efficient water use. For the more general strengthening of water availability, the document recommends some measures such as biotope networking, buffer formation, and water balance management of biotopes to limit effects on nature and landscape. Ministry of Sustainable Development (formerly) (2012) *Ministère du Développement durable et des Infrastructures, Département de l'aménagement du territoire* (2012) *Anpassung an den Klimawandel – Strategien für die Raumplanung in Luxemburg*, C-Change Changing Climate, Changing Lives, https://amenagement-territoire.public.lu/dam-assets/fr/affaires_europeennes_internationales/programmes_UE/projets_realises_par_dater/climate_change_strategie_raumplanung_de/climate-change-strategien-raumplanung-de.pdf

⁹⁶ Annex 4 to the PPSS presents a catalogue of 27 actions. The catalogue of activities contains a set of solutions aimed at achieving the specific objectives formulated in the PPSS, and thus at achieving the main objective of this document, i.e. counteracting the effects of drought. The following activities stand out among the catalogue activities: 1) 10 actions at the national level; 2) 2 regional actions; 3) 3 actions of both regional and local scope; 4) 10 local actions; 5) 2 actions at the national, regional and local level. The following types of activities were identified: 1) 2 educational activities; 2) 3 activities in the field of construction and reconstruction of water devices; 3) 3 activities in the field of increasing retention; 4) 11 formal activities; 5) 3 activities of both formal and educational character; 6) 3 activities in the field of construction and retention; 7) 1 activity involving change of use of water.

⁹⁷ The National Strategy for reduction of the effects of droughts on the short-, medium-, and long-term defines the drought management actions as “all the measures for the protection of water and soil resources, as well as the reconstruction of areas affected by drought exposure”.

⁹⁸ Section 7.2. Institutional framework of the Water Strategy determines the establishment of the Operational Centre for Water Management and warning in case of Flood and Drought events at the Ministry of Environment and Water, and its functions. The National Disaster Protection Plan determines the procedure for coordination of the structures of the unified rescue system in case of large and complex forest fires caused by prolonged drought and high temperatures.

⁹⁹ Each of the drought measures included in the RBMP includes information on the associated entities. (RBMP 2016)

¹⁰⁰ The DMP itself does not assign the drought management actions to specific competent authorities. However, the basic and supplementary measures proposed as proactive measures for droughts and water scarcity are detailed in the PoM of the 1st RBMP (and cross-linked to in the second cycle RBMP). For each measure in the PoM, the implementing authority is defined. Special Water Secretariat (2014) Drought & Water Scarcity Management Plan of the RBD EL08 Thessalia, Available at: <http://wfdver.ypeka.gr/el/project/gr08-24-approved-management-hydro-gr/> & Special Water Secretariat (2017) Revised (2nd) River Basin Management Plan of the RBD EL08 Thessalia, Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL08_SDLAP_APPROVED.pdf

¹⁰¹ Attributions of all entities involved in the prevention, response, evaluation/investigation and rehabilitation of normal state after pedological drought emergencies are established in the regulation on the management of emergencies caused by dangerous meteorological phenomena resulting in the occurrence of pedological drought. Regulation on the management of emergencies caused by floods, dangerous meteorological phenomena, accidents in hydro-technical constructions, accidental pollution on watercourses and marine pollution in the coastal area (order no 1422/192 from 16.05.2012) lists, under the Chapter III, the attributions and responsibilities in case of emergencies of droughts period, as follow: **Section 1** for the Ministry of Environment, Water and Forests (art. 16), National Administration Romanian Waters (art. 17), National Environmental Guard (art. 18), National Institute of Hydrology and Water Management (art. 19), National Meteorological Administration (art. 20), National Agency for Environmental Protection (art. 21), National Forestry Administration (art. 22). In general, all these administrations have a technical and supporting role in drought management. **Section 2** for other central and local public administrations, e.g. Ministry of Internal Affairs (art. 23), Ministry of Transport and Infrastructure (art.24), Ministry of Regional Development (art. 25), Ministry of Economy and Business Environment (art.26), Ministry of National Defence (art. 27), Ministry of Agriculture and Rural Development (art.28), prefectures and the local municipalities (art 29). **Section 3** for the general public and businesses. Section 4 for the county and local emergencies committees. **Chapter IV** of this regulation specifies the prevention measures and preparedness for intervention, while chapter V stipulates operative measures for interventions in case of emergencies.

¹⁰² **BG:** The primary regulation (Water Act, Climate Change Limitation Act, etc.) does not contain an explicit definition of drought. Section 2.1.5. of the second cycle RBMPs defines “Drought - a natural phenomenon that occurs gradually rather than suddenly, unlike floods. From a meteorological point of view, drought is associated with dry periods of varying duration and degree. The primary measure of drought is the insufficient precipitation and the time of their fall, the distribution and intensity of this deficit in terms of existing reserves, water consumption, and use”. The National Disaster Protection Plan defines the drought as a “consequence of reduced rainfall over a long period of time. Often a number of meteorological elements such as high temperatures, strong winds and low relative humidity occur together with drought, which makes this phenomenon very pronounced.”. **CY:** Drought is an extreme meteo-climatic phenomenon, which may come unannounced and be of indefinite duration, being the result of the combined action of several parameters.”. **CZ:** hydrological drought as a fluctuation of the hydrological cycle, which arises mainly as a result of precipitation deficit and manifests itself in a decrease in flows in watercourses and groundwater levels. **EL:** “Natural occasional (random) temporary state of continuous decrease in rainfall and water availability relative to normal values, extending over a significant period of time and covering a wide area. It is due to natural causes.” (DMP EL08 Thessalia of 2014). **ES:** Drought: non-predictable natural phenomenon that occurs mainly due to a lack of precipitation resulting in a significant temporary decrease in the available water resources. Prolonged drought: drought caused by exceptional circumstances or circumstances that could not have been reasonably foreseen. These circumstances are identified by using indicators related to the lack of precipitation over a period of time and taking into account aspects such as intensity and duration. It will be defined, for each planning area, by the Drought Management Plans. **FR:** No official definition is clearly stated in legislation. However, structural water management and water allocations are based on the expected achievement of meeting monthly river flow and aquifer level management targets providing sufficient water for downstream users while ensuring the good functioning of aquatic ecosystems at least 8 years out of 10. De facto, drought management mechanisms are expected to be implemented to a maximum 2 years out of 10. **HU:** either by an index, or a number of days with a rainfall threshold in relation to temperatures. **IT:** “Drought can be defined in relation to the average balance conditions (over a long period) between rainfall and evapotranspiration in a given area, i.e. in relation to what is perceived to be a “normal condition”. Or, in a more articulated way, it can be defined as a natural and temporary condition of important reduction of rainfall and of important decrease of water availability compared to usual values

during a significant time period and over a large area; its effects can imply water scarcity for some activities (or areas or communities) and it is often associated to other climate factors that can worsen the severity (higher temperatures; stronger or more persistent winds; lower relative humidity; lower cloud coverage)“. **LV**: “a natural phenomenon when there are no precipitations observed for an extended period of time“. **MT**: „Drought represents relevant temporary decrease of the average water availability – important deviations from the average levels of natural water availability and is considered as a natural phenomenon“ (second cycle RBMP). **NL**: Drought is defined by the National Climate Adaptation Strategy 2016 as a shortage of rainfall of an order that may be expected to occur only once in ten years. (p. 8). Water shortage is (in a legal sense) "when the demand for water from various social and ecological needs exceeds the supply of water of a quality suitable for the various needs". **PL**: According to the Plan for Counteracting the Effects of Drought PPSS, “Drought is understood as: a natural phenomenon, caused by a long-term lack of precipitation, manifested by a periodic decrease in the level of surface water or groundwater, which may result in limitations of possibilities to use water, to access water services or the possibilities of agricultural or forestry production. Depending on its types, i.e. whether we are dealing with atmospheric or agricultural drought, hydrological or hydrogeological drought, it may lead to various effects in terms of use of water resources. The common denominator of the drought effects is the volume of available water resources intended for use and maintenance of the functioning of ecosystems“. **PT**: according to different alert levels determined for agrometeorological and hydrological droughts, combining different indicators (SPI, PDSI, dam storage, crop production). **RO**: Drought is a natural phenomenon resulting from a significant decrease in precipitation below the average level, producing major hydrological imbalances and negatively influencing production systems.

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https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WPI_con%20copertina_ec.pdf

¹⁰⁴ The draft national strategy for climate change adaptation to 2030 includes an indicator for regional plans for the management of risks regarding drought in risk areas. More information at: <https://www.lausuntopalvelu.fi/SV/Proposal/DownloadProposalAttachment?attachmentId=19435> (pages 55-56)

¹⁰⁵ IT has adopted an approach to drought management that does not include the elaboration of a DMP as such. However, in 2016 the Po River Basin Authority issued a Plan that includes several elements of a DMP. Since then that DMP-approach is dormant since IT decided to channel its drought management efforts through the so-called Permanent Observatories for water resources uses.

¹⁰⁶ There is one Drought Management Plan piloted in Sirppujoki Basin addressing the Eura and Pyhärinta municipalities. The plan is ready and the implementation is planned to be piloted in 2023. More information at: https://www.ely-keskus.fi/documents/10191/46616838/Sirppujoen+vesist%C3%B6alueen+kuivuusriskien+hallintasuunnitelma_KRHS_Sirppujoki_15122020.pdf/8f763aea-5046-6b3a-ad19-72b559dfcef8?t=1651245590970

¹⁰⁷ Drought contingency plans are in place or being prepared by most of the large water users (urban supply companies, irrigation facilities, hydropower producers), as determined under Section VI.5 of the National Plan

¹⁰⁸ Flemish Environmental Agency (2019): Action Plan Drought and Flooding 2019 – 2021 (*Actieplan Droogte en Wateroverlast 2019 – 2021*), VR 2019 0504 DOC.0552/2BIS. Accessible at: <https://www.vmm.be/water/droogte/actieplan-droogte-en-wateroverlast>

¹⁰⁹ Flemish Government (2020): Blue Deal. Accessible at: <https://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/blue-deal/wat-en-waarom-1>

¹¹⁰ for example, the Drought Strategy of the Province of Antwerp, [available at: https://www.provincieantwerpen.be/aanbod/dlm/dienst-integraal-waterbeleid/droogte.html](https://www.provincieantwerpen.be/aanbod/dlm/dienst-integraal-waterbeleid/droogte.html)

¹¹¹ Coordination Commission Integral Water Policy (ND): Blueprint for municipal rainwater and drought plans, available at: <https://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/hemelwater-en-droogteplannen>

¹¹² https://www.uvcw.be/no_index/files/6450-webinaire-secheresse-18-juin-2021.pdf; no further documents are available online

¹¹³ State of the Environment in Wallonia (2022) Schéma Régional des Ressources en Eau. Accessible at: http://etat.enviroennement.wallonie.be/contents/indicatorsheets/EAU_Focus_2.html

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https://umwelt.thueringen.de/fileadmin/001_TMUEN/Aktuelles/Topthemen/Trockenheit und Niedrigwasser/Thueringer_Niedrigwasserstrategie.pdf

¹¹⁵ <https://mluk.brandenburg.de/sixcms/media.php/9/Landesniedrigwasserkonzept-Brandenburg.pdf>

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[https://www.bestellen.bayern.de/application/eshop_app000004?SID=1341908590&ACTIONxSESSxSHOWPIC\(BILDxKEY:%27lfu_was_00124%27,BILDxCLASS:%27Artikel%27,BILDxTYPE:%27PDF%27\)](https://www.bestellen.bayern.de/application/eshop_app000004?SID=1341908590&ACTIONxSESSxSHOWPIC(BILDxKEY:%27lfu_was_00124%27,BILDxCLASS:%27Artikel%27,BILDxTYPE:%27PDF%27))

¹¹⁷ <https://www.umwelt.niedersachsen.de/startseite/themen/wasser/wasserversorgungskonzept-niedersachsen-210626.html>

- https://mwu.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MWU/Klimaschutz/00_Startseite_Klimawandel/220330_Dritter_Umsetzungsbericht_bf.pdf
- ¹¹⁹ <https://um.baden-wuerttemberg.de/de/umwelt-natur/wasser-und-boden/wasserversorgung/>
- ¹²⁰ https://www.berlin.de/sen/uvk/_assets/umwelt/wasser-und-geologie/europaeische-wasserrahmenrichtlinie/zwischenbericht_masterplan-wasser.pdf
- ¹²¹ https://umwelt.hessen.de/sites/umwelt.hessen.de/files/2022-02/entwurf_wasserwirtschaftlicher_fachplan_14-02-2022.pdf
- ¹²² https://www.lanuv.nrw.de/publikationen/infoblaetter-und-broschueren?tx_cartproducts_products%5Bproduct%5D=1038&cHash=87a832e7e288656186c5b8582d00c487
- ¹²³ <https://www.wasser.sachsen.de/konzeptionelle-planung-10224.html>
- ¹²⁴ draft, 06/08/2021, <https://www.bmu.de/en/topics/water-resources-waste/water-management/national-water-strategy>
- ¹²⁵ Water Directorate of Crete (2021), Drought & Water Scarcity Management Plan of the RBD EL13 Crete.
- ¹²⁶ <https://www.miteco.gob.es/es/agua/temas/observatorio-nacional-de-la-sequia/planificacion-gestion-sequias/>
- ¹²⁷ <https://www.vesi.fi/vesitieto/kuivuuteen-varautuminen-ja-kuivuusriskien-hallinta/>
- ¹²⁸ Gouvernement Français (2021). Décret no 2021-795 du 23 juin 2021 relatif à la gestion quantitative de la ressource en eau et à la gestion des situations de crise liées à la sécheresse
- ¹²⁹ Climate Change Adaptation Strategy in Croatia for the period until the year 2040 with a view to the year 2070 [Strategija prilagodbe klimatskim promjenama u Republici Hrvatskoj za razdoblje do 2040. godine s pogledom na 2070. godinu] (Official Gazette [Narodne Novine] Nos. 46/2020 Available at: https://mingor.gov.hr/UserDocsImages/klimatske_aktivnosti/klima/prilagodba/strat_prilagodbe_rh_2020.pdf
- ¹³⁰ Irish Water (2021) National Water Resources Plan - Framework Plan Technical Appendices: Appendix E Drought Planning. Available at <https://www.water.ie/projects/strategic-plans/national-water-resources/#:~:text=The%20NWRP%20is%20our%20plan,short%2C%20medium%20and%20long%20term>
- ¹³¹ <https://www.autoritadistrettoac.it/le-azioni-contratti-di-fiume/osservatorio-permanente>
- ¹³² see the map on p. 23 of *Deltaplan Zoetwater*
- ¹³³ Ministry of Agriculture and Rural Development, 2008. National Strategy and Action Plan/Plan of Measures for Mitigating the Effects of Drought and, Combating Land Degradation and Desertification on short-, medium-, and long-term. Available at: http://old.madr.ro/pages/strategie/strategie_antiseceata_update_09.05.2008.pdf
- ¹³⁴ Government of Romania (2007) National Strategy for reduction of the effects of droughts on short-, medium-, and long-term. Bucharest, Official Gazette no 565/2007. Available at: <https://legislatie.just.ro/Public/DetaliuDocument/84536>
- ¹³⁵ Ministry of Agriculture and Rural Development (2008) National Strategy and Action Plan/Plan of Measures for Mitigating the Effects of Drought and, Combating Land Degradation and Desertification on short-, medium-, and long-term. Available at: http://old.madr.ro/pages/strategie/strategie_antiseceata_update_09.05.2008.pdf
- ¹³⁶ Vattenmyndigheten Södra Östersjön (2022), Delåtgärdsprogram mot torka och vattenbrist 2022-2027 Södra Östersjön, Available at: <https://www.vattenmyndigheterna.se/tjanster/publikationer/2022/atgardsprogram/delatgardsprogram-mot-torka-och-vattenbrist-2022-2027-sodra-ostersjon.html>
- ¹³⁷ Vattenmyndigheten Södra Östersjön (2022), Delförvaltningsplan mot torka och vattenbrist 2022-2027 Södra Östersjön, Available at: <https://www.vattenmyndigheterna.se/tjanster/publikationer/2022/forvaltningsplan/delforvaltningsplan-mot-torka-och-vattenbrist-2022-2027-sodra-ostersjon.html>
- ¹³⁸ Gregorič G., Sušnik A., Tajnik T. (2014) Pot k boljšemu upravljanju s sušo. A Way to Better Drought Management in Slovenia. GWP SEE & ARSO (DMCSEE). Ljubljana, 2014. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiS97aAoIT3AhXwS_EDHXehB7AQFnoECAMQAQ&url=https%3A%2F%2Fwww.gwp.org%2Fglobalassets%2Fglobal%2Fgwp-cee_files%2Fidmp-cee%2Fidmp-ncd-brochure-slovenia.pdf&usq=AOvVaw0_JbKNGC_gN5MoVRHsajsX
- ¹³⁹ Krajnik M., Sušnik A., Gregorič G., Bokal S. (2015) *Suša in vodna direktiva*. Drought and EU WFD. GWP SEE & ARSO (DMCSEE). Ljubljana, 2015. Available at: <https://www.arso.gov.si/novice/datoteke/036393-Su%C5%A1a%20in%20Vodna%20direktiva.pdf>
- ¹⁴⁰ <https://www.gwp.org/en/GWP-CEE/WE-ACT/news/2020/danube-drought-strategy-now-ready/>
- ¹⁴¹ *Hodnota je Voda*, H2 Value is Water, Ministry of Environment website, <https://www.minzp.sk/files/sekcia-vod/hodnota-je-voda/h2odnota-je-voda/h2odnota-je-voda.pdf>
- ¹⁴² Supreme Control Authority, Report on the preparedness of Slovakia for droughts, December 2021, <https://www.nku.gov.sk/documents/10157/12622/Spr%C3%A1va++sucho/6f4cc8ce-eea0-489d-9f36-75e4382e5aaf>
- ¹⁴³ The concept includes a specific Objective 3.2 on Drought: Functional crisis management for periods of drought and water scarcity with the following Measures: a) evaluate the Action Plan for dealing with the consequences of drought and water shortage, b) develop decision-making schemes for the regulation of water

withdrawals and use with the option to limit the use of water in situations of water shortage and drought (semaphore for water withdrawals) following operational drought monitoring, c) reassess the security of water supplies for key customers, especially for critical infrastructure and prepare water security scenarios for it, including water transfers between basins and connections of water supply systems of regional and supra-regional importance, d) determine locations with water shortages based on the processed water balance in the context of new environmental priorities and goals, e) ensure the primary functions of existing water structures in view of the changing climate conditions and ensure the safe and reliable operation of their water management works reconstruction and modernization (for updated flood and extreme flows), f) modernize the existing water structures built to balance the uneven distribution of water in space and time; where it is efficient and technically possible, at the same time with modernization, implement measures to minimize negative impacts on the state of waters and biotopes, to complete the infrastructure enabling efficient water management – small retention and storage tanks, underground water tanks, etc., g) promote innovative and efficient methods of water management and reuse purified waste and technological water. Objective 9.2. Improve the scope and quality of water data collection includes a Measure: h) ensure effective monitoring of water shortages and drought as a basis for crisis management and setting the hierarchy of water use. In the Milestones section, it is also stated that 1.7. Legislative proposal for the introduction of prioritization of the claims of individual users to withdrawals and use of water (traffic lights - regulation of withdrawals and use of water in the case of shortage and/or drought) (objectives 3.1., 3.2) – to be carried out in 2024 from the state budget. More info at: <https://www.minzp.sk/files/sekcia-vod/koncepcia-vodnej-politiky/koncepcia-vodnej-politiky.pdf>

¹⁴⁴ <https://eagri.cz/public/web/mze/voda/planovani-v-oblasti-vod/x3-planovaci-obdobi/zverejnene-informace/narodni-plan-y-povodi-1.html>

¹⁴⁵ Ministry of the Environment (2022), *Meetmeprogrammi Lisa 1 Planeeritud meetmed 2022-2027* (Measure Plan Annex 1 Planned measures 2022-2027), <https://envir.ee/media/5912/download>

¹⁴⁶ Hungary's river basin management plan second review - II. Discussion material – 17 May 2021 (<https://vizeink.hu/vizgyujto-gazdalkodasi-terv-2019-2021/vgt3-vitaanyag/>) addresses the issues of climate change and related drought issues. The Background document 8-4 of the 3rd cycle RBMP deals with elaboration of possible methods for the prevention and reduction of damage caused by water scarcity (drought) and the development of action plans.

¹⁴⁷ The River Basin Management Plans are a legal annex to the National Water Programme 2022-2027. The WFD requires that river basin management plans be drawn up describing the water systems, targets and measures. (source <https://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/kaderrichtlijn-water/stroomgebiedbeheerplannen-2022-2027/>)

¹⁴⁸ There are several mentions of diminishing water quantity trends in the draft for consultation of the 3rd cycle RBMP (2022-2027) in relation to climate change, water use and ecological status. There is no definition of drought and no distinction is made between water scarcity and drought. Individual measures are described in paragraph 7.2.

¹⁴⁹ Drought was for the first time identified as a significant water management problem in the Water Plan of Slovakia for the years 2021 to 2027. In the chapter on Droughts, it refers to the H2 je voda action plan and the 2018 Climate Adaptation plan and briefly lists the preventive measures stemming from these documents. In addition, this chapter describes drought in Slovakia and evaluates their severity, but does not address drought event management.

¹⁵⁰ State of the Environment in Wallonia (2022), Schéma Régional des Ressources en Eau. Accessible at:

¹⁵¹ National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria, Adopted by a decision of the National Assembly on 21.11.2012. Available at: http://etat.environnement.wallonie.be/contents/indicatorsheets/EAU_Focus_2.html
<https://www.moew.government.bg/bg/nacionalna-strategiya-za-upravlenie-i-razvitie-na-vodniya-sektor-v-republika-bulgariya/>

¹⁵² The Government has approved seven regional water management plans and a marine management plan as part of its RBMP for 2022–2027.

¹⁵³ In the Water Management Strategy, drought is recognized as one of the risks. Water Management Strategy [*Strategija upravljanja vodama*] (Official Gazette [*Narodne Novine*] Nos. 91/2008) Available at: https://www.voda.hr/sites/default/files/dokumenti/strategija_upravljanja_vodama.pdf

¹⁵⁴ National Water Strategy (The *Jenő Kvassay* Plan) (<https://www.vizugy.hu/vizstrategia/documents/997966DE-9F6F-4624-91C5-3336153778D9/Nemzeti-Vizstrategia.pdf>)

¹⁵⁵ Government of Ireland (2021) Water Quality and Water Services Infrastructure - Climate Change Sectoral Adaptation Plan, Department of Housing, Local Government and Heritage. Available at <https://www.gov.ie/en/publication/f5710-water-quality-and-water-services-infrastructure-climate-change-sectoral-adaptation-plan/>. Document assessing risks of climate change concerning the water services sector. Many impacts mention risk of drought.

¹⁵⁶ The Final Report of the Policy table Droughts (Eindrapportage Beleidstafel Droogte) sets out 46 recommendations to make the Netherlands more drought-resistant. Most of the recommendations are part of the

Freshwater Delta Programme. The implementation of virtually all recommendations is on schedule or has been completed. The drafting of regional displacement series is an important action which is still in the completion phase. Policytable Droughts (2019) *Nederland beter weerbaar tegen droogte - Eindrapportage Beleidstafel Droogte*. Available at:

https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2019Z25564&did=2019D52599.

¹⁵⁷ The Program for counteracting water scarcity for the years 2022-2027 with a perspective until 2030 is planned to be adopted in 2022. <https://www.gov.pl/web/infrastruktura/program-przeciwdzialania-niedoborowi-wody>. The program seems to primarily focus on water storage, and according to the governmental website dedicated to this document, the effects of the program will be the following: **increasing the volume of the retained water**; increasing the capacity of small retention facilities; **mitigating the effects of drought with particular emphasis on rural and forest areas**; reducing the risk of floods, including those associated with the so-called flash floods in urbanized areas; restoration or improvement of conditions for the energy use of water; increasing the share of local and regional projects related to the creation of water retention; increasing **public awareness** of the problem of diminishing water resources and the need for their retention; improving the conditions of agricultural water use; enhancement of ecosystems created or maintained as a result of water retention; improvement of the class and stability of navigation conditions on inland waterways; improving the landscape value of water-related areas. The Program for counteracting water scarcity implements the action entitled "Development of the Program for Counteracting Water Scarcity" indicated under item No. 27 in the catalogue of measures of the PPSS. It is being developed on the basis of the "Assumptions to the Program for counteracting water scarcity on years 2021-2027 with a perspective to 2030", adopted by Resolution No. 92 of the Council of Ministers on 10 September 2019 (<https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WMP20190000941>).

¹⁵⁸ Regional Water Efficiency Plans for Alentejo (*Despacho n.º 444/2020, de 14 de janeiro*) and Algarve (*Despacho n.º 443/2020, de 14 de janeiro*), proposing a set of measures both on the supply and demand side, determining the budget and financing mechanisms (mainly under the National Resilience and Recovery Plan) for such measures, and predicting the water volume increase delivered by each measure.

¹⁵⁹ Åberg, A. (2017). 'Rapportering av regeringsuppdrag: Plan för kartläggning – SGUs plan för kartläggning 2018–2024' <http://resource.sgu.se/produkter/regeringsrapporter/2017/RR1710.pdf>.

¹⁶⁰ Ministry of environment and water (2014) National Climate Change Adaptation Strategy and Action Plan until 2030, Available at: <https://www.moew.government.bg/bg/adaptaciya-kum-izmenenieto-na-klimata-9299/>

¹⁶¹ The National Action Plan for Adaptation to Climate Change is an implementation document of the Strategy for Adaptation to Climate Change in the Conditions of the Czech Republic. The first update of the action plan for the period 2021-2025 was approved by Government Resolution No. 785 of 13 September 2021 https://www.mzp.cz/cz/narodni_akcni_plan_zmena_klimatu. The action plan is focused on addressing all major manifestations of climate change in the Czech Republic which includes prolonged drought periods. The Action Plan elaborates the framework of measures for the years 2021–2025 set out in the adaptation strategy into specific tasks, to which it assigns responsibilities, deadlines, the relevance of measures to individual impacts of climate change and sources of funding. The action plan contains 108 adaptation measures divided into 322 specific tasks, which are assigned to the relevant ministries, and specifies the deadlines for implementation, the relevance of the measures to individual manifestations of climate change, sources of funding and estimated costs by 2025.

¹⁶² Climate Programme 2020 - Denmark's Mid-century, Long-term Low Greenhouse Gas Emission Development Strategy. It was submitted under the Paris agreement and mentions the likelihood of increased drought frequency and its future risk. The Danish Government (2020). 'A Green and Sustainable World - The Danish Government's long-term strategy for global climate action'. Available at: https://um.dk/en/-/media/websites/umen/foreign-policy/global-climate-action-strategy/a_green_and_sustainable_world.ashx.

¹⁶³ Ministry of the Environment (2017), *Kliimamuutustega kohanemise arengukava aastani 2030* (Climate Change Adaptation Development Plan until 2030), <https://envir.ee/media/912/download> and Ministry of the Environment (2017), *Kliimamuutustega kohanemise arengukava rakendusplaan 2017-2020* (Implementation Plan of the Climate Change Adaptation Development Plan 2017-2020), <https://envir.ee/media/929/download>

¹⁶⁴ Ministry for Ecological Transition and the Demographic Challenge (2020) *Plan Nacional de Adaptación al Cambio Climático 2021 – 2030* - National Climate Change Adaptation Plan 2021 - 2030. Available at: https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/pnacc-2021-2030-en_tcm30-530300.pdf

¹⁶⁵ Finland's National Adaptation Strategy - an integral part of the National Energy and Climate Strategy. This strategy provides an overview of droughts, their risk and adaptation needs. However, it only briefly covers drought and is far from the strategy's focal point. Ministry of Agriculture and Forestry of Finland (2014). 'Finland's National Climate Change Adaptation Plan 2022'. Available at: https://mmm.fi/documents/1410837/0/Finland_s_National_climate_Change_Adaptation_Plan_2022+%281%29.pdf.

¹⁶⁶ The Climate Change Adaptation Strategy of the Republic of Croatia (CCAS) for the period until 2040 with a view to 2070 indicates the requirement of a drought management plan. A working version of the Strategy (Green Book) has been prepared and includes climate modelling results, analysis of climate change impacts and vulnerability for individual sectors as well as measures and activities for climate change adaptation. Climate Change Adaptation Strategy in Croatia for the period until the year 2040 with a view to the year 2070 [*Strategija prilagodbe klimatskim promjenama u Republici Hrvatskoj za razdoblje do 2040. godine s pogledom na 2070. godinu*] (Official Gazette [Narodne Novine] Nos. 46/2020 Available at: https://mingor.gov.hr/UserDocsImages/klimatske_aktivnosti/klima/prilagodba/strat_prilagodbe_rh_2020.pdf)

¹⁶⁷ Second National Climate Change Strategy (2018-2030, with a view to 2050) (available at: http://doc.hjegy.mhk.hu/2018413000023_1.PDF)

Adopted by the 23/2018. (X. 31.) Parliamentary Resolution on the second National Climate Change Strategy for the period 2018-2030, providing an outlook for the period up to 2050.

¹⁶⁸ Department of the Environment, Climate and Communications (2018) National Adaptation Framework: Planning for a Climate Resilient Ireland. Available at: <https://www.gov.ie/en/publication/fbe331-national-adaptation-framework/> This document references the risk of drought rather than the management of drought.

¹⁶⁹ 1) There is a **1999 “National Programme for the fight against drought and desertification”** derived from international commitments (UN Convention against Drought and Desertification, ratified by Italy through law n. 70 of June 4 1997) that, among other issues, recommends the “development of plans for the prevention, mitigation and adaptation in relation to the effects of drought events” (“*sviluppo di piani di prevenzione, mitigazione ed adattamento in relazione agli effetti di eventi di siccità*”) and the support to identify territories vulnerable to drought and desertification. The Program also lists a number of possible measures to foster sustainable water management. Reference: *Comitato interministeriale* (1999) *Comitato interministeriale per la programmazione economica. Deliberazione 21 dicembre 1999. Programma nazionale per la lotta alla siccità e alla desertificazione. (Deliberazione n. 299/99). (GU Serie Generale n.37 del 15-02-2000)* Available at: https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2000-02-15&atto.codiceRedazionale=000A1503&elenco30giorni=false 2) The **2014 National Strategy of Adaptation to Climate Change** mentions drought in several occasions and has a specific attachment on so-called “soft measures” related to water resources and referring explicitly to drought (*Allegato 3: Proposte d’azione - Azioni di tipo non strutturale o “soft”*). Reference: *SNAC (2014) Strategia Nazionale di Adattamento ai Cambiamenti Climatici. Ministero del Ambiente e della Tutela del mare.*

¹⁷⁰ Ministry of Environment (2018): National Climate Adaptation Plan 2018-2023, https://environnement.public.lu/content/dam/environnement/documents/klima_an_energie/Strategie-Adaptation-Changeement-climatique-Clean.pdf The Ministry of Environment, Climate and Sustainable Development has published the National Climate Adaptation Plan, where drought is listed as one of 6 main impacts of climate change in the sector/category on the water regime (*Régime hydrologique et gestion de l'eau*). In the plan, climate change is used as a significant indicator when judging the impacts of climate change on the biosphere. In the adaptation plan, drought is not discussed as an explicit risk.

¹⁷¹ Action 46 fixes that the Ministry for Resources and Rural Affairs shall bring together all the appropriate stakeholders so that a contingency plan for drought periods is prepared, with immediate effects. Int 4 informs that this activity is modified to develop an indicator set. Ministry for Resources and Rural Affairs (2012): National Adaptation Strategy. Available at: <https://environment.gov.mt/en/Documents/Downloads/maltaClimateChangeAdaptationStrategy/nationalAdaptationStrategy.pdf>

¹⁷² *Programa de Ação para a Adaptação às Alterações Climáticas* (P-3AC), which structures adaptation measures to be implemented up to 2030, based on direct intervention actions in the territory and its infrastructures, including water supply and water demand management. *Resolução do Conselho de Ministros n.º 130/2019, de 2 de agosto* <https://dre.pt/application/conteudo/123666112>

¹⁷³ Ministry of Environment (2013) National Strategy for Climate Change 2013 – 2020. Ministry of Environment, Water and Forests, 2013. Available at: <http://mmediu.ro/app/webroot/uploads/files/Strategia-Nationala-pe-Schimbari-Climatice-2013-2020.pdf>. Of relevance is also the following document: Better prepared for drought - Danube Drought Strategy (2019) – developed by the DriDanube project, financed by the Interreg Danube Transnational Programme (2017 – 2019). Slovenian Environmental Agency, 2019. Available at: <https://www.interreg-danube.eu/approved-projects/dridanube>

¹⁷⁴ Various regional water supply plans (regional vattenförsörjningsplan). These regions can decide how to distribute water themselves. Furthermore: Sweden's climate goals and climate policy framework (*Sveriges klimatmål och klimatpolitiska ramverk*; <https://www.klimatpolitiskaradet.se/en/det-klimatpolitiska-ramverket/>). The climate policy framework was agreed upon in 2017 and encompasses new climate goals, a Climate Act and the Swedish Climate Policy Council.

¹⁷⁵ The Resolution on the Slovenian climate long-term strategy 2050 (2021) recognizes drought as a long-term climate risk along with floods, wildfires and other natural hazards. Resolution on the Slovenian climate long-term strategy 2050 (2021) Pursuant to Article 109 of the Rules of Procedure of the National Assembly (Official

Gazette of the Republic of Slovenia [Uradni list RS], Nos. 92/07– official consolidated text, 105/10, 80/13, 38/17, 46/20 and 105/21 – Constitutional Court Decision), the National Assembly adopted at its session on 13 July 2021. Available at: <https://unfccc.int/documents/302702>

¹⁷⁶ 2018 Climate adaptation strategy, page 39, 45– measures for droughts. Droughts are only one of the issues listed as a consequence of climate change, it is not addressing them directly. The strategy mentions droughts as an issue and proposes several adaptation measures – e.g. Restoration of degraded wetlands (revitalization of peatlands, restoration of disturbed water regime, prevention of overgrowth of woody plants) and inundation areas, enabling natural dynamics of flows, ensuring repair and maintenance of drainage facilities of forest roads so as to prevent soil erosion. Several other water management measures are proposed – e.g. 1. Retain surface waters by technical or nature-friendly measures for their accumulation and retention. - 2. Ensure the protection and restoration of wetlands. EU biodiversity strategy. 3. Optimally adjust ecological flows so that, as far as possible, the ecological status of watercourses is maintained throughout the year, taking into account the qualitative and quantitative assumptions of the water body in allocating water for various uses in order to save water, through measures for more efficient water use. Adaptation strategy for climate change, Update 2018, available at: <https://www.minzp.sk/files/odbor-politiky-zmeny-klimy/strategia-adaptacie-sr-zmenu-klimy-aktualizacia.pdf>

¹⁷⁷ 1) Department of Environment and Spatial Development (2018) Strategic Vision of the Flemish Spatial Policy Plan. Available at: https://www.vlaanderen.be/publicaties/beleidsplan-ruimte-vlaanderen-strategische-visie-geïllustreerde-versie_2) Department of Agriculture and Fisheries (2018) Action plan water in agri- and horticulture 2019 - 2023. Available at: <https://www.vlaanderen.be/publicaties/actieplan-water-voor-land-en-tuinbouw-2019-2023> 3) Aquaflanders (2018)- Action plan drinking water. Available at: <https://www.aquaflanders.be/standpunten-en-publicaties/duurzaam-waterbeheer/actieplan-drinkwater> 4) Flemish Network of Undertakings (2020) Voka Charter of Sustainable Entrepreneurship. Available at: <https://www.voka.be/activiteiten/voka-charter-duurzaam-ondernemen>

¹⁷⁸ The draft CAP Strategic Plan (status 12/2021) includes actions relevant to addressing droughts in the agriculture and forestry sectors. [http://www.paa.gov.cy/moa/paa/paa.nsf/All/C4DA9AB0A2AD27B9C225857B00364F81/\\$file/CY%20STRATEGIC%20%20PLAN%20FINAL.pdf](http://www.paa.gov.cy/moa/paa/paa.nsf/All/C4DA9AB0A2AD27B9C225857B00364F81/$file/CY%20STRATEGIC%20%20PLAN%20FINAL.pdf)

¹⁷⁹ Ministry of Rural Affairs (2012), *Põllumajandussektoris kliimamuutuste leevendamise ja kliimamuutustega kohanemise tegevuskava 2012-2020* (Action Plan for Mitigating and Adaptation with Climate Change in Agricultural Sector 2012-2020), <https://www.agri.ee/sites/default/files/public/juurkataloog/ARENDUSTEGEVUS/kliimamuutused-tegevuskava-2012-2020.pdf>

¹⁸⁰ The draft CAP Strategic Plan (status 12/2021) includes actions relevant to addressing droughts in the agriculture and forestry sectors.

¹⁸¹ The CAP Strategic Plan will support investments into adaptation measures that strengthen the resilience of farms to drought impacts

¹⁸² The 2021 draft CAP Strategic Plan for Malta identifies drought as a threat and that “research is necessary to help producers consider switching to less climate-vulnerable production systems, e.g. moving from dairy cattle to buffalo or goat dairying; switching choice of vegetables to drought-tolerant species and varieties and moving into various forms of permanent cropping“ (page 40). A similar assessment is included in the National Agricultural Policy for the Maltese Islands 2018 – 2028, which includes (page 236) three measures for fostering irrigation efficiency, rainwater and runoff harvesting. 2021 Draft Common Agricultural Policy Strategic Plan – Malta, Version 1.0. Available at <https://eufunds.gov.mt/en/EU%20Funds%20Programmes/EU%20Territorial%20Programmes/Documents/CAP%20Strategic%20Plan%202021%20Draft.pdf>

¹⁸³ An action plan for climate change adaptation by the Swedish Board of Agriculture, which includes actions against drought (Markensten et al., 2022). There are sectorial action plans per authority.

¹⁸⁴ The draft CAP Strategic Plan for Slovenia recognizes drought as an important climate-related natural hazard and predicts several adaptation and mitigation measures for agriculture (*Ministrstvo za kmetijstvo, gozdarstvo in prehrano. Strateški načrt skupne kmetijske politike 2023–2027 za Slovenijo. Osnutek*. Strategic Common Agriculture Policy Plan for Slovenia 2023 – 2027. Draft. Available at: https://skp.si/wp-content/uploads/2021/12/Predlog_SN_SKP_22.12.2021_koncna_cista.pdf). The previous 2017 Plan for the Development of Irrigation and Water use for irrigation in Agriculture until 2023 and its Program of measures foresee the development of irrigation until 2023. However, very few measures were actually implemented. Available at: <https://www.gov.si/assets/ministrstva/MKGP/DOKUMENTI/KMETIJSTVO/Kmetijska-zemljisca/UPRAVLJANJE-KMETIJSKIH-ZEMLJISC/NacrtNavg2017-a.pdf>

¹⁸⁵ Slovakia CAP Strategic Plan for 2021-2027, available at: <https://www.mpsr.sk/aktualne/strategicky-plan-spp-2023-2027-odoslanie-na-ek/17516/> Droughts as an issue are acknowledged in the CAP SP for 2021-2027 and the Plan lists a few measures targeting irrigation in both farmland and outside. For example - Productive investment in expanding and building new irrigation infrastructure outside farm, Productive investments in

expanding and building new irrigation on farms, Investment in water retention measures outside farms, Productive investments in the reconstruction and modernization of existing irrigation infrastructure.

¹⁸⁶ 5th National Environmental Protection Program 2021-2026 – draft (<http://www.hermanottointezet.hu/nkp5skv>)

¹⁸⁷ The 2015 Strategic Plan for Environment and Development includes some “principles” which target water use efficiency, ecosystem restoration and other related areas, but does not foresee specific operational management of droughts.

¹⁸⁸ In 2021, the Walloon Recovery Plan has selected 4 pilot projects which are in line with the objectives of the three axes of the Strategy. They concern the reuse of water (treated water leaving the treatment plant) for agriculture and industry, the creation of decentralised water supply networks (supply of quality water adapted to the needs of a certain area, from local resources), the implementation of water storage and irrigation structures via rural land development and the improvement of the performance of public drinking water supply infrastructures (reduction of leaks in the drinking water distribution network).

¹⁸⁹ Cyprus Recovery and Resilience Plan (RRP) 2021-2026, (2.3 – Smart and Sustainable Water Management, page 168) [http://www.cyprus-tomorrow.gov.cy/cypresidency/kyprostoavrio.nsf/all/B37B4D3AC1DB73B6C22586DA00421E05/\\$file/Cyprus%20RRP%20For%20Upload%2020052021.pdf?openelement](http://www.cyprus-tomorrow.gov.cy/cypresidency/kyprostoavrio.nsf/all/B37B4D3AC1DB73B6C22586DA00421E05/$file/Cyprus%20RRP%20For%20Upload%2020052021.pdf?openelement) .

The RRP includes a number of water resources management measures of an estimated budget of €44 million that aim to improve infrastructure and water quality, improve water resource management efficiency and operational capacity of the competent authorities and ensure water adequacy and adaptation to climate change.

¹⁹⁰ Piano Nazionale di Ripresa e Resilienza: <https://www.italiadomani.gov.it/content/sogei-ng/it/it/home.html>

¹⁹¹ Piano Operativo per l’Ambiente: <https://www.mase.gov.it/pagina/piano-operativo-lambiente>

¹⁹² Coordination Commission Integral Water Policy (ND) Decision making framework for prioritising water use during drought and water scarcity. Available at: <https://www.vmm.be/water/projecten/afwegingskader-prioritair-watergebruik-tijdens-droogte>

¹⁹³ The National Disaster Protection Plan determines the procedure for coordination of the structures of the unified rescue system in case of large and complex forest fires caused by prolonged drought and high temperatures. National Disaster Protection Plan, adopted by the Decree of the Council of Ministers № 973 dated 29.12.2010. Available at: <https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=664>

¹⁹⁴ Drought Indicators - Drought Policy Management Plan including the Drought Management Diagram [http://www.moa.gov.cy/moa/wdd/Wdd.nsf/all/0470B8BDFE20E681C225835300402C1D/\\$file/DROUGHT%20MANAGEMENT_FINAL_%2011_6_2012_Corrected.pdf?openelement](http://www.moa.gov.cy/moa/wdd/Wdd.nsf/all/0470B8BDFE20E681C225835300402C1D/$file/DROUGHT%20MANAGEMENT_FINAL_%2011_6_2012_Corrected.pdf?openelement). Strategic Study for Water Management and Drought Management, November 2018. ([http://www.moa.gov.cy/moa/wdd/wdd.nsf/all/D075B511901214DAC225850D003E4200/\\$file/Stratigiki_Diaxisis_Ydaton_March_2019.pdf?openelement](http://www.moa.gov.cy/moa/wdd/wdd.nsf/all/D075B511901214DAC225850D003E4200/$file/Stratigiki_Diaxisis_Ydaton_March_2019.pdf?openelement))

¹⁹⁵ In the Disaster Risk Assessment for the Republic of Croatia, drought is recognized as one of the risks that will increase in the future. It also defines drought as a natural phenomenon of low precipitation and high temperatures. Disaster risk assessment for the Republic of Croatia (2019) [*Procjena rizika od katastrofa za Republiku Hrvatsku*] Main Working Group of Croatian Platform for lowering disaster risk [*Glavna radna skupina Hrvatske Platforme za smanjenje rizika od katastrofa*] Available at: https://civilnazastita.gov.hr/UserDocsImages/CIVILNA%20ZA%20C5%A0TITA/PDF_ZA%20WEB/Procjena_rizika%20od%20Okatastrofa_2019.pdf

¹⁹⁶ The Ministry of the Interior has a specific "Water" plan which defines a crisis plan in case of extreme droughts as part of its general civil security plan ORSEC

¹⁹⁷ National Civil Protection Plan, Cabinet of Ministers Order No 476, Riga, 26 August 2020 On the National Civil Protection Plan. <https://likumi.lv/ta/id/317006-par-valsts-civilas-aizsardzibas-planu>

¹⁹⁸ The National Crisis Management Plan (KPZK) is a planning document prepared by the Government Center for Security in cooperation with ministries, central offices and regions (voivodships), based on the Act on Crisis Management. <https://www.gov.pl/web/rcb/krajowy-plan-zarzadzania-kryzysowego>. Drought is indicated in this plan as one of the natural threats.

¹⁹⁹ National Action Program for Sustainable Land Management and Combating Desertification in the Republic of Bulgaria (update for the programming period 2014-2020), Ministry of environment and water, 2020. Available at: <https://www.moew.government.bg/bg/pochvi/strategicheski-dokumenti/>

²⁰⁰ The National Action Plan to Combat Desertification, endorsed via a Joint Ministerial Decision in 2001, is strongly related to drought phenomena. This plan outlines the main directions and measures to be implemented at national level to address the risks and impacts of desertification. However, the actions defined were not implemented and a National Committee to combat desertification which was set up in 2008 to monitor progress in implementing the UN Convention on Desertification is not active anymore (according to Tsantilas, C. (2021) Impact of climate change: The case of extreme drought events. Available at: https://www.enainstitute.org/wp-content/uploads/2021/02/ENA_Xirasia_03012021_UPD.pdf).

²⁰¹ National Civil Protection Plan, Cabinet of Ministers Order No 476, Riga, 26 August 2020 On the National Civil Protection Plan <https://likumi.lv/ta/id/317006-par-valsts-civilas-aizsardzibas-planu>

²⁰² Webpage on the RBMP 2022 – 2027 by the Flemish Coordination Committee Integrated Water Policy, available at: <https://www.integraalwaterbeleid.be/nl/stroomgebiedbeheerplannen/stroomgebiedbeheerplannen-2022-2027>

²⁰³ Coordination Commission Integral Water Policy (ND) Decision making framework for prioritising water use during drought and water scarcity. Available at: <https://www.vmm.be/water/projecten/afwegingskader-prioritair-watergebruik-tijdens-droogte>

²⁰⁴ adopted by a Decree of the National Assembly dated 21.11.2012, State Gazette No 96/6.12.2012, pursuant to Art. 151, para. 1 of the Water Act, <https://www.moew.government.bg/bg/nacionalna-strategiya-za-upravlennie-i-razvitie-na-vodniya-sektor-v-republika-bulgariya/>

²⁰⁵ adopted by the Decree of the Council of Ministers № 621 dated 25.10.2019, pursuant to Art. 9, para. 3 of the Climate Change Limitation Act, <https://www.moew.government.bg/bg/adaptaciya-kum-izmenenieto-na-klimata-9299/>

²⁰⁶ update for the programming period 2014-2020 , <https://www.moew.government.bg/bg/pochvi/strategicheski-dokumenti/>

²⁰⁷

[http://www.moa.gov.cy/moa/wdd/wdd.nsf/all/D075B511901214DAC225850D003E4200/\\$file/Stratigiki_Diaxiris_Ydaton_March_2019.pdf?openelement](http://www.moa.gov.cy/moa/wdd/wdd.nsf/all/D075B511901214DAC225850D003E4200/$file/Stratigiki_Diaxiris_Ydaton_March_2019.pdf?openelement)) approved by the Council of Ministers with the Ministerial Decision No. 87.608 and date 5/6/2019

²⁰⁸ <https://www.intersucho.cz/cz/?from=2022-03-14&to=2022-04-11¤t=2022-04-10>

²⁰⁹ In the Needs section P4.01 — Making agriculture more resilient to climate change – it is stated that “Climate change is accompanied, among other things, by a higher frequency of agrometeorological extremes with high economic losses (especially droughts, spring frosts) and an increase in average temperatures. In this context, a higher degree of vulnerability to the agricultural land fund is also expected by various types of degradation processes (in particular water and wind erosion). In order to avoid the most serious risks posed by climate change and in particular large-scale irreversible impacts, adaptation and resilience measures are needed.” Within P4.05 — Improve water protection functions of forest stands – the CSP recognizes the risk of extreme weather fluctuations, including torrential rainfalls and large floods, or longer droughts, as an increasing threat. In the SWOT chapter of the CSP, droughts are mentioned as a serious threat within the SO4 SO5, and SO9 sections. SO 5 – Promote sustainable development and efficient management of natural resources The Strategy to protect against the consequences of drought for the territory of the Czech Republic is referred to as responding to the occurrence of episodes of drought in the period 2014-2016 and it is listed in the SO5 relevant legislation. In addition, the strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030 responds to the ongoing changes in climate conditions as well as the long-term strategic challenges arising from the implementation of measures to mitigate the negative effects of drought and water scarcity approved by the government in July 2015. The national river basin management plans set objectives for the protection and improvement of the status of surface water and groundwater and aquatic ecosystems, for the reduction of the adverse effects of floods and droughts. <https://eagri.cz/public/web/mze/dotace/szp-pro-obdobi-2021-2027/zakladni-informace/navrh-strategickeho-planu-szp-odeslany-k.html>

²¹⁰ draft, 06/08/2021, <https://www.bmu.de/en/topics/water-resources-waste/water-management/national-water-strategy>

²¹¹

https://www.bbk.bund.de/SharedDocs/Downloads/DE/Risikomanagement/Risikoanalyse_2018_Duerre.pdf;jsessionid=6E539A07D9789A1B464E68948804B9A5.live132?__blob=publicationFile&v=3

²¹² Ministry of the Environment (2017), *Kliimamuutustega kohanemise arengukava aastani 2030* (Climate Change Adaptation Development Plan until 2030), <https://envir.ee/media/912/download>

²¹³ Ministry of Rural Affairs (2012), *Põllumajandussektoris kliimamuutuste leevendamise ja kliimamuutustega kohanemise tegevuskava 2012-2020* (Action Plan for Mitigating and Adaptation with Climate Change in Agricultural Sector 2012-2020), <https://www.agri.ee/sites/default/files/public/juurkataloog/ARENDUSTEGEVUS/kliimamuutused-tegevuskava-2012-2020.pdf>

²¹⁴ Ministry of the Environment (2012), *Looduskaitse arengukava 2012-2020* (Nature Protection Development Plan 2012-2020), <https://envir.ee/media/50/download>

²¹⁵ Ministry of the Environment (2012), *Looduskaitse arengukava rakendusplaan 2012-2020* (Implementation Plan of the Nature Protection Development Plan 2012-2020), <https://envir.ee/media/51/download>

²¹⁶ Ministry of the Environment (2022), *Meetmeprogramm 2022-2027* (Measure Plan 2022-2027), <https://envir.ee/media/5509/download>

²¹⁷ Ministry of Environment & Energy (2016). National Strategy for Climate Change Adaptation. Available at: https://ypen.gov.gr/wp-content/uploads/legacy/Files/Klimatiki%20Allagi/Prosarmogi/20160406_ESPKA_teliko.pdf

- ²¹⁸ 2e *Plan national d'adaptation au changement climatique*, adopted in 2018: <https://www.ecologie.gouv.fr/adaptation-france-au-changement-climatique>
- ²¹⁹ National Irrigation and Agricultural Land and Water Management Project [*Nacionalni projekt navodnjavanja i gospodarenja poljoprivrednim zemljištem i vodama*] Available at: <https://cdn.agroklub.com/upload/documents/napnav-2005.pdf>
- ²²⁰ Piemonte Region (2021). *Deliberazione della Giunta Regionale 22 dicembre 2021, n. 27-4395 - Attuazione del Piano regionale di Tutela delle Acque (PTA) di cui alla DCR n. 179-18293 del 2 novembre 2021. Approvazione delle Linee di indirizzo regionali per la gestione dinamica degli scenari di scarsità idrica*. Available at <https://www.legislazionetecnica.it/8230747/normativa-edilizia-appalti-professioni-tecniche-sicurezza-ambiente/deliberaz-gr-piemonte-22-12-2021-n-27-4395/pta-gestione-dinamica-scenari-scarsita-idrica>
- ²²¹ <https://www.autoritadistrettoac.it/pianificazione/pianificazione-distrettuale/pgdac/pgdac3-secondo-aggiornamento-adottato-dalla-cip-del-20122021>
- ²²² Sicilia Region (2020). *Piano regionale per la lotta alla siccità. Autorità di Bacino del Distretto Idrografico della Sicilia* Available at <https://www.regione.sicilia.it/istituzioni/regione/strutture-regionali/presidenza-regione/autorita-bacino-distretto-idrografico-sicilia/siti-tematici/pianificazione>
- ²²³ <https://www.deltaprogramma.nl/deltaprogramma/wat-is-het-deltaprogramma#:~:text=Deltaplannen%3A%20hierin%20staan%20concrete%20maatregelen,deltabeslissingen%2C%20voorkeursstrategie%3ABn%20en%20de%20deltaplannen>
- ²²⁴ <https://www.slimwatermanagement.nl/>
- ²²⁵ <http://44mpa.pl/miejskie-plany-adaptacji/>
- ²²⁶ https://eko.um.warszawa.pl/documents/63448/23542443/strategia_2030.pdf
- ²²⁷ established through the order no 9 from 6.01.2006. Available at: <https://legislatie.just.ro/Public/DetaliiDocumentAfis/70793>
- ²²⁸ <https://www.iksr.org/en/topics/low-water>
- ²²⁹ https://www.ccr-zkr.org/files/documents/workshops/wrshp261119/ien20_06en.pdf
- ²³⁰ Ministry for Ecological Transition and the Demographic Challenge (2018) *Instrucción técnica para la elaboración de los planes especiales de sequía y la definición del sistema global de indicadores de sequía prolongada y de escasez* - Technical Instruction for the elaboration of the Special Drought Plans and the definition of the Global System of Indicators of Prolonged Drought and Water Scarcity. Available at: https://www.miteco.gob.es/images/es/pp-orden-instruccion-tecnica-elaboracion-planes-especiales-sequia-nov2017_tcm30-434700.pdf
- ²³¹ Drought management plan to determine drought risk management actions and identification of water management measures to improve climate resilience (http://vizeink.hu/wp-content/uploads/2021/04/Aszaly_VGT3_2021.pdf)
- ²³² Irish Water (2021) National Water Resources Plan - Framework Plan Technical Appendices: Appendix E Drought Planning. Available at <https://www.water.ie/projects/strategic-plans/national-water-resources/#:~:text=The%20NWRP%20is%20our%20plan,short%2C%20medium%20and%20long%20term>
- Appendix E proposes steps for developing a tactical drought planning process for public water supplies.
- ²³³ Coordination Commission Integral Water Policy (ND): Blueprint for municipal rainwater and drought plans, available at: <https://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/hemelwater-en-droogteplannen>
- ²³⁴ Coordination Commission Integral Water Policy (ND) Decision making framework for prioritising water use during drought and water scarcity. Available at: <https://www.vmm.be/water/projecten/afwegingskader-prioritair-watergebruik-tijdens-droogte>
- ²³⁵ [Water scarcity and drought](#) coordination plan / roadmap
- ²³⁶ <https://eagri.cz/public/web/mze/voda/legislativa/metodicke-pokyny/zakon-o-vodach/metodika-k-priprave-planu-pro-zvladani.html>
- ²³⁷ https://www.miteco.gob.es/images/es/pp-orden-instruccion-tecnica-elaboracion-planes-especiales-sequia-nov2017_tcm30-434700.pdf
- ²³⁸ 1) Spanish Association of Water Supply and Sanitation, AEAS. 1st Commission on Drinking Water Collection and Treatment (2019) *Guía para la elaboración de planes de emergencia ante situaciones de sequía en sistemas de abastecimiento urbano* - Guidance for the development of emergency plans for drought situations in urban supply systems. Available at: https://www.aeas.es/images/Doc_Manua_Guia/GUIA_PARA_LA_ELABORACION_DE_PLANES_DE_EMERGENCIA-small.pdf; 2) Nuria Hernández-Mora, Jesús Vargas, Fundación Nueva Cultura del Agua (2018). *SeGuía-Guía metodológica para la elaboración participada de planes de gestión de riesgo por sequía en pequeñas y medianas poblaciones* - Methodological guide for the participatory development of drought risk management plans in small and medium-sized towns and villages. Available at: <https://fnca.eu/investigacion/proyectos-de-investigacion/seguia/guia-metodologica>
- ²³⁹ Parjanne, A. Ahopelto, L. and Parkkila, P. (2020). ‘Ohjeita kuivuusriskien hallintasuunnitelman laadintaan’, available at: <https://www.ymparisto.fi/download/noname/%7B1941224D-FF39-4E8B-AA6F-E9D58381C842%7D/164354>

²⁴⁰ Ministère de la Transition Écologique (MET) (2021). *Guide de mise en œuvre des mesures de restriction des usages de l'eau en période de sécheresse*. Available at : <https://www.gouvernement.fr/risques/secheresse>

²⁴¹ http://vizeink.hu/wp-content/uploads/2021/04/Aszaly_VGT3_2021.pdf

²⁴² ISPRA & IRSA-CNR (2018) *Linee guida sugli indicatori di siccità e scarsità idrica da utilizzare nelle attività degli Osservatori permanenti per gli utilizzi idrici*. Available at: https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WP1_con%20copertina_ec.pdf

²⁴³

http://eventi.utilitalia.it/download/Campagna_Acqua_rubinetto/GMA2020/NOTE%20TECNICHE%20SU%20CRISI%20IDRICHE%20SICCIT%C3%80%20E%20SERVIZIO%20IDRICO%20INTEGRATO%20WEB.pdf

²⁴⁴ Po River Basin Authority (2016): *Allegato 3 alla Relazione Generale- Piano per la gestione delle siccità e Direttiva Magre. Piano stralcio del Bilancio Idrico del Distretto Idrografico Padano Piano di Gestione del Distretto Idrografico del Fiume*. 06/12/2016. Available at: <https://pianobilancioidrico.adbpo.it/piano-del-bilancio-idrico/>

²⁴⁵ <https://www.infomil.nl/onderwerpen/lucht-water/handboek-water/thema-s/watertekort/verdringingsreeks/>

²⁴⁶ Vattenmyndigheterna (2022). 'Torka och vattenbrist - förslag till fortsatt arbete' ('Drought and water scarcity - suggestions for continued work'). Available at: <https://www.vattenmyndigheterna.se/download/18.3d03f2b3180029a416945720/1651500899210/Torka%20och%20vattenbrist%20-%20F%C3%B6rslag%20till%20fortsatt%20arbete%202022-1.pdf>

²⁴⁷ 1) "Pot k boljsemu upravljanju s sušo" (A Way to Better Drought Management in Slovenia) (2014) gives a short overview of current state of drought management in Slovenia, lists few examples of good practice of drought management in the world and provides suggestions for preparation of national drought management strategy. 2) "Suša in vodna direktiva" (Drought and EU Water Framework Directive) (2015) was prepared following Global Water Partnership's Guidelines for preparation of the Drought Management Plans (GWP, 2015) and addresses drought management at national level as a base for implementation of EU Water Framework Directive. The document also gathers general information on national drought management policy for each of the steps of preparation of DMPs described in GWP's Guidelines. References: Krajnik M., Sušnik A., Gregorič G., Bokal S. (2015) *Suša in vodna direktiva*. Drought and EU WFD. GWP SEE & ARSO (DMCSEE). Ljubljana, 2015. Available at: <https://www.arso.gov.si/novice/datoteke/036393-Su%C5%A1a%20in%20Vodna%20direktiva.pdf> Gregorič G., Sušnik A., Tajnik T. (2014) *Pot k boljsemu upravljanju s sušo*. A Way to Better Drought Management in Slovenia. GWP SEE & ARSO (DMCSEE). Ljubljana, 2014. Available at:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiS97aAoIT3AhXwS EDHXehB7AQFnoECAMQAO&url=https%3A%2F%2Fwww.gwp.org%2Fglobalassets%2Fglobal%2Fgwp-see_files%2Fidmp-see%2Fidmp-ncd-brochure-slovenia.pdf&usq=AOvVaw0_JbKNGC_gN5MoVRHsajsX

²⁴⁸ §108 of the Water Act (3) Ministry of the Environment exercises the powers of the Central Water Authority in matters of q) managing drought and water scarcity together with the Ministry of Agriculture

²⁴⁹ Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

²⁵⁰ Ministry of Environment and Energy

²⁵¹ Ministry for Ecological Transition and the Demographic Challenge (MITERD) through the General Directorate for Water (DGA)

²⁵² Drought Policy is highly decentralized to the Regions, the two autonomous provinces of Trento and Bolzano and the RBD Authorities. However, the national Ministry responsible for water management and the environment and for the implementation of the EU Water Framework Directive, the Italian Ministry for the Environment and Energy Security (MASE, former MiTE - *Ministero della Transizione Ecologica*) coordinates and homogenizes efforts in this field.

²⁵³ Ministry of Environmental Protection and Regional Development

²⁵⁴ The Ministry for The Environment, Energy and Enterprise is responsible for water policy, climate policy and water services

<https://www.gov.mt/en/Government/Government%20of%20Malta/Ministries%20and%20Entities/Pages/Ministries%202022/Environment.aspx>

²⁵⁵ Swedish Environmental Protection Agency

²⁵⁶ Activities and measures for the management of drought and water scarcity are divided into preparatory (implemented in the period outside a drought period), implemented during a drought, in the event of a water scarcity and after the shortage period has passed. Planning is shared by both Ministries and the Methodology for drought management describes in detail the planning responsibilities of both ministries as well as regional authorities and the Meteorological Institute and other national/regional bodies such as the Police and Fire brigade services.

²⁵⁷ During the period when the water scarcity is declared, the competent authorities are: a) regional drought commissions in cooperation with water authorities, (b) the Central Drought Commission. The superior administrative body of the Regional Drought Commission and the Central Drought Commission is the Ministry

of Agriculture or the Ministry of the Environment within the scope of competence provided for in the Water Act. The Central Drought Commission is set up by the government, which also approves its statute. Central Drought Commission is chaired by the Minister of Agriculture or the Minister of the Environment.

²⁵⁸ Ministry of Agriculture, Rural Development and Environment (Water Development Department, responsible for 5 of 6 hydrological drought indicators; Department of Meteorology responsible for SPI index; Geological Survey Department gathering data on groundwater resources)

²⁵⁹ MITERD-DGA <https://www.miteco.gob.es/es/agua/temas/observatorio-nacional-de-la-sequia/informes-mapas-seguimiento/>

²⁶⁰ The Ministry for the Environment (Naturvårdsverket) is an important producer of various data, information and knowledge *Klimatanpassning i samhällsplaneringen* (naturvardsverket.se)

²⁶¹ The policy lead on drought management in Finland is at the ministry of Agriculture and Forestry.

²⁶² *Jordbruksverket* (2022), *Torka*, Accessed 14 December 2022: <https://jordbruksverket.se/om-jordbruksverket/krisberedskap/torka>

²⁶³ Ministry of Agriculture and Forestry

²⁶⁴ Ministry of Agriculture, Rural Development and Environment (Water Development Department, responsible for 5 of 6 hydrological drought indicators; Department of Meteorology responsible for SPI index; Geological Survey Department gathering data on groundwater resources)

²⁶⁵ Federal Ministry for Digital and Transport responsible to ensure safe and smooth navigation on federal waterways and reliably calculable transport conditions, even in the event of frequent climate change-related extreme low-water periods

²⁶⁶ Ministry of Infrastructure and Water Management

²⁶⁷ Ministry of the Interior, which develops nationwide general drought policy through its background institution OVF (General Directorate of Water Management).

²⁶⁸ Swedish Agency for Marine and Water Management; *Vattenmyndigheterna* (2022), *Om vattenmyndigheterna*, Accessed 14 December 2022: <https://www.vattenmyndigheterna.se/om-vattenmyndigheterna.html>

²⁶⁹ 1) Department of Housing, Local Government and Heritage; Office of public works. 2) Environmental Protection Agency

²⁷⁰ River Basin District Observatories

²⁷¹ Administration de la gestion de l'eau

²⁷² Federal Waterways and Shipping Administration (WSV)

²⁷³ Ministry of Finances manages the relief funds

²⁷⁴ Ministry of Internal Affairs through the General Inspectorate for Emergency Situations who coordinates in an integrated way with other national entities the interventions in case of droughts events and the evaluation of post events.

²⁷⁵ Royal Meteorological Institute (IRM)

²⁷⁶ §87i of Water Act: The Drought Forecast Service informs the Drought Authorities about the risk of drought and its further development. This service is provided by the Czech Hydrometeorological Institute in cooperation with river basin managers.

²⁷⁷ *Office Français pour la Biodiversité* – national observatory of low flows (*Observatoire national des étiages*, i.e. ONDE). *Direction Régionale de l'Environnement, de l'Aménagement et du Logement* (DREAL): records water flows and manages banque HYDRO

²⁷⁸ The Ministry of the Interior through its General Water Management Directorate (OVF) and 12 regional water management organizations (regional Water Directorates - VIZIG) runs a national drought monitoring network, called Operational Water Scarcity Assessment and Forecasting System. Details are available at (<http://aszalymonitoring.vizugy.hu/index.php?view=pattern>) or <https://vizhiany.vizugy.hu/>

²⁷⁹ ISPRA (<https://www.isprambiente.gov.it/it>) and IRSA-CNR (<https://www.irsa.cnr.it/wp/>) have defined guidelines for the calculation of indicators of drought and water scarcity to be used in the activities of the RBD Permanent Observatories for water resource uses. *The Istituto Superiore per la Ricerca e la Protezione Ambientale* (ISPRA) is the reference agency at the national level for scientific and technical support on hydrology and hydrogeology and for water resources management. ISPRA is also in charge of reporting to the European Commission for the WFD and other Directives and collects, among others, information about the status of ecosystems, water resource availability, and drought impacts (https://www.isprambiente.gov.it/pre_meteo/idro/idro.html). Officially, ISPRA tasks in relation to water resources management and the assessment of drought and water scarcity include the characterization of basins and analysis of pressures; monitoring, data validation, analysis and aggregation into appropriate estimates and indicators; weather forecasting, through the Hydro-Meteo-Marine Forecasting System (SIMM) and the identification of measures and interventions and evaluation of their effectiveness. In this context, ISPRA coordinates the National Board for Operational Hydrological Services (Tavolo Nazionale per i Servizi di Idrologia Operativa) and contributes to the works of other technical boards of the SNPA-the National System for

Environmental Protection. In the context of WFD, also IRSA-CNR implements and develops methods (<http://www.vb.irsacnr.it/wfd-en>).

²⁸⁰ Many different ministries in Sweden produce data and knowledge within their area of responsibility, e.g. SGU <https://www.sgu.se/grundvatten/paverkan-grundvatten/>, SMHI <https://www.smhi.se/kunskapsbanken/hydrologi/torka/torka-1.111075>, MSB, FHM, SLV etc

²⁸¹ In the framework of WFD, drought management is led by the RBA with the support of all the authorities and agencies, from local to national levels, that are members of the RBD Permanent Observatories for water resource uses, as competence over hydro-meteorological monitoring and water management is scattered, with a central role of the 19 Regions and the two Autonomous Provinces of Trento and Bolzano. The other national authorities that are involved in the RBD Permanent Observatories for drought management are the Department of Civil Protection, ISPRA, IRSA-CNR, Istat, CREA and several national ministries. Also, water utilities, and hydropower companies participate in the RBD Permanent Observatories.

²⁸² Regional departments of APA are responsible to apply the measures in articulation with the main users.

²⁸³ Data about drought monitoring are also collected, reported and analysed at RBD level through the RBD Permanent Observatories for water resource uses; each RBA publishes in their official website a water scarcity and drought monitoring bulletin that reports the results of the analysis conducted by the Observatory, including the magnitude of the water shortage. Bulletins also show data sources. In addition, RBD Permanent Observatories provided to ISPRA a summary of the bulletin results and the magnitude of the water shortage at RBD level, which are collected at the national scale and published online: https://www.isprambiente.gov.it/pre_meteo/idro/SeverIdrica.html.

²⁸⁴ The Ministry for Environment, Nature and Agriculture (Departement Omgeving) of Flanders is responsible for the preparation of environmental policy, including drought.

²⁸⁵ Ministry for the Environment, Nature, Forestry, Rurality and Animal Welfare

²⁸⁶ The Flanders Environment Agency (Vlaamse Milieumaatschappij) is responsible for planning and execution of environmental policy, including drought policy.

²⁸⁷ Including Service Public Wallon, Société wallonne des eaux, Société publique de gestion des eaux and AQUAWAL

²⁸⁸ Please note that RBAs in inter-regional basins are autonomous organizations under the national ministry MITERD, while in intra-regional basins (e.g. Galicia, Andalusia, Catalonia) they are regional departments (water agencies, environmental departments ...)

²⁸⁹ The County Administrative Board, which can, e.g., take decisions on water protection areas, conduct monitoring, and develop regional water supply plans.

²⁹⁰ The **Environment Department** prepares the Flemish Climate Adaptation Plan, is in charge of environmental spatial planning (including integration of water in spatial plans), is in charge of monitoring and enforcement regarding undertakings with an environmental permit (Class 1), supports integration of ecology in infrastructure and supports and supervises municipalities in various water-related activities. The **Coordination Commission Integral Water Policy** (*Coördinatiecommissie Integraal Waterbeleid*, “CIW”) is called the ‘drought coordinator’ in Flanders, and serves as a platform for coordination on water policy, including drought policy, across the different departments and levels of government with competencies related to water systems, including the environmental and agricultural ministries, agencies, organisations managing water infrastructure and local levels of government. The CIW’s role as drought coordinator follows from Article 6 of the Executive Decision regarding the Decree of 18 July 2003 on Integral Water Policy. The CIW is responsible for ensuring integrated water policy and water management in Flanders. The CIW’s role is illustrated by the process to prepare the Flemish RBMP, of which a draft is first prepared and approved by the CIW, before it is submitted to the Flemish government. CIW subsequently has coordination responsibilities in the execution of the drought management plan as contained in the RBMP. The **Flanders Environment Agency** (*Vlaamse Milieumaatschappij*) is responsible for groundwater and unnavigable waterways. It furthermore presides the Coordination Commission Integral Water Policy. Further agencies have minor relevance regarding water-related drought aspects.

²⁹¹ Ministry for Climate, Energy, Mobility and Infrastructure

²⁹² The regional governor, as a special body of the region, establishes the regional drought commission and is its chairman. Other members of this commission are appointed by the regional governor from among the employees of the region included in the regional Office, relevant river basin managers, Czech Hydrometeorological Institute, Czech Police, the regional fire brigade and the regional hygienic station. If located in the territory where a regional waterway is used for transport, the regional governor appoints a member of the regional commission for drought and employees of the Ministry of Transport.

²⁹³ OVF (General Directorate of Water Management) and the 12 regional water management organizations, called VIZIG (regional Water Directorates) are the responsible organizations to implement the 12 general water scarcity/drought management plans, and 84 detailed plans (for each water scarcity/drought districts).

²⁹⁴ Data that are relevant to drought monitoring and management are scattered among several bodies in charge of collecting them as a result of decentralization in the 1990s. Thus, data are collected by regional and autonomous

provincial offices and by the Department of Civil Protection. Source: Utilitalia (no date) Note Tecniche su Crisi Idriche, Siccità e Servizio Idrico Integrato.

²⁹⁵ The regional authorities (*Länsstyrelserna*) perform most of the management and are important producers of regional data

²⁹⁶ Water Services Corporation is in charge of managing the Reverse Osmosis Desalination Plants, and has to activate an increase in production if water demand increases or the groundwater shall be restricted (salinisation, levels)

²⁹⁷ The municipalities have the responsibility over water resources within their territories, and can, e.g., make watering bans etc.

²⁹⁸ The National Technical University of Athens (NTUA) has been involved in this process by developing the main repository for hydrometeorological data (<http://www.hydroscope.gr/>) on behalf of the Greek government and has also recently developed the national integrated information infrastructure for the collection, management and free dissemination of hydrological and environmental information related to the country's surface water resources (<https://openhi.net/en/>). Both these public infrastructures are pivotal for any drought-related study or application.

²⁹⁹ Météo France: seasonal hydro-meteorological and soil moisture forecasts. BRGM: Groundwater levels state and forecast. Two national projects bringing together various research institutions and state authorities have been running: a) PREMHYCE: a national web platform providing operational tools to forecast river flows – mainly used in the regional state services DREAL; b) AQUI-FR: still ongoing, the project aims to develop forecasting models for groundwater resources

³⁰⁰ Citizen Drought Observatory <https://observasequia.es/>

³⁰¹ responsibility of Latvian Environmental Geology Meteorology Centre, local municipalities and landowners to implement remedial measures

³⁰² The Hungarian Meteorological Service collects meteorological data and through its web page provides daily drought index and assessment information (<https://www.met.hu/idojaras/agrometeorologia/aszalyinfo/>)

³⁰³ Realised by the 21 organizations (mainly governmental (17)) that form the Drought Working Group supporting the Permanent Commission; as well as EDIA – the public company in charge of managing the Alqueva system; ANMP – the national association of municipalities; APRH – a water resources professional association; APDA – the water drainage and distribution professional association

³⁰⁴ <https://xn--miljtilstand-yjb.nu/temaer/klimaforandringer/toerke-og-klimaforandringer/>

³⁰⁵ Special Water Secretariat (2017) Revised (2nd) River Basin Management Plan of the RBD EL08 Thessalia, Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL08_SDLAP_APPROVED.pdf

³⁰⁶ http://www.aemet.es/es/serviciosclimaticos/monitor_sequia_met

³⁰⁷ <https://spei.csic.es/index.html>

³⁰⁸

http://www.cedex.es/CEDEX/LANG_CASTELLANO/ORGANISMO/CENTYLAB/CEH/Documentos_Descargas/EvaluacionImpactoCCsequiasEspana2017.htm

³⁰⁹ <https://observasequia.es/>

³¹⁰

More

information:

<https://www.lausuntopalvelu.fi/SV/Proposal/DownloadProposalAttachment?attachmentId=19435> (pages 55-56)

³¹¹

<https://www.syke.fi/sv-FI>

and

[https://www.syke.fi/sv-FI/Aktuellt/Grundvattnen_sjunker_den_regnfattiga_oc\(61230\)](https://www.syke.fi/sv-FI/Aktuellt/Grundvattnen_sjunker_den_regnfattiga_oc(61230))

³¹² Policytable Droughts (2019) *Nederland beter weerbaar tegen droogte - Eindrapportage Beleidstafel Droogte*. Available at:

https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2019Z25564&did=2019D52599 page 24

³¹³

<https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20170001566/U/D20171566Lj.pdf>

<https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20170001566/U/D20171566Lj.pdf>

³¹⁴ *Havs- och Vattenmyndigheten* (2020), *Ansvar för vatten – vem gör vad?*, Available at:

<https://www.havochvatten.se/miljopaverkan-och-atgarder/miljopaverkan/vattenbrist/ansvar-for-vatten---vem-gor-vad.html>
<https://www.havochvatten.se/miljopaverkan-och-atgarder/miljopaverkan/vattenbrist/ansvar-for-vatten---vem-gor-vad.html>

³¹⁵ There is no coordination body for droughts in Slovenia. However, the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPDR) is a constituent body of the Ministry of Defence and performs administrative and professional protection, rescue and relief tasks as well as other tasks regarding protection against natural and other disasters. It coordinates the assessment of environmental impact after a drought event based on monitoring (by the Slovenian Environment Agency (ARSO)) and field assessment (by the Chamber of Agriculture) and coordinates drought damage financial aid procedure in line with the decision on the use of the funds.

³¹⁶ <https://www.integraalwaterbeleid.be/nl/over-ciw>

³¹⁷ National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria, Adopted by a decision of the National Assembly on 21.11.2012. Available at: <https://www.moew.government.bg/bg/nacionalna-strategiya-za-upravlenie-i-razvitie-na-vodniya-sektor-v-republika-bulgariya/>

³¹⁸ Rules of Procedure of the Ministry of Environment and Water, adopted by the Decree of the Council of Ministers № 208 dated 27.09.2017, State Gazette No 80/6.10.2017. Available at: <https://www.lex.bg/bg/laws/ldoc/2137177049>

³¹⁹ Water Directorate of Crete (2021), Drought & Water Scarcity Management Plan of the RBD EL13 Crete.

³²⁰ Real Decreto 500/2020 <https://www.boe.es/buscar/doc.php?id=BOE-A-2020-4814>

³²¹ <https://www.mapa.gob.es/es/prensa/ultimas-noticias/la-mesa-de-la-sequ%C3%ADa-crea-un-grupo-permanente-de-trabajo-para-el-seguimiento-del-impacto-de-la-escasez-de-agua-en-las-producciones-agrarias/tcm:30-614192>

³²² <https://mmm.fi/hanke2?tunnus=MMM042:00/2022>

³²³ See, for example, The Water Forum (2020) Despite the lifting of Ireland's second-ever Water Conservation Order following recent rainfall, the future for Ireland's drinking water resources remains uncertain. Available at: https://thewaterforum.ie/app/uploads/2020/07/An-F%C3%B3ram-Uisce_Communication-on-Irelands-Water-Resources_08072020_2.pdf.

³²⁴ https://www.isprambiente.gov.it/pre_meteo/idro/idro.html

³²⁵ https://www.isprambiente.gov.it/pre_meteo/idro/idro.html

³²⁶ Livsmedelsverket (2022), *Vattenförsörjningsgruppen*, Available at: <https://www.livsmedelsverket.se/om-oss/samarbeten-och-projekt/nationell-samordningsgrupp-for-dricksvatten/vattenforsorjningsgruppen/>

³²⁷ <https://www.svenskvatten.se/om-oss/in-english/>

³²⁸ In the federal states, together with water supply companies created community-related and regional/national water supply concepts are developed. Based on these concepts, various measures are taken to ensure water supply is implemented. For the long-term security of the water supply, the connection of existing supply units and the creation of redundancies in raw water sources are important measures to ensure natural fluctuations in annual precipitation. For short-term adjustment measures, a forecasting tool is applied. Drought phases and the resulting groundwater levels are detected early. Further measures in the area of drinking water supply are the reduction of water losses through maintenance of the existing infrastructure and the promotion of conscious use of water.

³²⁹ Including wildfire risk

³³⁰ Due to climate change, the low flow levels tend to decrease in the future with the need for irrigation. Several Länder have created guidelines for agricultural irrigation, in which specifications/criteria for the withdrawal from surface waters are defined. Storage ponds will be increased, advice to farmers increased and water-saving irrigation technology are funded by the Rural Development Program.

³³¹ Flanders draft RBMP 2022 – 2027, Chapter 4, p. 8, Available at: <https://www.volvanwater.be/documenten/beheerplan-vlaams-deel>

³³² Flanders draft RBMP 2022 – 2027, Chapter 4, p. 4, Available at: <https://www.volvanwater.be/documenten/beheerplan-vlaams-deel>

³³³ Flanders draft RBMP 2022 – 2027, Chapter 4, p. 6, Available at: <https://www.volvanwater.be/documenten/beheerplan-vlaams-deel>

³³⁴ Flemish Climate Adaptation Plan 2013 – 2020, available at: <https://omgeving.vlaanderen.be/vlaams-adaptatieplan-2013-2020>

³³⁵ Flemish Government, Blue Deal, available at the CIW's Blue Deal webpage: <https://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/blue-deal/wat-en-waarom-1>

³³⁶ Flanders draft RBMP 2022 – 2027 – Chapter 1, p. 6 and 7, available at: <https://omgeving.vlaanderen.be/vlaams-adaptatieplan-2013-2020>

³³⁷ Multifunctional land consolidation in Denmark 2020-2021. Its purpose includes allowing farmers a better farmland allocation parallel to considering e.g. the environment and climate: <https://water-drive.eu/multifunctional-land-consolidation-in-denmark-2020-2021/>

³³⁸ Following the 2018 drought, Denmark has developed a project called 'Crops for future climates – Improve roots, boost resilience, RadiBooster', which aims to develop and plant crops that are more resistant to droughts and thereby minimise farmers' economic losses. [https://pure.au.dk/portal/en/projects/crops-for-future-climates--improve-roots-boost-resilience-radibooster\(17d7edc0-6434-422b-8f39-44c1aed1df63\).html](https://pure.au.dk/portal/en/projects/crops-for-future-climates--improve-roots-boost-resilience-radibooster(17d7edc0-6434-422b-8f39-44c1aed1df63).html)

³³⁹ <https://www.eau-rhin-meuse.fr/un-plan-dadaptation-et-dattenuation-au-changement-climatique-pour-les-ressources-en-eau-du-bassin>

³⁴⁰ https://www.ecologie.gouv.fr/secheresse#scroll-nav_3

³⁴¹ The National Irrigation and Agricultural Land and Water Management Project [*Nacionalni projekt navodnjavanja i gospodarenja poljoprivrednim zemljištem i vodama*] Available at: <https://cdn.agroklub.com/upload/documents/napnav-2005.pdf>

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- ³⁴² Irish Water (2021) National Water Resources Plan - Framework Plan Technical Appendices: Appendix E Drought Planning. Available at <https://www.water.ie/projects/strategic-plans/national-water-resources/#:~:text=The%20NWRP%20is%20our%20plan,short%2C%20medium%20and%20long%20term>
- ³⁴³ Ministry of Infrastructure and Water management (2021) *Nationaal Deltaprogramma Zoetwater*. Available at: <https://www.deltaprogramma.nl/documenten/publicaties/2021/09/21/dp2022-d-deltaplan-zoetwater-2022-2027>
- ³⁴⁴ Policytable Droughts (2019) *Nederland beter weerbaar tegen droogte - Eindrapportage Beleidstafel Droogte*. Available at: https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2019Z25564&did=2019D52599
- ³⁴⁵ Ministry of Infrastructure and the Environment (2016) National Climate Adaptation Strategy 2016 (NAS). Available at: <https://klimaatadaptatienederland.nl/en/policy-programmes/nas/>
- ³⁴⁶ More information is available: <https://rr.sapo.pt/noticia/pais/2022/01/25/seca-ativados-planos-de-contingencia-nas-zonas-mais-afetadas/269754/>; https://apambiente.pt/sites/default/files/_Agua/DRH/OrgaosConsultivos/ComissaoPermanenteSeca/Reunioes/15_ReuniaoCPS_Resumo_22Jul2022.pdf (page 39); [https://www.gpp.pt/index.php/monitorizacao-da-seca/impacto-da-seca](https://www.gpp.pt/index.php/monitorizacao-da-seca/impacto-da-seca;); <https://www.ersar.pt/pt/site-comunicacao/site-noticias/Paginas/abastecimento-de-agua-com-normalidade-seca.aspx>; https://www.cm-sabugal.pt/wp-content/uploads/2022/07/Plano-de-contingencia_agua_Sabugal.pdf; <http://www.cm-tvedras.pt/prociv/plano-de-contingencia-para-situacoes-de-seca/>
- ³⁴⁷ <https://www.apambiente.pt/agua/reunioes>
- ³⁴⁸ <https://www.apambiente.pt/agua/grupo-de-trabalho>, available since 2016/2017
- ³⁴⁹ <https://www.apambiente.pt/agua/comissao-de-gestao-de-albufeiras>
- ³⁵⁰ *Klimatanpassning* (2021). ‘Jordbruk’. Available at: <https://www.klimatanpassning.se/hur-samhallet-paverkas/areella-naringar/jordbruk-1.21502>.
- ³⁵¹ Decree on criteria for determination and on the mode of monitoring and reporting of ecologically acceptable flow (2009) (Official Gazette of the Republic of Slovenia [Uradni list RS], Nos. 97/09) Available at: <http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED5122>
- ³⁵² There are no measures in RBMPs or other plans addressing drought directly. Still, there are measures that are aimed at avoiding overuse of water resources, mainly via re-calculating the quantity of available water resources and adjusting the permitted water use of different users accordingly. Related to surface water bodies, no overuse is mentioned, but for several water bodies measures aim at „maintaining ecological water level” – although in description these measures seem to be related to water quality only. Ministry of the Environment (2022), *Meetmeprogramm 2022-2027* (Measure Plan 2022-2027), <https://envir.ee/media/5509/download>
- ³⁵³ No specific drought relief and response measures were found in the DMP. Annexes 1-3 to the PPSS contain long lists of investments including primarily the construction or modernisation of water reservoirs, dams and weirs, and the regulation of rivers. On the other hand, Annex 4 to the PPSS includes a general description of groups of measures which will be undertaken in future, divided into the following types: formal measures, education, construction, change of use, retention. The description of these measures contains elements which could be relevant for relief and response, for example, renaturalization, green and blue infrastructures for retention, without indicating, however, concrete investments or activities. Formal type measures include the preparation of procedures for ensuring drinking water in situations when there are limitations. Educational measures include the preparation of good practices and educational material regarding, among others, economical use of water in agriculture, water reuse solutions, and monitoring of the use of water. In addition to the Ministry of Infrastructure, such measures shall be implemented by other institutions, in particular regional administration (*voivodes*), Department of Population Protection and Crisis Management of the Ministry of Interior and Administration, Government Center for Security.
- ³⁵⁴ Droughts can trigger limitations on activities in forests and other affected ecosystems as well as intensified monitoring of water quantity and quality in water bodies.
- ³⁵⁵ Specific ecosystem action is taking place for the small rivers and lagoons with protected species, partly by ex-situ conservation but also by improved monitoring.
- ³⁵⁶ Sofroniou, Anastasia & Steven Bishop (2020) Water Scarcity in Cyprus: A Review and Call for Integrated Policy. In: Tewodros Tena, editor. *Water: Ecology and Management*. Hyderabad, India: Vide Leaf.
- ³⁵⁷ <https://eau.gouvernement.lu/dam-assets/actualites/2020/documents/DOC-Flyer-DE-CKR-190507-1-0.pdf>
- ³⁵⁸ <https://njt.hu/jogszabaly/1995-57-00-00>
- ³⁵⁹ <https://njt.hu/jogszabaly/2019-113-00-00>
- ³⁶⁰ e.g., <https://www.isprambiente.gov.it/it/evidenza/ispra/no-homepage/analisi-e-valutazione-dello-stato-ambientale-del-lago-di-bracciano-riferito-all2019estate-2017>
- ³⁶¹ Sofroniou, Anastasia & Steven Bishop (2020) Water Scarcity in Cyprus: A Review and Call for Integrated Policy. In: Tewodros Tena, editor. *Water: Ecology and Management*. Hyderabad, India: Vide Leaf.
- ³⁶² The NWRP states that in the event of temporary restrictions, prioritisation will be taken into account based on categories of water use and categories of vulnerable people. But it does not establish what those categories would be and the order for them.

³⁶³ Water Law, Art.10

³⁶⁴ At the community level, based on §25 WHG

³⁶⁵ Art. 50 (4) of the Water Act, State Gazette No 67/27.07.1999. Available at: <https://www.lex.bg/laws/ldoc/2134673412> [in Bulgarian, consolidated version with all amendments]; <https://www.moew.government.bg/en/environmental-protection-act-7628/> [In English, consolidated version with amendments until 2021]

³⁶⁶ Under the Federal Water Act (WHG § 50 Abs. 1 in connection with § 6 Abs. 1 Nr. 4) the public water supply has a priority role. Beyond that, no further order is specified for other uses (including water needs for ecosystems) yet.

³⁶⁷ According to OECD, 2015. Available at: <https://www.oecd.org/denmark/Water-Resources-Allocation-Denmark.pdf>

³⁶⁸ Drinking water use has priority over all other water uses, both in terms of quantity and quality. This is set in Art. 10 of Law 3199 of 2003 on “Water Protection and Management-Harmonisation with the WFD”.

³⁶⁹ Water Law (<https://www.boe.es/buscar/act.php?id=BOE-A-2001-14276>): Article 60. Order of preference of uses.

³⁷⁰ Water Law <https://www.finlex.fi/en/laki/kaannokset/2011/en20110587.pdf> Section 5 page 19

³⁷¹ Act VLII of 1995 on Water Management (<https://njt.hu/jogszabaly/1995-57-00-00>)

³⁷² Legislative Decree 152, 2006 D.lgs. 3 aprile 2006, n. 152 Available at https://www.bosettiegatti.eu/info/norme/statali/2006_0152.htm Arts 167 and 168

³⁷³ Article 2.9 of the Water Act regulates the distribution of water in times of water shortage. The Water Decree provides the order of precedence in Article 2.

³⁷⁴ *Lei n.º 58/2005, de 29 de dezembro*, approving the Water Law and transposing the Water Framework Directive. <https://dre.pt/util/getdiplomas.asp?iddip=20053626>

³⁷⁵ CIW, ‘Playbook coordination water scarcity and drought, reactive pillar water scarcity and drought management’(NL), CIW 86/30.06.2021/pt.5.3, Annex 1

³⁷⁶ Methodology for the preparation of plans for managing drought and water scarcity, 2021, available at: https://www.mzp.cz/cz/zvladani_sucha_metodika

³⁷⁷ Allocation is based on drought indicators: meteorological drought indicators, hydrological water scarcity indicators, water quality related scarcity indicators, rough water availability for the drinking water sector, filling degree water wells. Indicators cover the whole area of Flanders, but some provinces use regional indicators.

³⁷⁸ The allocation of water from the Government Water Works is based on the annual water accounts, as estimated in March of each year (after the end of the hydrological year/rainy period).

³⁷⁹ The "allocation and reservation of resources for current and future uses and demands, as well as for the conservation and restoration of the natural environment" is one of the mandatory contents of the RBMPs (article 42 of the Water Law). The RBMPs produce balances for the current situation and future time frames with the support of rainfall-runoff models (SIMPA) and water resources management simulation models (AQUATOOL).

³⁸⁰ Thresholds for imposing restriction on water use are based on a set of indicators on river flows and aquifer level that takes into account minimum biological flows and target daily river flows/aquifer levels for maintaining these biological flows and water uses. Thus, it is based on an evaluation of water use.

³⁸¹ A national law (2004) establishes the need and the guidelines to calculate the water balance <https://www.ambientediritto.it/Legislazione/ACQUA/2004/dm%2028lug2004.htm>. In the Po RBD, there is a specific document called the Water Budget Plan (<https://pianobilancioidrico.adbpo.it/>) that was approved in 2016 and is currently under revision. “The Water Budget Plan is the cognitive, regulatory and technical-operational tool with which to plan and program the lines of intervention and actions necessary for the achievement and maintenance of a balance of the water budget. To this end, water use must take place on the basis of the physical, environmental and socio-economic characteristics of the Po River drainage district, respecting the principles of subsidiarity, economy and efficiency and effectiveness of the actions of the various public and private stakeholders. Reference: Po River Basin Authority (2016): *Piano stralcio del Bilancio Idrico del Distretto Idrografico Padano. Relazione Generale*. Available at: <https://pianobilancioidrico.adbpo.it/piano-del-bilancio-idrico/> page 6. The Eastern Alps RBD has just started some advanced projects aimed to build up both the surface water balance and the groundwater one. Both will perform evaluations on climate change effects. The outcomes of these studies may consist in the drafting of the water balance plan. At the national level, the evaluation of monthly hydrological water budget is instead performed by ISPRA by means of a GIS-based model, named BIGBANG (Braga et al., 2022, 2021, 2019; https://www.isprambiente.gov.it/pre_meteo/idro/BIGBANG_ISPRA.html). BIGBANG uses official hydro-meteorological data and hydraulic and hydro-geological layers to provide data and statistics useful to assess renewable freshwater resources availability and its distribution in space and time and to study the impact of climate change and anthropogenic pressures on water resources. These evaluations become crucial in water resources planning and management at basin scale and in populating indicators required in compliance with national and EU legislation. An ad hoc initiative under the Italian Environment Operational Plan (POA-Piano

Operativo Ambiente) promoted by the Ministry of Environment and Energy Security is ongoing to strengthen the estimation of the hydrological water budget components at both RBD and national scales.

³⁸² The plan for water restrictions and use during droughts is based on water balances and the most recent scenarios of water uses per sector e.g. population and livestock farming, aquaculture, industry, irrigation.

³⁸³ The allocation during drought includes changes for the ecological/environmental flows established in the RBMPs. In the DMP, environmental flows are defined according to the level of drought alert. In Chapter 6.4.3 Diagnosis of Drought Levels, pages 200-202, four drought levels are defined: "Mild", "Moderate", "High" and "Extremely High", based on the 12-month indicator for each catchment area. Table 6-64 presents the alert level and the actions recommended by the drought management plan.

The 2nd DMP emphasizes that water scarcity systems provide water not only for basic human needs (e.g. water supply) but to all other uses including environmental conservation. In case of drought, the withdrawals from the dams have as first priority the potable water supply, then the environmental conservation and then irrigation.

³⁸⁴ The lower crisis levels are set so as to maintain environmental flows. However, as set out nationally, ultimately priority is given to health-related issues, civil safety and drinking water. Thus, restrictions over water use may result in not prioritizing environmental flows when reaching the highest crisis levels.

³⁸⁵ A national decree from 2004 (Reference: <https://www.ambientediritto.it/LegislaZIONE/ACQUA/2004/dm%2028lug2004.htm>) defines how to calculate e-flows and possible derogations in specific situations: "7.5. Derogations, gradualness of application and controls. The Competent Authorities, after informing the Basin Authorities, may justifiably adopt exceptions to the e-flow for limited and defined periods of time by allowing the maintenance of flows in the riverbed below the e-flow exclusively in the following cases: - when there are supply needs for human consumption that cannot otherwise be met; - when there are supply needs for irrigation uses limited to areas characterized by significant imbalances in the water balance previously identified in the [regional water] Protection Plan; - upon the occurrence of water crisis situations declared pursuant to Article 5, paragraph 1, of Law No. 225 of February 24, 1992. Waivers are allowed provided that all possible water-saving, leakage-containment and waste-elimination strategies provided for in the Water Protection Plan have been adopted, that it has been demonstrated that it is impossible to identify other supply alternatives and that actions have been implemented to minimize the effects on human health and ecosystems. Waivers, however, must not jeopardize the quality objective of the water body set forth in the Protection Plan..." The decision about whether those conditions are met lies with the Region, and the actual authorization to decrease/alter releases from water infrastructure is issued by Provinces and Metropolitan Areas. The authorization will specify the conditions of the reductions and the recovery measures to be implemented once the reductions are not in place anymore,

³⁸⁶ Water Law, articles 60 and 61

³⁸⁷ 1) Water Planning Regulation (<https://www.boe.es/buscar/act.php?id=BOE-A-2007-13182>), article 18: 4. In the event of prolonged droughts, a less stringent flow regime may be applied provided that the conditions set out in Article 38 on the temporary deterioration of the status of water bodies are met. This derogation shall not apply to areas included in the Natura 2000 network or in the List of Wetlands of International Importance in accordance with the Ramsar Convention of 2 February 1971. In these areas, the maintenance of the ecological flow regime shall be considered a priority, although the rule on the supremacy of use for supplying populations shall apply. 2) Water Law, article 59: 7. Ecological flows (..) shall be considered as a restriction imposed in general on the exploitation systems. In any case, the rule on the supremacy of use for supplying populations shall also apply to ecological flows.

³⁸⁸ Water Law <https://www.finlex.fi/en/laki/kaannokset/2011/en20110587.pdf>

³⁸⁹ *Ministère de la Transition Écologique (MET) (2021). Guide de mise en œuvre des mesures de restriction des usages de l'eau en période de sécheresse*

³⁹⁰ Ministry of Infrastructure and Water management (2020) *Handleiding Verdringingsreeks*. Available at: https://www.infomil.nl/publish/pages/162770/handleiding_verdringingsreeks_-_versie_2020.pdf page 9

³⁹¹ <https://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/handboek-water/themas/watertekort/verdringingsreeks/>

³⁹² https://sniambgeoviewer.apambiente.pt/GeoDocs/geoportaldocs/APA/DL_76_2,016_Plano_Nacional_Agua.pdf

³⁹³ No explicit usage of indicators for drought. Usage of precipitation measurements is made with the index of the World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS) index. <https://www.meteolux.lu/fr/climat/station-meteo/?lang=fr>. This information can be paired with the up-to-date maps based on precipitation and vegetation indicators by the WHO, that give insights on the current development of Luxembourg's Land: <https://www.fao.org/giews/earthobservation/country/index.jsp?lang=fr&type=23&code=LUX#>

³⁹⁴ Selected stations only; this applies to all SK indicators

³⁹⁵ Available at the MS level on: https://annuario.isprambiente.it/sys_ind/989, updated yearly, and based on 3-month and 12-month SPI values.

³⁹⁶ For instance, in the Piedmont region an indicator for forecasting extreme wet and dry conditions is calculated by means of the 3-month SPI and published in the monthly hydrological bulletin.

³⁹⁷ Ahopelto, L., Parkkila, P. and Parjanne, A. (2020). *Sirppujoen vesistöalueen kuivuusriskien hallintasuunnitelma*. (Drought risk management plan for the Sirppujoki watershed). Available at: <https://www.ymparisto.fi/download/noname/%7B304405A7-F03C-4CA2-A163-E292ED3A2FF3%7D/164353>

³⁹⁸ The Drought Policy Table recommends that the Ministry of Infrastructure and Water Management develops a practical and regionally representative drought indicator: “Use the results of the NL Drought Survey and KNMI’s (Royal Netherlands Meteorological Institute) initiative for an indicator based on the Standardized Precipitation Index (SPI).” The “drought monitor” (*Droogtemonitor*) of *Rijkswaterstaat* uses the SPI to create the precipitation index for the Netherlands. <https://waterberichtgeving.rws.nl/owb/droogtemonitor>

³⁹⁹ According to the National Strategy and Action Plan/Plan of Measures for Mitigating the Effects of Drought and Combating Land degradation and Desertification on short-, medium-, and long-term (2008)

⁴⁰⁰ Applied to the 12 RBDs for which DMPs were developed in 2013/2014 and the most recently published DMP of Crete (2021) (in total 13 DMPs out of 14 RBDs, still pending for the RBD Aegean islands)

⁴⁰¹ The SPI with four temporal scales (3, 6, 12 and 24) is included in a national bulletin produced by ISPRA. The index is provided on a monthly base for Italy, Mediterranean Region, Europe and Adriatic-Danubian area using daily rainfall data with a 2.5° grid in the NCEP/DOE (National Centers for Environmental Prediction (NCEP)–U.S. Department of Energy (DOE)) reanalysis. The Guidance Document also recommends calculating them at the RBD level using observed data from the weather station network that is managed at regional or at provincial levels. This indicator is calculated by all the RBD Permanent Observatories using data collected by the local hydro-meteorological offices. Temporal scales adopted for the SPI calculation vary from RBD to RBD to consider the climate and the hydrological characteristics of the river basins. For instance, 1- and 3-month SPI are monthly calculated for the Po RBD and from 3- to 24-months for the Southern Apennine RBD, whereas SPI is monthly computed for 6 temporal scales (1, 3, 6, 9, 12 and 24) for the Central Apennine RBD and for 8 temporal scales (from 10 days to 365 days) for the Northern Apennine RBD.

⁴⁰² Territorial Drought Unit (Unidad Territorial de Sequía – UTS) to be defined in the DMPs, related to the zones and sub-zones of the water resource study of the RBMPs.

⁴⁰³ aSPI (Agricultural Standardized Precipitation Index) used in the most recent DMP of Crete (2021); Modification of the SPI index including in calculation active rainfall to record more actively plant-agricultural droughts

⁴⁰⁴ No exact reference has been found, but the Ministry of Environment does seem to calculate the drought index for Denmark, which is based on a water balance model that estimates the amount of water in the soil water reservoir that the plants have available each day.

⁴⁰⁵ The use of this indicator is recommended by the national Guidance Book, where it is stated that “due to the complexity of the calculation of this indicators, it does not seem feasible for each Permanent Observatory to calculate it independently. Due to this reason, it is recommended to use the maps of fAPAR already available online in the portal Copernicus Global Land Service. Reference: ISPRA & IRSA-CNR (2018) Linee guida sugli indicatori di siccità e scarsità idrica da utilizzare nelle attività degli Osservatori permanenti per gli utilizzi idrici. Available

at: https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WPI_con%20copertina_ec.pdf

⁴⁰⁶ Federal water ways: <https://www.pegelonline.wsv.de/gast/start>

⁴⁰⁷ Federal states, e.g. Bavaria: <https://www.nid.bayern.de>

⁴⁰⁸ Use of the index SRI was found in the DMP EL03 East Peloponnese, although it is not used in the DMPs of EL08 Thessalia and EL07 Sterea Ellada that were also checked. Not all 12 DMPs of Greek RBDs have been checked, so it is possible that the indicator SRI is used in other DMPs as well.

⁴⁰⁹ Used at RBD level for the activities of the Po RBD and Central Apennine RBD Observatories, and published in the corresponding bulletins.

⁴¹⁰ Territorial Drought Unit (UTS) as explained for the SPI. This is only used in ES010 Miño-Sil. However, other indexes based on runoff are used in other RBDs.

⁴¹¹ According to RBMPs

⁴¹² Danube and Rhine.

⁴¹³ All Spanish RBDs should provide WEI+ estimates since net consumption is considered to be significant in all of them. The spatial scale may vary (e.g., ES30-Tagus calculates it at the water body level) but at least a value for the RBD as a whole must be provided.

⁴¹⁴ Rex (to identify river basins in the RBD most vulnerable to water scarcity)

⁴¹⁵ For the national level, the following indicators are calculated and published on ISPRA website (see, e.g., https://www.isprambiente.gov.it/pre_meteo/idro/idro.html and links within the webpage) and/or on ISPRA environmental database (https://annuario.isprambiente.it/sys_ind/macro/3): Hydro-climatic balance (Bilancio Idro-climatico); Internal flow; Percentage of areas affected by deficit (drought) or surplus of precipitation; and Aridity index. Additionally, in the framework of an agreement with FAO, ISPRA and Istat provide SDG 6.4.2

“Level of Water Stress” at the national and RBD levels. In the framework of UNCCD, Italy plans to provide the drought indicators requested for Strategic Objective 3 (SO3) (SO3) “To mitigate, adapt to, and manage the effects of drought in order to enhance resilience of vulnerable populations”.

⁴¹⁶ According to RBMPs

⁴¹⁷ Dam Storage Index

⁴¹⁸ E.g. SFI-Standardized Flow Index, Standardized Continuous Dry Days Index – SCCDI, STI-Standardized Temperature Index, Snow Water Equivalent, SVI-Standardized Volume Index, Spring Anomaly Index (SAI); Standardized Snow Pack Index (SSAI)

⁴¹⁹ Drinking water supply indicator

⁴²⁰ Salinity Indicator: Mainly in the coastal area salinification of smaller and larger waterways are followed via automatic measurements.

⁴²¹ LDK CONSULTANTS ENGINEERS & PLANNERS S.A. and ECOS CONSULTING S.A. (2016) Revision of the Drought Management Plan. Available at:

[http://www.moa.gov.cy/moa/WDD/wfd.nsf/E59310DC9F385F1BC22583C50045545D/\\$file/Revision%20of%20the%20Drought%20Management%20Plan%20\(Oct%202016\).pdf](http://www.moa.gov.cy/moa/WDD/wfd.nsf/E59310DC9F385F1BC22583C50045545D/$file/Revision%20of%20the%20Drought%20Management%20Plan%20(Oct%202016).pdf)

⁴²² Environment and Resources Authority (N.D.): The 2nd Water Catchment Management Plan for the Malta Water Catchment District 2015 – 2021. Available at: <https://drive.google.com/file/d/1a50ui5yuv7RJjN-GpKK3DMIIQdklnF0b/view> page 117.

⁴²³ http://www.moa.gov.cy/moa/wdd/wdd.nsf/page27_gr/page27_gr?opendocument

⁴²⁴ <https://sig.mapama.gob.es/siga/>

⁴²⁵ <https://lsc.csic.es/es/products/>

⁴²⁶ <https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/seguimientoplanes.aspx>

⁴²⁷ http://www.aemet.es/es/serviciosclimaticos/prediccion_estacional

⁴²⁸ <https://monitoresequia.csic.es/historico/?lang=es#index=spei#months=1#week=4#month=11#year=2021>

⁴²⁹ <http://aszalymonitoring.vizugy.hu/index.php?view=info>

⁴³⁰ <https://e-books.hu/dokumentum/159742ce/napi-1%C3%A9pt%C3%A9k%C5%B1-asz%C3%A1lyindex-orsz%C3%A1gos-meteorol%C3%B3giai-szolg%C3%A1lat>

⁴³¹ ISPRA & IRSA-CNR (2018) *Linee guida sugli indicatori di siccità e scarsità idrica da utilizzare nelle attività degli Osservatori permanenti per gli utilizzi idrici*. Available at: https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%206WPI_con%20copertina_ec.pdf

⁴³² The use of this indicator is recommended by the national Guidance Book, where it is stated that “due to the complexity of the calculation of this indicators, it does not seem feasible for each Permanent Observatory to calculate it independently. Due to this reason, it is recommended to use the maps of fAPAR already available online in the portal Copernicus Global Land Service. Reference: ISPRA & IRSA-CNR (2018) *Linee guida sugli indicatori di siccità e scarsità idrica da utilizzare nelle attività degli Osservatori permanenti per gli utilizzi idrici*. Available at:

https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%206WPI_con%20copertina_ec.pdf

⁴³³ *Bolletino della Siccità* https://www.isprambiente.gov.it/pre_meteo/siccitas/

⁴³⁴ The indicators and their calculation are included in regulation. Order No. D1-870 of 11 November 2011 of the Minister of Environment of Lithuania on the Approval of Meteorological and Hydrological Hazard Indicators. (Newest edition: No. D1-344 of 9 June 2020) and Order No. V-80 of 25 November 2020 of the Director of Lithuanian Hydrometeorological Service under the Ministry of Environment on the Approval of Dangerous Meteorological and Hydrological phenomena indicators.

⁴³⁵ Environment and Resources Authority (N.D.): The 2nd Water Catchment Management Plan for the Malta Water Catchment District 2015 – 2021. Available at: <https://drive.google.com/file/d/1a50ui5yuv7RJjN-GpKK3DMIIQdklnF0b/view> page 117.

⁴³⁶ <https://www.alpine-space.org/projects/ado/en/home>

⁴³⁷ River Basin Management Plan chapter 11.1 regarding water quantitative aspects based on researches on climate change and hydrological droughts scenarios for 2010-2080

⁴³⁸ National Research and Development Institute for Pedology, Agrochemistry and Environmental Protection, research project "Research and studies on the rehabilitation of the main irrigation infrastructure belonging to the public domain of the state with an area of 823,000 ha economically viable (2015 - 2018)".

⁴³⁹ Regarding climate change assessment see: Monitoring Report 2019. https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/das_monitoringbericht_2019_barrierefrei.pdf, page 54

⁴⁴⁰ In ES10, 12-month cumulative normalized SRI is used as the variable determining the prolonged drought index. As such, it serves both for monitoring and operational decision making.

⁴⁴¹ It is used to estimate the level of significant pressure regarding water resources and vulnerability to the occurrence of water scarcity phenomena. It informs the DMP. (DMP 2016)

⁴⁴² The main use so far is to comply with WFD reporting. Spanish RBDs use water resources management models (AQUATOOL <https://aquatool.webs.upv.es/aqt/en/home/>) to establish detailed water balances, simulate scenarios and support decisions on water infrastructure and management.

⁴⁴³ Reporting to international organisations

⁴⁴⁴ The Prolonged drought index may integrate a variety of indicators such as SPI or SRI, under different accumulation periods. The index is normalized to bound its variation between 0 and 1 and a significant threshold is set at 0.3 as the determinant of a prolonged drought. The threshold should correspond to the impossibility of the natural regime to provide the ecological minimum flows established in the RBMP.

When the standardized indicator falls below the value of 0.3, the actions foreseen for situations of prolonged drought may be applied, provided that the rest of the legal conditions are met: less demanding ecological flows and justified admission of the temporary deterioration of the status or potential of the water bodies

⁴⁴⁵ Reconnaissance Drought Index (RDI)

⁴⁴⁶ Drought State Index for Reservoirs (DSIR)

⁴⁴⁷ **Wet Period Runoff Index:** forecasting, inform management/adaptation plans, triggering stepwise implementation of measures; allows early diagnosis of drought threat and defines the alert level (low, medium, high, very high) (DMP 2016). **Hydrological Year Runoff Index:** Monitoring, forecasting, inform management/adaptation plans, it is used complementary to the SPI and predicts runoff impacts. (DMP 2016). **Monthly Regime Index:** Monitoring, forecasting, inform management/adaptation plans, triggering stepwise implementation of measures, It determines the level of pressure on river ecosystems. Calculated only in cases where the Wet Period Runoff Index defines the alert level as at least “high”. This index is particularly important as it determines the Exception of Article 4 of the WFD. (DMP 2016). **Dam Storage Index:** Monitoring, inform management/adaptation plans, triggering stepwise implementation of measures, It provides an assessment of surface water storage to identify if available resources are sufficient. (DMP 2016). **Groundwater Bodies Monitoring Index:** Monitoring, inform management/adaptation plans, As regards actions for prevention and immediate response to water scarcity problems resulting from drought events, the usefulness of this indicator is limited due to the use of groundwater for irrigation and water supply and the slow response of aquifers to changes in rainfall. (DMP 2016)

⁴⁴⁸ Temporary Water Scarcity Index: Significant thresholds (normally pre-alert, alert, and emergency) are established by matching water stored with the volume of allocated demands and environmental needs in the coming months, under pessimistic inflow hypotheses (percentiles 1 to 5 or historical minimums of the hydrological series). The index is normalized to bound between 0 and 1 and significant threshold are set at 0.50 (pre-alert), 0.30 (alert) and 0.15 (emergency). Once the index falls below each threshold, specific measures are proposed (restrictions, extraordinary supplies...) designed to overcome extreme episodes.

⁴⁴⁹ Spring Anomaly Index (SAI); Standardized SnowPack Index (SSAI) SFI-Standardized Flow Index, Standardized Continuous Dry Days Index – SCCDI, STI-Standardized Temperature Index Snow Water Equivalent, SVI-Standardized Volume Index (non comprehensive list)

⁴⁵⁰ At the beginning of 2000 the competences for hydro-meteorological monitoring passed to the Regions and the two autonomous provinces of Trento and Bolzano. Before that date, hydro-meteorological data were collected at the national level by DSTN (a national authority now partially absorbed by ISPRA). Hence, historical data used for SPI and other indicators are both regional and national data.

⁴⁵¹ The KNMI (Royal Netherlands Meteorological Institute) uses the data of 13 stations in the Netherlands to monitor drought (<https://www.knmi.nl/kennis-en-datacentrum/achtergrond/achtergrondinformatie-neerslagtekort>)

⁴⁵² Usage of sub-seasonal predictions from ECWMF as well as seasonal and decadal predictions from DWD is planned. Phenological in-situ observations. Monthly data sets provided by the Global Precipitation Climatology Centre (GPCC)

⁴⁵³ Regional observational dataset and the regional JSBACH forcing data

⁴⁵⁴ Standardized Evaporation-Precipitation Index in the year 2020 presented, source of data: <https://spei.csic.es/index.html>

⁴⁵⁵ Usage of sub-seasonal predictions from ECWMF as well as seasonal and decadal predictions from DWD is planned. Monthly data sets provided by the Global Precipitation Climatology Centre (GPCC). NOAA's Climate Prediction Centre (CPC) Monthly Global Surface Air Temperature Data Set

⁴⁵⁶ Computed with the layer-2 soil moisture from the regional JSBACH simulation

⁴⁵⁷ Data from the hydrographical service <https://ehyd.gv.at/> and abstraction data were generated with data from water supply companies, community data, agricultural data, and evaporation data.

⁴⁵⁸ Water permit holders (annual water use reports)

⁴⁵⁹ Spanish RBDs include complete water resources assessment (hydrological series for all SWBs and quantitative balances for GWBs) as well as water demands assessment for the so-called “water demand units”. A variety of sources may be used depending on the RBD, combining statistical data with registered water rights,

metering, and other sources. It should be noted that a national rainfall-runoff model (SIMPA <https://www.miteco.gob.es/es/agua/temas/evaluacion-de-los-recursos-hidricos/evaluacion-recursos-hidricos-regimen-natural/>) provides spatially distributed estimates of all the hydrological cycle components.

⁴⁶⁰ Article 15(1) to 15(6) of the Water Protection and Management Law (3812 of 2004) is about temporary deterioration due to unforeseen events. This law (45 p.) harmonised the national legal framework of Cyprus with the WFD.

⁴⁶¹ Water Act §26 (5) - Programs of measures

⁴⁶² WFD Art 4(6) was transposed in Germany in the Federal Water Act § 31, Abs. 1, Nr. 1a. and Abs 2 and 3.

⁴⁶³ Presidential Decree 51/2007 that defines measures and procedures for integrated protection and management of water according to the WFD

⁴⁶⁴ Article R. 212-24 of the Environment Code provides those temporary alterations in the condition of water due to natural or accidental, exceptional or unforeseeable causes, are not taken into account in the evaluation of the achievement of the objectives set by the master plan development and water management (SDAGE). In accordance with this article, the basin coordinator prefect must inform the basin committee of these alterations and the measures taken to remedy them. These measures aim to: a) prevent any further deterioration in the status of the waters; b) restore the affected body of water as quickly as possible to the state it was in his; c) not jeopardize the achievement of objectives in other water bodies. During each update, the SDAGE must list these events and present a summary of the effects observed and the measures taken. In addition, a national guidance on exemptions was prepared, first in 2014 and then in 2020 for the third cycle: MEDDE (2020). *Guide méthodologique de justification des dérogations prévues par la directive cadre sur l'eau*. Cycle 3. <https://economie.eaufrance.fr/guide-methodologique-de-justification-des-derogations-prevues-par-la-directive-cadre-sur-leau-dce>

40pp, including one page on Art. 4.6 exemption

⁴⁶⁵ 221/2004. (VII. 21.) Government Decree on certain rules for river basin management <https://njt.hu/jogszabaly/2004-221-20-22> Art.8.

⁴⁶⁶ 2008 Water Law („Loi du 19 décembre 2008 relative à l'eau modifiant”, accessible online: <http://data.legilux.public.lu/eli/etat/leg/loi/2008/12/19/n17/jo>) which comprises 74 articles in different chapters across 40 pages. The regulation on the exemption is addressed in Art. 10. -Circonstances empêchant la réalisation des objectifs environnementaux.

⁴⁶⁷ Water Management Act, in force since 15.10.2002., <https://likumi.lv/ta/id/66885-udens-apsaimniekosanas-likums>

⁴⁶⁸ Water Policy Framework Regulations, 2015 (<http://extwprlegs1.fao.org/docs/pdf/mlt150946.pdf>). In addition, the following text has been included: “(d) the effects of the circumstances that are exceptional or that could not reasonably have been foreseen are reviewed annually and, subject to the reasons set out in sub-regulation” (page B3698)

⁴⁶⁹ Water Law Act Art. 65 (1)

⁴⁷⁰ N.º 2 and 3 of the article 51.º of the Law 58/2005, from 29 December

⁴⁷¹ Water Law no 107/ 1996 with its successive modification and updates

⁴⁷² Water Act 364/2004 § 16 (6) Setting environmental goals

⁴⁷³ Article 3 of the Decree on quality requirements and monitoring of water 2009

⁴⁷⁴ Finland’s water management is regulated by the Act on the Organisation of Water Management and Marine Management (272/2011), the Government Decree on the Organization of Water Management (1040/2006) and the Government Decree on Water Management Areas (1303/2004).

⁴⁷⁵ According to <https://www.irishstatutebook.ie/eli/2003/si/722/made/en/print>

⁴⁷⁶ Water Act [Zakon o vodama] (Official Gazette [Narodne Novine] Nos. 153/2009) Available at: http://narodne-novine.nn.hr/clanci/sluzbeni/2009_12_153_3744.html Articles 61, 62 and 65.

⁴⁷⁷ Water Law Art.56. <http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1244>

⁴⁷⁸ Article 1.7.2.5.3 of the Flemish Water Act. However, drought indicators are defined in the Water Scarcity and Drought Playbook, a comprehensive manual designed to ensure coordinated decision making and targeted response by all actors involved in case of situations of water scarcity and drought. The Flemish RBMP refers to the playbook for drought indicators (chapter 3 on targets and assessments). The Water Scarcity and Drought Playbook describes the set of indicators that are used to (i) describe the environmental status and are directly linked to drought; and (ii) relate to the impact of water scarcity and therefore are linked with the required reactive measures. The indicator framework works with threshold values for each indicator using four levels. The Coordination Commission Integral Water Policy is in charge of monitoring and following up on the indicators. Reference: CIW, ‘Playbook coordination water scarcity and drought, reactive pillar water scarcity and drought management’(NL), CIW 86/30.06.2021/pt.5.3, Annex 1

⁴⁷⁹ Art. 156e (p. 1-5) of the Water Act, State Gazette No 67/27.07.1999. Available at: <https://www.lex.bg/laws/ldoc/2134673412> [in Bulgarian, consolidated version with all amendments]; <https://www.moew.government.bg/en/environmental-protection-act-7628/> [In English, consolidated version with amendments until 2021]

⁴⁸⁰ Chapter 6, §20 (6) of the Water Planning Act (Lov om vandplanlægning): The Minister for the Environment and Food may, in rules issued pursuant to section 19, subsection 1, provide that authorities shall prevent and prevent further deterioration of the condition and, as far as possible, re-establish the original condition in the event of any temporary deterioration of the condition of a body of water due to circumstances of a natural nature, force majeure which is exceptional or could not reasonably have been foreseen, or circumstances resulting from an accident, including the implementation of all practicable steps and special measures.

⁴⁸¹ *Real Decreto 907/2007, de 6 de julio, por el que se aprueba el Reglamento de la Planificación Hidrológica. Arts 3 and 38.*

⁴⁸² Legislative Decree 152, 2006 D.lgs. 3 aprile 2006, n. 152 Available at https://www.bosettiegatti.eu/info/norme/statali/2006_0152.htm. In addition, Italy clarifies that the minor gap related to the point “measures to be taken under such exceptional circumstances are included in the programme of measures” of the RBMP (Art.4(6)c) is only in the literal transposition into Art. 77, 10th clause of the Legislative Decree 152/2006. However, the Italian transposition of the Art.4(6)c clearly refers to the fact that the measures need to be “previste”, which means that need to be defined in advance. Moreover, to overcome this minor gap in the literal transposition, in the act (“*Protocolli di Intesa*”) establishing the Permanent RBD Observatories (which are measures under the Programme of measures of RBMPs) the entire Art. 4.6 of WFD is cited in the legal premises, also including the reference to the Programme of measures.

⁴⁸³ According to the Water Law Art.56, the measures can be included in any document, not only/specifically in the RBMP

⁴⁸⁴ National water law: § 30f WRG 1959 Ereignisse unter außergewöhnlichen Umständen

⁴⁸⁵ Article 15(1) to 15(6) of the Water Protection and Management Law (3812 of 2004) is about temporary deterioration due to unforeseen events. This law (45 p.) harmonised the national legal framework of Cyprus with the WFD.

⁴⁸⁶ Water Act §26 (5) - Programs of measures

⁴⁸⁷ Water Act *Riigi Teataja*, §38-41, <https://www.riigiteataja.ee/en/eli/ee/501062022002/consolide/current>

⁴⁸⁸ Presidential Decree 51/2007 that defines measures and procedures for integrated protection and management of water according to the WFD

⁴⁸⁹ Article R. 212-24 of the Environment Code provides those temporary alterations in the condition of water due to natural or accidental, exceptional or unforeseeable causes, are not taken into account in the evaluation of the achievement of the objectives set by the master plan development and water management (SDAGE). In accordance with this article, the basin coordinator prefect must inform the basin committee of these alterations and the measures taken to remedy them. These measures aim to: a) prevent any further deterioration in the status of the waters; b) restore the affected body of water as quickly as possible to the state it was in his; c) not jeopardize the achievement of objectives in other water bodies. During each update, the SDAGE must list these events and present a summary of the effects observed and the measures taken. In addition, a national guidance on exemptions was prepared, first in 2014 and then in 2020 for the third cycle: MEDDE (2020). *Guide méthodologique de justification des dérogations prévues par la directive cadre sur l'eau. Cycle 3.* <https://economie.eaufrance.fr/guide-methodologique-de-justification-des-derogations-prevues-par-la-directive-cadre-sur-leau-dce>

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⁴⁹¹ 2008 Water Law („*Loi du 19 décembre 2008 relative à l'eau modifiant*”, accessible online: <http://data.legilux.public.lu/eli/etat/leg/loi/2008/12/19/n17/jo>) which comprises 74 articles in different chapters across 40 pages. The regulation on the exemption is addressed in Art. 10. -Circonstances empêchant la réalisation des objectifs environnementaux.

⁴⁹² Water Management Act, in force since 15.10.2002., <https://likumi.lv/ta/id/66885-udens-apsaimniekosanas-likums>

⁴⁹³ Water Policy Framework Regulations, 2015 (<http://extwprlegs1.fao.org/docs/pdf/mlt150946.pdf>). In addition, the following text has been included: “(d) the effects of the circumstances that are exceptional or that could not reasonably have been foreseen are reviewed annually and, subject to the reasons set out in sub-regulation” (page B3698)

⁴⁹⁴ Article 3 of the Decree on quality requirements and monitoring of water 2009

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⁴⁹⁶ N.º2 and 3 of the article 51.º of the Law 58/2005, from 29 December

⁴⁹⁷ Water Law no 107/ 1996 with its successive modification and updates

⁴⁹⁸ Water Act 364/2004 § 16 (6) Setting environmental goals

⁴⁹⁹ <https://www.apambiente.pt/node/1598>

⁵⁰⁰ *Plano Nacional da Água* (National Water Plan), which transposes the WFD, section 1.4.6 – *Mitigação de fenómenos meteorológicos extremos* (mitigation of extreme weather phenomena), 57 pages *Decreto-Lei 76/2016*,

<https://files.dre.pt/1s/2016/11/21500/0395104007.pdf> dated 9/11/2016, p.3962. Also included in the third cycle river basin management plan” (2022-2027).

⁵⁰¹ ŠHS (state hydrological network) and ŠMS (state meteorological network), publicly accessible on the SHMÚ website, as well as Drought assessment reports

⁵⁰² For example, irrigation allowance changes can take farmers up to 10-15 years, which is very problematic during dry periods.

⁵⁰³ This refers to hydro-meteorological data, water levels, and water abstraction for domestic/civil uses.

⁵⁰⁴ This refers to monitoring of water withdrawals especially for irrigation and industry and for groundwater (information is fragmented).

⁵⁰⁵ Advance monitoring - Soil drought - preliminary assessment of development for 10 days in advance, meteorological drought for 7 days (Monday), hydrological regime - expected development in selected stations for 24 hours in advance

⁵⁰⁶ The drought management in agriculture is more mature than across other sectors. One of the possible reasons is the stakeholders that are more involved in policy and planning.

⁵⁰⁷ Set up of SPI indicator

⁵⁰⁸ Improved spatial resolution and accessibility are planned for agriculture.

⁵⁰⁹ The extended temporal forecast and projections for future scenarios are foreseen for all sectors.

⁵¹⁰ For instance, some of the forecast tools already developed and in the process of being adopted (e.g. INOPIA, SIDIAS) aim at adding information on exposure and/or vulnerability/future scenarios.

⁵¹¹ Drought bulletins from the RBD Observatories, as well as the products from ISPRA, support the engagements of media and dissemination.

⁵¹² <https://www.brs.dk/da/borger/forebyg-brand/brandfare.dk/>

⁵¹³ ISPRA & IRSA-CNR (2018) Linee guida sugli indicatori di siccità e scarsità idrica da utilizzare nelle attività degli Osservatori permanenti per gli utilizzi idrici. Available at: https://www.isprambiente.gov.it/pre_meteo/idro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WP1_con%20copertina_ec.pdf

⁵¹⁴ <https://sdage-sage.eau-loire-bretagne.fr/home/le-sdage-2022-2027.html>

⁵¹⁵ <https://www.rhone-mediterranee.eaufrance.fr/gestion/sdage2022/etapes-delaboration-du-sdage-2022-2027>

⁵¹⁶ Page 280

⁵¹⁷ Ministry of the Environment (2017), *Kliimamuutustega kohanemise arengukava aastani 2030* (Climate Change Adaptation Development Plan until 2030), <https://envir.ee/media/912/download>

⁵¹⁸ Ministry of Rural Affairs (2012), *Põllumajandussektoris kliimamuutuste leevendamise ja kliimamuutustega kohanemise tegevuskava 2012-2020* (Action Plan for Mitigating and Adaptation with Climate Change in Agricultural Sector 2012-2020), <https://www.agri.ee/sites/default/files/public/juurkataloog/ARENDUSTEGEVUS/kliimamuutused-tegevuskava-2012-2020.pdf>

⁵¹⁹ Ministry of the Environment (2012), *Looduskaitse arengukava 2012-2020* (Nature Protection Development Plan 2012-2020), <https://envir.ee/media/50/download>

⁵²⁰ Ministry of the Environment (2012), *Looduskaitse arengukava rakendusplaan 2012-2020* (Implementation Plan of the Nature Protection Development Plan 2012-2020), <https://envir.ee/media/51/download>

⁵²¹ Ministry of the Environment (2022), *Meetmeprogramm 2022-2027* (Measure Plan 2022-2027), <https://envir.ee/media/5509/download>

⁵²² https://www.lawa.de/documents/lawa-klimawandel-bericht_2020_1618816705.pdf

⁵²³ Auswirkungen des Klimawandels auf die Wasserwirtschaft: Bestandsaufnahme, Handlungsoptionen und strategische Handlungsfelder 2020 (lawa.de), available at: https://www.lawa.de/documents/wri100365-21e-20210506-lawa-klimawandel-bericht-2020-korrendfassung_2_1646820370.pdf.

⁵²⁴ <https://www.bmvi.de/SharedDocs/DE/Artikel/WS/gemeinsame-erklarung-acht-punkte-plan-niedrigwasser-rhein.html>

⁵²⁵ Plan for counteracting consequences of droughts (*Plan przeciwdziałania skutkom suszy*, PPSS), Journal of Laws 3 September 2021, item 1615, available at: <https://dziennikustaw.gov.pl/D2021000161501.pdf>

⁵²⁶ *Koncepcia vodnej politiky Slovenskej republiky do roku 2030 s výhľadom do roku 2050*, <https://www.minzp.sk/files/sekcia-vod/koncepcia-vodnej-politiky/koncepcia-vodnej-politiky.pdf>

⁵²⁷ *Vodný plán Slovenska (aktualizácia 2021)* <https://www.minzp.sk/voda/vodny-plan-slovenska/>

⁵²⁸ *Stratégia adaptácie Slovenskej republiky na zmenu klímy – aktualizácia* (2018) <https://www.minzp.sk/files/odbor-politiky-zmeny-klimy/strategia-adaptacie-sr-zmenu-klimy-aktualizacia.pdf>

⁵²⁹ *Akčný plán pre implementáciu Stratégie adaptácie SR na zmenu klímy* (2021), <https://www.minzp.sk/files/odbor-politiky-zmeny-klimy/akcny-plan-implementaciu-nas.pdf>

⁵³⁰ *H2ODNOTA JE VODA - Akčný plán na riešenie dôsledkov sucha a nedostatku vody*, <https://www.minzp.sk/files/sekcia-vod/hodnota-je-voda/h2odnota-je-voda/h2odnota-je-voda.pdf>

⁵³¹ *Stratégia environmentálnej politiky Slovenskej republiky do roku 2030*, https://www.minzp.sk/files/iep/publikacia_zelensie-slovensko-sj_web.pdf

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