

Chapter 2

European Drought and Water Scarcity Policies

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2.1 Introduction: Drought Events and the Importance of Policy Responses on the European Level

Over the last decade, Europe's drought management and policy has been characterized by a predominantly crisis-oriented approach. However, the widening gap between the impacts of drought episodes and the ability to prepare, manage and mitigate such droughts has motivated the European Union (EU) to make significant improvements that address drought management using a preventative approach (Kampragou et al. 2011). Not surprisingly, disaster response and recovery policy, disaster prevention, and mitigation and preparedness approaches have become increasingly more widespread.

That said, in order to tackle drought risk and its impacts, an integrated approach to water governance is needed, one that considers multiple dimensions of water management (Bressers et al. 2013). Such an increased demand for more sustainable and proactive policies must stem from all sectors, including agriculture, urban development, energy, nature conservation, and recreation. To create a drought-resilient society, equipped with the appropriate tools and abilities to respond and cope with the impacts of extreme events such as droughts, requires development of long-term strategies and processes to address and reduce the risks of drought (Kampragou et al. 2011).

This chapter focuses on the main EU policies related to drought and water scarcity and highlights recent policy developments in all relevant sectors. Additionally, it provides an overview of those European policies that impact drought and

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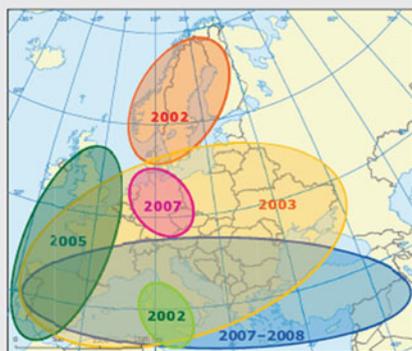
drought-related management issues, through an examination of legal, organizational, financial and political issues that guide and structure the interactions among all actors.

Over the past thirty years, there has been an increasing trend in droughts events and their impacts in the EU. Water is relatively abundant in much of Europe; however, large areas are affected by water scarcity and droughts (Kazmierczyk et al. 2010). Water scarcity affects at least 11 % of the European population and 17 % of EU territory (European Union 2010); it is experienced by various member states and not limited to the Mediterranean region (European Commission 2011). The comparison of the periods 1976–1990 and 1991–2006, that shows a doubling in both area and population affected (European Environmental Agency 2010) and the quadrupled yearly average costs (European Union 2010). One of the worst droughts occurred in 2003, when one-third of EU territory and over 100 million people were affected (European Union 2010); see also the Box 1.1 in Fig. 2.1). The State of the Environment Report states that “except in some northern and sparsely-populated countries that possess abundant resources, water scarcity occurs in many areas of Europe, particularly in the south, confronted with a crucial combination of a severe lack of and high demand for water” (Kazmierczyk et al. 2010).

Climate change is further projected to increase water shortages across Europe. The most severe impacts are expected in southern and southeastern regions, which already suffer from water scarcity. These areas will face reductions in water availability as more frequent and intense drought events occur. While water availability will generally increase in northern regions, in summer periods availability of water may decrease and lead to drought spells (Jol et al. 2008 in European Environmental Agency 2010).

Box 1.1 Main drought events in Europe over the last 10 years

Figure 1.1 Main drought events in Europe, 2000–2009



Source: Adapted from Tallaksen, 2007.

In the following is listed a brief description of some of the droughts events — more information is available in the forthcoming EEA report Mapping the impacts of natural hazards and technological accidents in Europe (EEA, 2010a).

South-eastern Europe is increasingly facing long periods of drought, creating economic problems.

During the 2003 heat wave and drought, much of Southern and Central Europe experienced a substantial drop in crop yields — the largest negative deviation from the long-term trend in Europe in the past 43 years.

In 2004–2006 severe droughts hit the south-western part of Europe including the Iberian Peninsula, France and the southern part of the United Kingdom.

In 2008, Cyprus suffered a fourth consecutive year of low rainfall and the drought situation reached a critical level in the summer. To ease the crisis 30 water tankers sailed in from Greece and households were supplied with water for around twelve hours only three times a week.

Fig. 2.1 Recorded drought events in Europe between 2000–2009. As shown, the year 2003 drought disproportionately impacted much of South and Central Europe (Tallaksen 2007 in European Environmental Agency 2010). *Source:* <http://www.eea.europa.eu/legal/copyright>

Issued in 2000, the Water Framework Directive (WFD) established the EU wide framework for water management, incorporating tools to achieve ‘good status’ of all European waters (European Community 2000). The quantitative water issues with regards to water scarcity and droughts were identified as a gap in the implementation of the WFD, which influence the achievement of the environmental objectives, and therefore the good status of waters. The occurrence of major drought events during this period (in particular in 2003) further increased these concerns. They were captured by the EU Water Directors during the informal meeting in Rome in 2003, where the development of an initiative on water scarcity issues was agreed upon, and a technical document on drought management and long-term imbalances was consequently prepared and presented to the Water Directors Meeting in 2006. The document showed that these phenomena have been increasing in intensity and extent at European level in the last decades, with worsening socio-economic and environmental impacts. Therefore, in the same year (2006), some member states requested European action on water scarcity and drought events at the Environment Council, raising concerns on the need for further development at political and technical levels to address the environmental, social and economic impacts of water scarcity and drought (WS&D) (Informal Council of Environment Ministers 2007). In response the Environmental Council requested for actions on this issue in 2006 and within the Common Implementation Strategy (CIS) of the WFD, the European Commission has conducted several analyses of WS&D in the EU (i.e. (European Commission—DG ENV 2007). This assessment showed that water scarcity and drought events affect all EU countries in a variety of ways (Informal Council of Environment Ministers 2007) and now have an added European dimension, as drought and water scarcity is no longer exclusive to southern European countries (Portuguese Ministry of Environment, Spatial Planning and Regional Development 2007). This shift provided the basis for establishing a common approach at European Union level. The EU Presidency of Portugal (2007) placed water scarcity and droughts as one of its main environmental policy priorities. It welcomed the Communication 414 final (European Commission 2007b) on ‘Addressing the challenge of water scarcity and droughts in the European Union’ and succeeded in making WS&D an active environmental policy area with specific instruments and strategies (Portuguese Ministry of Environment, Spatial Planning and Regional Development 2007). The Communication summarized the main trends and concerns and identified a series of actions to be taken at EU and national level, giving priority to water savings and water efficiency measures, and further integrating water issues into all cross-cutting policies. It also emphasized the importance of taking stock of climate change and adaptation policy areas, such as agriculture (Farmer et al. 2008; European Environmental Agency 2010).

The Environment Council was supportive of the Communication and invited the Commission to review and further develop the evolving EU strategy for WS&D by

2012 (European Commission—DG ENV 2012). In 2008, the European Parliament adopted a report on the Communication, calling for a number of initiatives at the EU level. It also requested the Commission to initiate pilot projects in areas of key interest (European Commission—DG ENV 2012).¹

In January 2008, MEPs and experts convened at the European Parliament's Climate Change Temporary Committee's Fourth Thematic Session to discuss the complex links between water issues and climate change. The session determined that significant decisions regarding the best way forward with climate adaptation strategies was a top priority. Specifically, the discussion focused on the need for water policies to respond to the impacts of climate and changing agricultural demands, calling policy development to move beyond water policy itself to be more encompassing (Farmer et al. 2008).

The former European Parliament Environment Commissioner Potočnik was a key leader in mobilisations efforts following the session. At a hearing in January 2010, he announced a new focus area on resource efficiency, including water efficiency, for the upcoming mandate. He also unveiled a new Commission initiative entitled "Blueprint for safeguarding European Waters," slated for release in 2012. The Blueprint aimed to review the WFD, including the successes and challenges of its implementation, as well as provide insight on water and resource vulnerabilities in the face the climate change and other man-made pressure (European Commission—DG ENV 2012).

The European Commission Joint Research Centre also helped to establish the European Drought Observatory (EDO) as part of ongoing efforts to integrate drought into policy. Since 2011, the EDO has been the leading disseminator on drought-relevant information and maps of indicators derived from a range of different data sources, including precipitation measurements, satellite measurements and modelled soil moisture content (Vogt et al. 2011). At its core, the EDO serves to buttress the already existing Global Drought Information System, with a focus on the European context.

Like its sister initiative, the EDO provides a technical approach to drought policy and integrates "relevant data and research results, drought monitoring, detection and forecasting on different spatial scales, from local and regional activities to a continental overview at EU level (Vogt 2011)" in order to aid evaluation and decision-making of future water scarcity and drought events (Vogt et al. 2011). The EDO is also responsible for severe drought events, and produces reports detailing the situation to better inform policymakers (European Commission—JRC 2015). In addition, the EDO is also responsible for retrieving information on droughts and related topics from global news portals using the European Media Monitor tool (Council of the European Communities 1979).

¹See also: http://ec.europa.eu/environment/water/quantity/scarcity_en.htm.

2.2 Policy Frameworks for the European Governance Structure

Understanding the policy framework is essential for analyzing the governance structures in general. All five dimensions of governance (cp. Chaps. 1 and 3) are directly or indirectly linked to the respective policy framework. Developed over time from a series of scattered policies, the overarching drought and water scarcity policy approach in the EU is undeniably complex. To make sense of this complexity, an applied framework for understanding the mix of policies is necessary. This section introduces and describes a typology of tools for unpacking this complexity, known as the policy mix concept (Flanagan et al. 2011). Later in the chapter, we will explain the dimensions of the policy mix concept in more detail. We will also apply this comprehensive policy mix concept as a conceptual tool for deeper analysis of each policy we discuss.

2.2.1 Drought Policy Context

Concepts within the broad arena of water scarcity and drought are often not clearly differentiated. This may hamper effective implementation of policies and measures, as the lack of clear definitions and methods for analysis and adaptation cannot adequately address the inherent drivers and pressures (Schmidt et al. 2012; Vanneuville et al. 2012). Thus, in order to delineate adequate responses, defining both drought and water scarcity is essential (see also Chap. 1).

As briefly touched upon in previous sections, there are three types of drought policy responses: the post-impact (often crisis-oriented) drought policy approach, the pre-impact drought policy approach (often vulnerability reduction and resilient oriented), and the development and implementation of preparedness plans and policies (often focused on institutional capacity, including organizational frameworks and operational arrangements) (Wilhite et al. 2014).

A harmonized approach to drought risk management is still lacking both at the EU level and at the member state level. Consequently, the regional level also lacks the full integration of drought risk management into relevant water policies (Kampragou et al. 2011).

A core question for water scarcity and drought policy to consider centres around supply and demand: Should the government respond to growing water uses by finding additional supply to increased demands, or should it implement measures to curb water use and encourage efficiency (European Environmental Agency 2009; Water Scarcity and Droughts Expert Network 2007).

From the supply-side approach, policy measures often encourage restoration and improvement of existing water infrastructures and/or continued usage and expansion of natural catchments and aquifers. The demand-side approach, on the other hand, promotes policy measures that encourage subsidies and water efficiency

strategies, such as reducing leaks infrastructure, smarter water use for agricultural purposes, public and water user education on conservation, as well as tailored pricing schemes and policies.

To address this central question, the (European Commission 2007a, 2010) formulated three policy options: the first, Option A, takes a supply approach; the second, Option B, aims for a water pricing approach; and the third, Option C, offers an integrated approach based on water efficiency. The three options are elaborated in greater detail in Table 2.1.

Option B is closely associated with so-called ‘economic policy instruments’ (EPIs). EPIs are believed to play a foundational role in shaping and achieving WS&D policy goals in the future (Mysiak and Maziotis 2012). In this context, EPIs are designed to foster efficient allocation and use of water, and cover a range of different instruments, including pricing, trading and risk sharing. Already, EPIs have contributed to making provision of water service financially sustainable by converting payments on the use of water into working incentives for water conservation. Moving forward, EPIs have the real potential to promote individual actions to save water, increase water efficiency, improve water quality and reduce water-associated risks. Thus EPI are also an important building block of Option C.

For Option C it is important to know that additional water supply infrastructures will be considered only when all other options have been exhausted, with priority for effective water pricing policy and cost-effective alternatives. Embedded within policy options set forth, the European Commission also makes it clear that water uses should be prioritized, with overriding priority to public water to ensure access to adequate water provision.

As highlighted in Table 2.1, to supplement the policy options offered by the Commission, the EC provides additional policy instruments that work towards: (1) putting the right price tag on water, (2) allocating water and water-related funding more efficiently, (3) improving drought risk management and (4) considering additional water supply infrastructures (European Commission 2007a). The European Commission suggests specific actions to this end, such as improving land

Table 2.1 Options for addressing supply, demand, and integrated approach to water scarcity and drought in Europe (European Commission 2007a, 2010)

Policy option		Actions
A	Water supply only	<ul style="list-style-type: none"> • Enhance development of new water supply based on existing EU legislation • Support widespread development of new water supplies, with priority to EU and national funds
B	Water pricing policies only	<ul style="list-style-type: none"> • Effective water pricing • Cost recovery
C	Integrated approach	<ul style="list-style-type: none"> • Support efficient water allocation and sustainable land use planning • Foster water efficiency technologies and practices • Foster emergence of a water-saving culture in Europe • Provide new water supply

use planning, financing water efficiency, developing drought risk management plans and early warning system on droughts, and further optimizing the use of EU Solidarity Fund and European mechanism for Civil Protection are suggested actions by the European Commission. Across all policy instruments and actions, improving knowledge and data collection regarding water quantity is a critical first step.

Despite such suggested policy options and supplemental actions, currently, the European Commission notes that most measures applied by the member states target pressures, status and impacts, and lack focus on targeting key drivers (European Commission 2012a, c). Adoption of policy instrument mixes, which include water conservation, agricultural stewardship and awareness-raising campaigns, are highly recommended to combat this gap (EEA 2009; Water Scarcity and Droughts Expert Network 2007).

2.2.2 EU Drought Policy Objectives

At the EU level, drought policy objectives share common themes. They include: (1) promoting risk management policies, (2) promoting drought preparedness and mitigation and planning measures and (3) consideration of financial assistance tools (Wilhite et al. 2014).

Engaging risk assessment and addressing management practices are essential to drought policy objectives moving forward (Kampragou et al. 2011). A risk management approach seeks to address hazard prediction and vulnerability, centering on pre-disaster preparedness measures and long-term risk reduction as means to reduce vulnerability and increase drought resiliency (Kampragou et al. 2011).

Such an approach is best captured by drought preparedness policy, which refers to actions undertaken prior to drought events intentionally designed to improve the ability of institutions to appropriately respond to a drought event operationally. This is most often accomplished through drought mitigation, which refers to actions undertaken prior to drought events designed to minimize impacts on people, the economy and the environment (Kampragou et al. 2011). Even though drought events are highly variable and geographically specific, differing in intensity, duration and spatial extent, general guidelines for processes and measures to be applied and implemented in the event of a drought are essential (Kampragou et al. 2011).

2.2.3 Policy Instrument, Measures and Strategies

In the literature, the definition of policy instruments is diverse and widely debated. In this book, **policy instruments** are defined as the fluid tools, techniques or mechanisms for achieving overarching policy objectives, in this case: the establishment of drought resilience (Bressers and O'Toole 2005; Flanagan et al. 2011;

Reichardt and Rogge 2015). Specifically, here we consider policy instruments that diffuse goal-oriented influence (also known as an intervention) of one or more actors that in turn produce effects over entire populations or very large target groups (Kaufmann-Hayoz et al. 2001), primarily in the public sector, over time. In the process of this influence, the behaviour of the target population is transformed in a structured way.

Generally, the following policy instruments types can be distinguished (Kaufmann-Hayoz et al. 2001):

- Regulatory (Command and control) instruments (e.g. water licenses)
- Economic instruments (e.g. water abstraction charges, compensation for crop losses)
- Infrastructure (Service) instruments (e.g. co-financing of water-saving infrastructure by the means of Rural Development Policy (DG AGRI), Structural and Cohesion Funds (DG REGIO), LIFE + Funds (DG ENV))
- Collaborative instruments (e.g. CGIAR Fund, ACP-EU Water Facility)
- Information (Communication) instruments, e.g. the European Drought Observatory

Policy instruments are not to be confused with **policy measures**, though they are sometimes used interchangeably. Policy measures indicate the concrete realization of a policy instrument and represent the tangible means for achieving objectives determined in the formulation of the policy instrument. To this end, policy measures serve to validate the policy instrument.

Policy strategies, on the other hand, denote the strategic orientation and management of policy instruments and their policy measures within a policy mix, in order to achieve the vision put forth by policy objective. It refers to both the ends and the means, and thus the policy objectives and principal plans of a policy strategy are closely interlinked through the proposed policy strategy (Kaufmann-Hayoz et al. 2001).

Finally, a **policy mix**, for the purposes of this chapter, is defined as the complex arrangement of policy instruments, measures and strategies that interact via dynamic processes to influence and achieve a specific broader objective. According to Reichardt and Rogge (2015) a policy mix is shaped by three defining building blocks: (1) inherent to policy mixes are the consideration of their *complexity and dynamism*; (2) within policy mixes, there is a need for identification and integration of relevant *policy processes*; (3) the incorporation of a *strategic component*. Central to the policy mix concept is the element of *policy interactions*, or the interplay among actors, instruments, measures and strategies, which operate in a multi-level and multi-actor context (Flanagan et al. 2011). This framework serves as a starting point for building up more sophisticated conceptualizations of the policy mix in the drought context, as explored in the following sections.

2.3 European Drought Policy: Policy Relations Between Flooding, Drought, Agriculture and Nature

The structure of the remainder of the chapter is organized so that relevant policy instruments on water scarcity and drought at the EU-level are explored holistically. Because there is a wide entry point for discussing water scarcity and drought-related policy instruments, we chose to focus on three perspectives, namely: nature (or conservation-based perspectives), water (specifically, the water management perspective) and agriculture (including the land management perspective). We recognize that other key perspectives exist, including the land planning perspective and the socio-economic perspective, among others.

In addition, as describing individual policy instruments would simply produce a long list and dilute the purpose of this chapter, a more systems approach is applied in order to explore relevant water scarcity and drought policy mixes. Such an approach inherently introduces more complexity. At the same time, it aims to distill that complexity to produce a comprehensive understanding of the policy landscape at hand.

In consequence, directives, often composed of several interacting policy instruments, are explored alongside Communications, often a single policy instrument interconnected with and embedded into larger the broader policy space. The aim of the section in suite is to provide an entry point for untangling the policy mixes and the relationships and interactions among the individual policy instruments. As a result, each section applies the categories developed by Landgrebe et al. (2011): (1) history, aims and objectives, (2) structure, and components and implementation and (3) relevance to drought policy implementation in order to structure the analysis.

In the following sections, we examine eight policy mixes: the EU Climate Adaptation Policy, the European Commission's Communication 'Blueprint to Safeguard Europe's Water Resources', the EU Water Framework Directive, the EU Floods Directive, the EU Habitat and Birds Directives, the EU Groundwater Directive, and the European Common Agriculture Policy (CAP). As already touched on, each policy mix applies one or more of the three perspectives outlined above as an entry point for analysis.

Lastly, it is also important to note that this chapter acknowledges that water scarcity and drought policies at the EU level also operate horizontally, such as within the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) Directives, the Sustainable Development Strategy (European Council DOC 10917/06), (Council of the European Communities 1979), and cohesion policies (Cohesion Funds and Structural Funds). However, due to the scale of these regimes, they remain outside the scope of this chapter.

EU Climate Adaptation policy is one of the main drivers for activities related to WS&D. This policy is aiming at reducing the vulnerability of relevant sectors (e.g. agriculture, tourism, industry, energy and transport) and thus mainstreaming of climate change aspects into other EU policies is the main priority.

The Review of the European Water Scarcity and Droughts Policy emphasizes that “climate change is expected to worsen the impacts of already existing stresses on water as changes in precipitation, combined with rising temperatures, will cause significant changes in the quality and availability of water resources”. Therefore, the policy responses to water scarcity and drought should include adaptation measures (European Commission 2012c). According to the results of the ClimWatAdapt project (Flörke et al. 2011)—changes in water withdrawals will be the main driver of the changes in future water scarcity.

2.3.1 EC Communication on Water Scarcity and Drought

The European Commission’s Communication on water scarcity and drought highlights the need for increased integration of WS&D policy and policy objectives into existing policy frameworks. Though the Communication is written from and for a dominantly water-oriented perspective, it also inherently touches upon cross-cutting challenges that interact with the agricultural sector. We apply both perspectives in our analysis of the Communication.

2.3.1.1 History, Aims and Objectives

The Water Scarcity and Drought Communication represents and captures the milestones of EU policy to address water scarcity and drought through the Communication Document to European Parliament and the Council, titled “Addressing the challenge of water scarcity and droughts in the European Union” (European Commission 2007b; Kampragou et al. 2011). The Communication was adopted in 2008, after review. In the document, the Commission identified policy areas to address movement towards a water-efficient economy.

The 2007 Communication offers a variety of technical and political initiatives to mitigate the impacts of water scarcity and drought (Estrela and Vargas 2012). As part of the policy, the 2007 Communication put forth an initial set of policy options to address the challenges related to water scarcity and drought, with special emphasis on pricing, land use planning and water-saving (Kampragou et al. 2011).

The 2007 Communication also sets out a number of policy options addressing to increased drought frequencies as a result of climate change (Quevauviller 2014). The Communication also indicated the need for prioritization of drought risk management plans, the expansion of the European Drought Observatory, and a more rigorous use of the EU Solidarity Fund (Kampragou et al. 2011). The 2007 Communication on Water Scarcity and Droughts also address water pricing policies, advocating for ‘putting the right price tag on water’, ‘allocating water more efficiently’ and ‘fostering water efficient technologies and practices’. These efficiency measures fit into the overall resource efficiency objective of Europe 2020.

2.3.1.2 Structure, Components and Implementation

A key feature of the water scarcity and drought policy is its use of a common framework. As a result, it lacks adequate differentiation of policy options and coping mechanisms for long-term or permanent discrepancies between water supply and demand (water scarcity) and temporary but sustained decrease in water availability as a result of natural forces (Kampragou et al. 2011).

Member states were encouraged to develop and implement Drought Management Plans (DMPs) as part of the Communication, considered to be an annex to the RBMP according to Article 13.5 of the WFD (Rossi 2009). RBMPs have to include a summary of the programmes of measures in order to achieve the environmental objectives (article 4 of WFD) and may be supplemented by the production of more detailed programmes and management plans (e.g. DMPs) for issues dealing with particular aspects of water management. The DMPs extend the criteria set forth by the WFD and aim to minimize impacts on the economy, social life and the environment, before the onset of drought using a multi-level approach (Rossi 2009).

Follow-up reports to the original Communication, which recalibrated priorities in 2008 and in 2010, revealed strides in water management efficiency. The follow-up reports also noted the limited response of member states in engaging in drought risk assessment, management, and development of DMPs (Kampragou et al. 2011).

The review of the Strategy for water scarcity and drought was integrated into the 'Blueprint to Safeguard European waters', in parallel with an analysis of the Implementation of the Water Framework Directive.

2.3.1.3 Relevance to Drought Policy Implementation

The 2007 Communication calls for a paradigm change from crisis-oriented to a planned drought risk management approach and expresses the need to explore all possibilities to improve water efficiency before exploring increase in supply (Estrela and Vargas 2012). The Communication also highlights the untapped potential for water efficiency measures in water user sectors, including agriculture, industry, distribution networks, buildings and energy production.

The Communication also states that clear, water use hierarchy established through participative approaches should inform policy-making (Estrela and Vargas 2012). More specifically, the Communication offers voluntary measures to cope with water scarcity and droughts, recommends development of DMPs and the establishment of a comprehensive European drought strategy, and discusses consideration of a European drought observatory (Estrela and Vargas 2012).

2.3.2 *EC Communication ‘Blueprint to Safeguard Europe’s Water Resources’*

The European Commission’s Communication on ‘Blueprint to Safeguard Europe’s Water Resources’ (European Commission 2012a) takes an inherently water-oriented perspective to its analysis. However, agriculture is also a major component of the recommendations set forth by the blueprint. The Communication underscores the increasing interplay between the water and agricultural sectors to address issues of water scarcity and drought.

2.3.2.1 History, Aims and Objectives

The ‘Blueprint to Safeguard Europe’s Water Resources’ (European Commission 2012a) is an EU policy response to recent water challenges, to be encompassed by the EU 2020 Strategy and the Resources Efficiency Roadmap (Estrela and Vargas 2012). The Blueprint emerged from gaps in the WFD to address land use and management that affect both water quality and quantity. It assesses existing policy to highlight the obstacles and challenges which prevent actionable safeguarding of Europe’s water resources. According to the Blueprint the main negative impacts on water resources are stemming from climate change, land use, economic activities, urban development and demographic change and are interlinked with each other.

As part of a larger goal to secure equal access to good-quality water, the primary objective of the Blueprint is to promote sustainable activities relating to water. The Blueprint does not aim to provide a one-size-fits-all solution and instead documents and assesses the vulnerability of EU waters. Within the Communication, it is argued that the objectives of the Blueprint are scattered throughout and already enshrined within the WFD, and consequently, the Blueprint attempts to gather, distill, and link the disparate elements of water policy as well as the root causes of negative impacts on water status.

The Blueprint identifies green growth as primary driving force behind changes to the water sector, with a special emphasis on innovation for water efficiency.

2.3.2.2 Structure, Components and Implementation

The Blueprint was developed in close cooperation with stakeholders, and is based on extensive public consultations. It consists of an overall Fitness Check of European Waters, as well as an assessment of the policies and measures in place.

2.3.2.3 Relevance to Drought Policy Implementation

The Blueprint identifies several pressures to address moving forward. First, the Blueprint calls for better implementation and increased integration of water policy objectives in policy areas such as the CAP, the Cohesion and Structural Funds, as well as energy, transport, and integrated disaster management. The Blueprint views the development of CIS guidance on natural water retention measures to be essential to facilitating such an integrated approach.

Second, the Blueprint identifies over abstraction of water. The Blueprint addresses the need for more quantitative water management, including identification and implementation of the concept of ecological flow, as well as a legal framework for addressing illegal abstraction of water.

As a reaction to these pressures, the Blueprint calls for the following measures:

- Addressing the vulnerability of EU waters: data from the Blueprint impact assessment show increasing trends in river flow droughts and flood-related losses in Europe over the last decades. The Blueprint encourages looking into measures based on an integrated disaster management approach, with special emphasis on extreme events including droughts.
- Increased financing measures under the CAP for (more) green infrastructure, specifically natural water retention measures.
- Continued development of the European Drought Observatory, an early-system aimed to serve as a preparedness measure for member states and affected stakeholders.
- Focusing on cross-cutting solutions, such EU water policy relating to Innovation Partnerships on Water and on Agricultural Productivity and Sustainability.

2.3.3 *EU Water Framework Directive*

The EU Water Framework Directive foregrounds much of the water policy field in Europe. As such, this section will pursue a strong focus on the water management perspective in which to ground discussions regarding implementation of water scarcity and drought policies within the WFD.

2.3.3.1 History, Aims and Objectives

The EU Water Framework Directive (WFD) (2000/60/EC) was adopted on 23 October 2000. It is the holistic legislation that encompasses all EU water policy, based on four main pillars that aim to first achieve ‘good status’ of all EU waters by 2015, second to establish river basin management plans, third to build a framework for integrated water management, and fourth, encourage public and stakeholder participation. The WFD operates on six-year cycles, with a new cycle set for 2015–2021.

Since 2000, the WFD has incorporated previous policies to create a single comprehensive framework for addressing surface waters, coastal waters, transitional waters, and groundwater, as well as linking to daughter directives that include: the Nitrates Directive (91/676/EEC), the Habitats Directive (92/43/EEC), the Urban Waste Water Treatment Directive (91/271/EEC), Integrated Pollution Prevention and Control Directive (96/61/EC), and other measures.

The WFD includes mandatory components for member states to implement. These instruments span several objectives, including costing/pricing, zoning of designated areas, abstraction and discharge permitting, and authorization of water quality-impacting activities (Kallis et al. 2005). The WFD is the dominant legislative instrument for addressing water-related issues.

2.3.3.2 Structure, Components and Implementation

According to the WFD, EU member states are required to develop a robust but flexible integrated water resources management system, based on the subsidiarity principles of river basin management planning (Quevauviller 2014). The provisions of the WFD imply that drought planning and management should be implemented at the level of river basins (Kampragou et al. 2011). Within the WFD, the River Basin Management Plans (RBMPs) act to prevent a drought crisis situation by clearly outlining the measure and actions to apply at varying triggering thresholds for water reserves (Kampragou et al. 2011). Therefore, drought scenarios must be clearly defined in the RBMP (Estrela and Vargas 2012). DMPs are contingency management plans supplementary to the River Basin Management Plans (RBMP)s. DMPs mainly aim to identify and schedule onset activation tactical measures to delay and mitigate the impacts of drought.

To implement the WFD, the Common Implementation Strategy (CIS) sets standards and guidance for implementation for all EU countries. Overall, the implementation strategy of the WFD is rather flexible and cooperative due to the vague core requirements set forth by the legal text of the WFD (Kallis et al. 2005). The WFD does not supply any direct financial support. However, funding opportunities for measures are available through EU Regional Policy and EU Common Agricultural Policy (CAP). The use of structural and cohesion funds, as part of the regional policy of the European Union, need to be mobilized by either municipality initiatives or water authorities of the MSs. Against the background of the financial crisis the EU took the temporary decision to improve the EU co-financing rates for selected MSs (Stanley et al. 2012).

Because the WFD is a more general framework, it was also implemented via other directives, including the Groundwater Directive and Nitrates Directive. It is also complemented by the Floods Directive and the Communication on water scarcity and drought.

The implementation of pricing instruments under the WFD is a way to provide an incentive for efficient water use. Water pricing serves not only as a powerful awareness-raising tool but also combines environmental with economic benefits.

(cp. European Commission 2012a). However, effective metering is a prerequisite for actualizing such incentive-based pricing instruments. Consequently, the WFD also makes use of mentions cost recovery of water services, operating on the polluter pays principle.

2.3.3.3 Relevance to Drought Policy Implementation

Though the WFD does not provide a common definition of drought (Estrela and Vargas 2012), nor does it explicitly address droughts (Quevauviller 2011), due to its innate flexibility as framework, the WFD does offer a dynamic, evolving strategy to address drought and water scarcity challenges in the context of climate change through planning processes (Kampragou et al. 2011).

In the context of drought, the WFD aims to provide technical tools and targeted guidance to member states on the best methods for incorporating and addressing drought risks in current and future management plans (Kampragou et al. 2011).

In addition, the WFD also provides general criteria for assessing the status of water bodies from a drought perspective (Estrela and Vargas 2012). Specifically, abstraction and discharge permitting is required by all member states (Landgrebe et al. 2011). Besides permitting, water efficiency targets, as outlined within the CIS based on water stress indicators, are also being implemented at the river basin level.

From the land management perspective, the WFD has also set up several mechanisms that work to prevent land degradation and desertification impacts, mainly through measures outlined in the Programme of Measures and the River Basin Management Plans provided by each member state. On the one hand, this allows for ample flexibility for adapting the measures to the ecological needs and boundaries of the local and regional ecosystems. However, this approach also often leads to differences in interpretation and implementation, and creates uneven levels of achievement with regards to drought measures.

In conclusion, though the WFD provides a flexible entry point for EU-wide operationalization of drought-related instruments and measures, there are still opportunities for improving its approach. As already touched on, the focus of the WFD on water quality and not water quantity leaves provisioning of the amount of water resources too general and insufficient to tackling issues of drought and water scarcity management. Moreover, the WFD and its daughter Directives (discussed in further sections), place a stronger emphasis on northern Europe, where there is limited need for measures relating to water quantity, so far. However, this is likely to change in the coming decades, with climate change impacts shifting water quantity regimes throughout the whole of Europe (CITE). In light of this, more expansive guidance for implementing specifically tailored measures for water scarcity and drought for regions within both southern and northern Europe is essential.

2.3.4 EU Floods Directive

The EU Floods Directive, as first glance, may not appear immediately relevant to understanding drought and water scarcity policy in Europe. However, the Directive is worth exploring from the water management perspective as a way to inform WS&D policy measures and policy strategies. There is a great deal of potential for harnessing overlaps between drought and flood policy instruments, which to date are minimal. The water, in particular the water efficiency, perspective thus offers a rich entry point for understanding interactions between the Floods Directive and WS&D.

2.3.4.1 History, Aims and Objectives

In 2007, following the increase in occurrence of floods throughout Europe, the Floods Directive (2007/60/EC) emerged as the principle body of policy for targeting flood risk management. By 2011, member states were asked to undertake a Preliminary Flood Risk Assessment to identify areas with significant flood risks. By 2013, member states were asked to prepare flood hazard and risk maps. As of 2015, member states were requested to prepare flood risk management plans with set objectives and methods for achieving those objectives.

2.3.4.2 Structure, Components and Implementation

The Floods Directive promotes an integrated and sustainable approach to the management of flood risk, in particular regarding the use of river basin-scale approaches that promote better environmental options of land use. By improving nature's water storage capacity and conserving water in natural systems, the severe effect of droughts and preventing floods are curbed (European Commission—DG ENV 2011). In order to harness synergies with the WFD, the Floods Directive Flood Risk Management Plans (FRMPs) should be coordinated with the River Basin Management Plans (RBMPs).

The implementation of the Floods Directive is based on a six-year planning cycle. In the first stage of the Floods Directive (already completed), preliminary flood risk assessment and the identification of areas of potential significant flood risk were largely based on available information about past significant floods and on forecasts. In the second stage of the Floods Directive risk management process was the production of flood hazard maps and flood risk maps for the areas identified as areas of potential significant flood risks by the end of 2013. The European Commission is currently assessing the information reported by member states (European Commission 2015).

The European Commission has performed a preliminary assessment of the implementation of the Floods Directive, which notes the diversity of approaches and methodologies used by member states.

2.3.4.3 Relevance to Drought Policy Implementation

Flood risk management plans may include the promotion of water efficiency practices, such as the improvement of water retention and controlled flooding. The Floods Directive is designed to improve green infrastructure and promote Natural Water Retention Measures (NWRM). Unfortunately, the direct impact of this directive to integrate and connect different planning purposes and scales, including drought is expected to be low. The reason for this is that most member states are prioritizing hard, technical flood protection measures for soft, non-technical ones. A lack of land availability is one out of many factors behind this development.

2.3.5 *EU Habitats Directive and EU Birds Directive*

Together, the EU Habitats and Birds Directives offer a strong conservation and land management perspective to inform water scarcity and drought challenges. Nature and agriculture are thus heavily referenced in analysis of its relevance to WS&D.

2.3.5.1 History, Aims and Objectives

Nature conservation and protection of biodiversity in the EU is regulated by two main directives: the Birds Directive (1979)² and the Habitats Directive (1992).³ Both directives address the growing deterioration of natural habitats and increasing threats to wildlife species across the Europe. The overall objective of the two Directives is to ensure that the species and habitat types they protect are maintained, or restored, to a favourable conservation status (FSC) within the EU. The two directives do not directly reference WS&D and do not set explicitly WS&D-relevant obligatory requirements. However, the conservation measures outlined are inherently interlinked with issues of WS&D.

2.3.5.2 Structure, Components and Implementation

Member states are responsible for implementing the necessary laws, regulations, and administrative provisions to comply with both Directives, including: designation of Special Areas of Conservation (SACs) and establishment of necessary conservation measures for selected habitats, animal and plant species and designation of Special Protection Areas (SPAs) for targeted bird species with special

²Council Directive of 2 April 1979 on the conservation of wild birds (79/409/EEC).

³Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

conservation measures required in these areas. Natura 2000, the EU-wide ecological network of protected areas, encompasses the different types of conservation areas and serves as the cornerstone of the EU's action on nature conservation. Natura 2000 sites are therefore highly protected against damaging development.

For each Natura 2000 site, conservation measures, such as voluntary management plans (MPs) are either particularly designed for the site or integrated into other development plans. Alternative conservation measures include statutory, administrative or contractual measures and member states must choose at least one of the three categories (European Commission 2013), reported every six years (European Environmental Agency 2015).

In addition, the Habitats Directive asks member states to prepare Prioritised Action Frameworks (PAFs) (Art. 8) to set out the official nature conservation priorities for a country or region. The PAFs act as strategic planning tools encouraging access to as many EU financial instruments as possible in the financing of the Natura 2000 network (European Commission 2012b).

2.3.5.3 Relevance to Drought Policy Implementation

While damage to wildlife and habitats are few examples of direct impacts from drought and water scarcity (Wilhite et al. 2007; Vanneuville et al. 2012) the conservation measures for the protection of vulnerable species and habitats contribute to prevention and mitigation of the WS&D effects.

The designation of SACs and SPAs contributes indirectly to WS&D by way of necessary conservation measures. Additionally, the WFD ensures that protected areas (SACs and SPAs) of the Natura 2000 network are integrated into the river basin strategies. Such associated conservation measures might have a positive impact on the state of water systems, as they, for example, may prevent “the deterioration of natural habitats” (Art. 6.2 of the Habitats Directive) or by paying “particular attention to the protection of wetlands [...]” (Art. 4.2 of the Birds Directive). The Natura 2000 sites also work “to ensure a favourable conservation status of the habitat types and species, including all relations with their environment like water, air, soil and vegetation” (European Commission 2000; Sánchez Navarro et al. 2012 both in Vanneuville et al. 2012).

2.3.6 EU Groundwater Directive

To understand the EU Groundwater Directive and its interplay with WS&D, a water management perspective is important. As such, we focus on the water sector in exploring the Groundwater Directive in the context of drought.

2.3.6.1 History, Aims and Objectives

Within the larger European water policy framework, the Groundwater Directive (80/68/EEC), along with other similar Directives, is often referred to as daughter directives to the overarching WFD (Quevauviller 2014). Initially, the Groundwater Directive aimed to prevent the pollution of groundwater by hazardous substances and to check or eliminate the consequences of pollution already incurred.

The main goal of the Groundwater Directive is to ensure good water quality. Similar to the WFD, the Groundwater Directive focuses on water quality, rather than quantity.

2.3.6.2 Structure, Components and Implementation

The Groundwater Directive provides a binding agreement prohibiting any and all direct discharge of hazardous substances. Authorization, as well as a detailed record of the discharges has to be provided to the European Commission for both types of substances.

The new Directive, established in 2006, requires member states to establish quality standards to protect groundwater, based on identified appropriate levels based on local or regional conditions and thresholds. The standards are based on pollution trend studies, compliance, regular monitoring and reporting, and pollution reversal trends.

2.3.6.3 Relevance to Drought Policy Implementation

The Groundwater Directive is relevant to drought policy directly, as it aims to protect underground water reserves, by ensuring good water quality standards are upheld across all groundwater resources.

The Groundwater Directive focuses on water quality rather than quantity, which is still relevant to groundwater policy. As the need for groundwater aquifer monitoring will increase in coming decades and it is expected that the focus will increase more on water quantity.

2.3.7 European Common Agricultural Policy

As the name already suggests, the European Common Agricultural Policy (CAP) focuses primarily on the agricultural perspective to water scarcity and drought, though it also has implications within the water management perspective as well.

2.3.7.1 History, Aims and Objectives

Introduced in the 1950s, the CAP originally aimed to ensure a stable supply of food through improvements to agricultural productivity.

Beginning in the early 1990s, greater emphasis was placed on the environmental dimension with the introduction of agri-environment schemes in 1992. The Agenda 2000 reform established two pillars within the CAP, with the first pillar providing agricultural market and income support and the second pillar integrating rural development policy more broadly.

Since the 2000s, the CAP has undergone major reforms, including the introduction of decoupled farm payments and compulsory cross-compliance, both introduced in 2003.

The last round of the CAP reform for the current 2014–2020 programming period increases the links between the two pillars and thus offers a more holistic and integrated approach to policy support.

2.3.7.2 Structure, Components and Implementation

The structure of the CAP operates in seven-year budget cycles. Member states are awarded a degree of autonomy in applying the CAP at the national and regional level. This autonomy allows flexibility and results in varied implementation structures for both first and second pillars, and in effect, diverse impacts on soil across the EU.

The most recent CAP introduces a ‘greening payment’, where 30 % of the available direct payments national envelope is linked to the provision of particular sustainable farming practices. This means that in addition to the cross-compliance mechanism, a significant share of direct payments will in future be linked to rewarding farmers for the provision of environmental public goods.

Furthermore, under the second pillar a focus on environmental issues is enhanced with the provisions to allocate at least 30 % of the rural development programmes’ budget to agri-environmental measures, organic farming or projects associated with environmentally friendly investment or innovation measures. The agri-environmental measures will need to complement greening practices, in this way meeting higher environmental protection targets. Furthermore, more focus is given to mainstreaming climate change mitigation and adaptation actions, for example, by developing greater resilience to disasters such as flooding, drought and fire (European Commission—DG AGRI and Rural Development 2013). However, the most recent reform did not address the water issues explicitly.

Each member state is required to prepare Rural Development Programmes that in addition to specific agricultural development policies also address the challenges posed by the environment and climate change. Agri-environment schemes are the

key measures for the integration of environmental concerns into the CAP. The RDPs encouraging farmers to conserve and enhance environmental features by providing incentives for the provision of environmental services.⁴ In addition, a number of other rural development measures contribute to environmental protection (including water issues) and climate adaptation and mitigation measures, in particular, measures such as the cultivation of legumes, reduced use of fertilizers and pesticides, or organic farming methods.⁵ Though indirectly, these measures also contribute to reduction of drought and water scarcity, as the improved soil quality also improves natural water retention capacity of soil. However, how rural development measures are designed and implemented is ultimately decided by the member states.

2.3.7.3 Relevance to Drought Policy Implementation

Water scarcity and droughts can cause significant economic impacts, particularly on agricultural activity, as it is one of the largest water demanding sectors after industry and domestic use (Farmer et al. 2008). As a major water user, agriculture plays a large role in impacting water scarcity and drought on ecosystems ‘through effects such as the drying of wetlands, concentration of pollutants affecting river biota, increasing risk of forest fires, etc’. (Farmer et al. 2008).

The CAP remains one of the key EU policies relating to drought and water scarcity due to its scope and EU-wide coverage. Despite the reciprocal interlinkages between agricultural sector and water scarcity and droughts, the CAP only minimally offers financial and legal instruments to address drought (Rossi 2009).

However, the CAP remains the primary instrument for financial support for agriculture, and has in the past often led to increased pressures on water usage from this sector thus exacerbating the issue of water scarcity, in particular through the subsidies to water-intensive crops.

In addition, the definition of GAEC requirements at national level enables member states to address drought and water scarcity flexibly according to national priorities and local needs. One of three water-related GAEC standards focuses on water irrigation issues setting the requirement of compliance with authorisation procedures (European Community 2013) and is of relevance addressing water scarcity issues. The GAEC standards related to soil and carbon stock might be relevant to drought issues as well, as they support sustainable soil management practices that increase the resilience of farming systems to floods and droughts and contribute to soil health and quality in general. Such measures also improve natural water retention capacity of the soil and increase the resilience against drought.

The new CAP also offers a risk management toolkit as part of the rural development policy. The toolkit addresses adverse climatic events, through an income

⁴Agri-environment Measures, http://ec.europa.eu/agriculture/envir/measures/index_en.htm.

⁵Read more: <http://www.ecologic.eu/9955>.

stabilization tool that assists farmers with compensations paid for losses suffered as a result of adverse climatic events, such as severe drought. The water-related rural development measures focus mainly on water use and water pollution prevention and reduction measures. Therefore, it does not address the issue of drought prevention.

To address the issue of drought, both water and land ecosystems should be involved. Thus sustainable land management practices that increase the resilience of the farming systems have a large potential in contributing to drought prevention and reduction. In order to strengthen the aspect of risk prevention management of drought, coordination of activities between drought and agriculture policies should in addition to supporting improved water demand management practices, place a stronger focus on sustainable farming practices with potential to improve natural water retention capacity of soil. Several measures, including for example buffer strips, crop rotation, meadows and pastures, traditional practices, grasslands, terracing or green cover, can act as NWRM, by encouraging the retention of water within a catchment and, through that, enhancing the natural functioning of the catchment.⁶

2.4 Where to Go: A Conclusion on the Development of the European Perspective on Drought

Over the last two decades EU Drought Policy has developed from a series of scattered policies that range from broader forms of water governance that tackle water issues to more recently, direct policy actions to adapt and mitigate drought occurrences. In either case, the effectiveness of drought-related policy frameworks largely depend on the mobilization and operationalization of the policy through national and regional drought policies and initiatives (Bressers et al. 2013).

Moving forward, there is a critical need to shift from a crisis-oriented management approach to a risk-based (or even resilience-based) management approach. In addition, further integration and strengthening of various policy instruments, as suggested by the Blueprint for Safeguarding, that aim to promote policy measures, such as water efficiency, across water, land, and nature, and other management and policy spaces, are necessary to begin catalyzing such a shift. More support, in the form of financial mechanisms, at all policy levels is also essential, particularly within more complex policy mixes such as the WFD and the CAP. At the moment, the only policy instrument directly tackling drought that exists at the European level is the Europeans Commission's Communication on water scarcity and drought. However, due to its lesser status in relation to Directives, the Communication is still weak and lacks teeth in the policy landscape. Somehow coupling WS&D with the

⁶Natural Water Retention Measures, <http://www.nwrm.eu/concept/3857>.

Table 2.2 Policy instruments and strategies and their potential to contribute to European drought and water scarcity policies in the different environmental domains

Policies	Water			Nature	Agriculture
	Water supply	Water saving	Water allocation		
Water Framework Directive	●	○	●	○	○
Floods Directive	○	○	●	○	○
Habitats Directive/ Birds Directive	○	○	●	●	○
Groundwater Directive	●	○	○	○	●
Water Scarcity and Drought policy	●	●	●	●	●
Blueprint to Safeguard Europe's Water Resources	●	●	○	○	●
CAP	●	●	○	○	●
Relevance for EU drought policy: ● high, ○ medium, ○ low					

Floods Directive may offer one solution for upgrading the Communication while also supporting better integration of climate change-related events (please see Table 2.2).

In light of this, based on recommendations already set forth by Kampragou et al. (2011), we highlight several challenges that should be explored at the EU level. They include: (1) shifting from crisis management to risk management, (2) launching policy instruments and initiatives that promote water efficiency, (3) integrating environmental considerations when selecting drought mitigation actions, (4) increasing the knowledge base that informs policy instruments, (5) developing more holistic response and recovery frameworks and (6) harmonizing and disseminating policy instruments relating to drought and water scarcity.

Not surprisingly, an appropriate policy mix, consisting of a combination of mutually strengthening policy instruments, measures, and strategies is determining the success of European drought and water scarcity policies. This mix is ensuring the flexibility of policy responses that is needed to appropriately react to the water-related deterioration of land and water ecosystem caused by climate change.

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References

- Bressers H, O'Toole LJ Jr (2005) Instrument selection and implementation in a networked context. In: Elidas P, Hill MM, Howlett M (eds) *Designing government. From instruments to governance*. McGill-Queen's University, Montreal, pp 132–153
- Bressers H, de Boer C, Lordkipanidze M, Özerol G, Vinke-De Kruijf J, Furusho C, La Jeunesse I, Larrue C, Ramos M-H, Eleftheria Kampa, Stein U, Tröltzsch J, Vidaurre R, Browne A (2013) *Water governance assessment tool. With an elaboration for drought resilience*. Report to the DROP project. CSTM University of Twente, Enschede
- Council of the European Communities (1979) Council Directive of 2 April 1979 on the conservation of wild birds: (79/409/EEC). <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31979L0409&from=EN>. Accessed 17 Dec 2015
- EC (2012) Communication from the Commission to the European Parliament the Council the European Economic and Social Committee and the Committee of the Regions A Blueprint to Safeguard Europe's Water Resources. COM (2012) 673 final, European Commission, Brussels, p 24
- Estrela T, Vargas E (2012) Drought management plans in the European Union. The case of Spain. *Water Resour Manag* 26(6):1537–1553
- European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf. Accessed 17 Dec 2015
- European Commission (2007a) Accompanying document to the communication from the commission to the Council and the European Parliament on Addressing the challenge of water scarcity and droughts in the European Union—Impact Assessment. COM (2007) 414 final, Brussels
- European Commission (2007b) Communication from the Commission to the European Parliament and the Council on addressing the challenge of water scarcity and droughts in the European Union. COM (2007) 414 final, Brussels
- European Commission (2010) Second follow-up report to the communication on water scarcity and droughts in the European Union: COM (2010) 228 final. http://ec.europa.eu/environment/water/quantity/eu_action.htm. Accessed 14 Dec 2015
- European Commission (2011) Report from the commission to the European Parliament and the council: third follow up report to the communication on water scarcity and droughts in the European Union COM (2007) 414 final. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0133&from=EN>. Accessed 17 Dec 2015
- European Commission (2012a) A blueprint to safeguard Europe's water resources. COM (2012) 673 final, Brussels <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0673>. Accessed 17 Dec 2015

- European Commission (2012b) Format for a prioritised action framework (PAF) for Natura 2000: for the EU multiannual financing period 2014–2020. <http://ec.europa.eu/environment/nature/natura2000/financing/docs/PAF.pdf>. Accessed 17 Dec 2015
- European Commission (2012c) Report on the review of the European water scarcity and droughts policy. Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: COM (2012) 672 final. http://www.semide.net/media_server/files/semide/topics/waterscarcity/report-review-european-water-scarcity-and-droughts-policy/Water_Scarcity_COM-2012-672final-EN.pdf. Accessed 14 Dec 2015
- European Commission (2013) Agricultural policy perspectives brief N°5: Overview of CAP reform 2014–2020, Dec 2013, Brussels
- European Commission (2015) Communication from the EC to the EP and Council, The WFD and the floods directive: action towards the good status of EU's water and to reduce flood risks. COM (2015) 120 final. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0120&from=EN>. Accessed 16 Dec 2015
- European Commission—DG AGRI and Rural Development (2013) Overview of CAP reform 2014–2020. http://ec.europa.eu/agriculture/policy-perspectives/policy-briefs/05_en.pdf. Accessed 15 Dec 2015
- European Commission—DG ENV (2007) Water scarcity and droughts in-depth assessment: second interim report. http://ec.europa.eu/environment/water/quantity/pdf/comm_droughts/2nd_int_report.pdf. Accessed 17 Dec 2015
- European Commission—DG ENV (2011) Towards better environmental options for flood risk management. http://ec.europa.eu/environment/water/flood_risk/pdf/Note_Better_environmental_options.pdf. Accessed 17 Dec 2015
- European Commission—DG ENV (2012) Water scarcity & droughts: 2012 policy review—building blocks non-paper. [https://www.bdew.de/internet.nsf/id/DE_Non-paper_on_Water_Scarcity_Droughts_-_2012_Policy_review_-_Building_blocks_April_2010/\\$file/Br%C3%BCssel_20100421_final.pdf](https://www.bdew.de/internet.nsf/id/DE_Non-paper_on_Water_Scarcity_Droughts_-_2012_Policy_review_-_Building_blocks_April_2010/$file/Br%C3%BCssel_20100421_final.pdf). Accessed 17 Dec 2015
- European Commission—JRC (2015) Reports of severe drought events: drought news in Europe. <http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1051>. Accessed 10 Dec 2015
- European Community (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy: 2000/60/EC. <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32000L0060>. Accessed 17 Dec 2015
- European Community (2013) Annex II in Regulation (EU) No 1306/2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management and monitoring of the common agricultural policy and repealing Council Regulations (EEC) No 352/78, (EC) No 165/94, (EC) No 2799/98, (EC) No 814/2000, (EC) No 1290/2005 and (EC) No 485/2008
- European Environmental Agency (2009). Water resources across Europe—confronting water scarcity and drought. http://www.eea.europa.eu/publications/water-resources-across-europe/at_download/file. Accessed 1 Dec 2015
- European Environmental Agency (2010) Water resources: quantity and flows—SOER 2010 thematic assessment. <http://www.eea.europa.eu/soer/europe/water-resources-quantity-and-flows>. Accessed 17 Dec 2015
- European Environmental Agency (2015) State of nature in the EU: results from reporting under the nature directives 2007–2012. <http://www.eea.europa.eu/publications/state-of-nature-in-the-eu/download>. Accessed 10 Dec 2015
- European Union (2010) Water scarcity and drought in the European Union. <http://ec.europa.eu/environment/water/quantity/pdf/brochure.pdf>. Accessed 17 Dec 2015
- Farmer A, Bassi S, Fergusson M (2008) Water scarcity and droughts: European Parliament. Policy Department Economic and Scientific Policy. http://www.europarl.gr/resource/static/files/projets_pdf/water_scarcity.pdf. Accessed 12 Dec 2015

- Flanagan K, Uyarra E, Laranja M (2011) Reconceptualising the ‘policy mix’ for innovation. *Res Policy* 40(5):702–713
- Flörke M, Wimmer F, Laaser C, Vidaurre R, Stein U, Tröltzsch J, Dworak T, Stein U, Marinova NJF, Ludwig FSR, Giupponi C, Bosello F, Mysiak J (2011) Climate adaptation: modelling water scenarios and sectoral impacts. Final Report. http://climwatadapt.eu/sites/default/files/ClimWatAdapt_final_report.pdf. Accessed 28 Oct 2011
- Informal Council of Environment Ministers (2007) Water scarcity and drought (WS&D). https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj6aG6xLrJA-hVFeQ8KHevJBrYQFggfMAA&url=http%3A%2F%2Fwww.semide.net%2Ftopics%2FWaterScarcity%2Fbackground%2FWSDBackgroundext25jul07_EN.pdf%2Fdownload%2F1%2FWSDBackgroundext25jul07_EN.pdf&usq=AFQjCNEAve740bAHcROftzwHifgQNgG9Aw&sig2=2HwoDRjXn-Lq2n_ilF4Wi-g&bv=bv.108194040,d.ZWU. Accessed 17 Dec 2015
- Jol A, Šťastný P, Raes F, Lavalle C, Menne B, Wolf T (2008) Impacts of Europe’s changing climate: 2008 indicator-based assessment. European Environment Agency. http://www.eea.europa.eu/publications/eea_report_2008_4. Accessed 17 Dec 2015
- Kallis G, Briassoulis H, Liarikos C, Petkidi K (2005) Integration of EU water and development policies: a plausible expectation? In: Briassoulis H (ed) Policy integration for complex environmental problems: the example of mediterranean desertification. Ashgate, Burlington, Vt
- Kampragou E, Apostolaki S, Manoli E, Froebrich J, Assimacopoulos D (2011) Towards the harmonization of water-related policies for managing drought risks across the EU. *Environ Sci Policy* 14(7):815–824
- Kaufmann-Hayoz R, Bättig C, Bruppacher S, Defila R, Di Giulio A, Flury-Kleubler P, Friederich U, Garbely M, Gutscher H, Jäggi C, Jegen M, Mosler H-J, Müller A, North N, Ulli-Beer S, Wichteremann J (2001) A typology of tools for building sustainability strategies. In: Kaufmann-Hayoz R, Gutscher H (eds) Changing things—moving people. Birkhäuser Basel, Basel, pp 33–107
- Kazmierczyk P, Reichel A, Bakas I, Isoard S, Kristensen P, Werner B, Jol A, Kurnik B, Fogh Mortensen L, Ribeiro T, Adams M, Lükewille A, Christiansen T, Meiner A, Jones A, van Aardenne J, Fernandez R, Spyropoulou R, Collins R (2010) The European environment—state and outlook 2010: water resources—quantity and flows. <http://www.eea.europa.eu/soer/europe/water-resources-quantity-and-flows>. Accessed 17 Dec 2015
- Landgrebe R, Naumann S, Cavalieri S, Wunder S (2011) Policy context and policy recommendations for LEAD in cropland—general: Deliverable 141, <http://www.envistaweb.com/leddris/>. Accessed 16 Dec 2015
- Mysiak J, Maziotis A (2012) Economic policy instruments for sustainable water. Presentation at the 1st Pan-EU drought dialogue forum Cyprus. http://www.eu-drought.org/media/default.aspx/emma/org/10815374/7.+EPIWATER_Maziotis__31Oct2012.pdf. Accessed 1 Dec 2015
- Portuguese Ministry of Environment, Spatial Planning and Regional Development (2007) Water scarcity and drought. A priority of the portuguese presidency. <ftp://infoeuropa.euroid.pt/files/database/000042001-000043000/000042875.pdf>. Accessed 12 Dec 2015
- Quevauviller P (2011) Adapting to climate change: reducing water-related risks in Europe—5EU6 policy and research considerations. *Environ Sci Policy* 14(7):722–729
- Quevauviller P (2014) European water policy and research on water-related topics—an overview. *J Hydrol Part B* 518:180–185
- Reichardt K, Rogge K (2015) How the policy mix and its consistency impact innovation: findings from company case studies on offshore wind in Germany. Working Paper Sustainability and Innovation (7):1–37
- Rossi G (2009) European Union policy for improving drought preparedness and mitigation. *Water Int* 34(4):441–450
- Sánchez Navarro R, Schmidt G, Benítez Sanz C, Dubar M, Hernández T, José M, Raso Quinta J, Seiz Puyuelo R (2012) Environmental flows as a tool to achieve the WFD objectives:

- Discussion Paper. <http://www.pianc.org/downloads/euafd/Eflows%20discussion%20paper%20draft%20NAVI%20TG%20response%20v2%2010-8-12.pdf>. Accessed 15 Dec 2015
- Schmidt G, Benítez JJ, Benítez C (2012) Working definitions of water scarcity and drought. https://circabc.europa.eu/sd/d/02a234f7-ac60-4f81-bd8d-a3a0973e77d1/55171-Drought-WS_Definitions_V4-27Abril2012.doc. Accessed 12 Dec 2015
- Stanley K, Depaoli G, Strosser P (2012) Comparative study of pressures and measures in the major river basin management plans in the EU. Task 4b. Financing water management and the economic crisis—a review of available evidence. ACTeon, France
- Tallaksen LM (2007) Tørke—også i ikke-tørrestrøk? Presentation at Faglig-Pedagogisk Dag (2007) www.geo.uio.no/for_skolen/ (cited not accessed)
- Vanneuville W, Werner B, Uhel R (2012) Water resources in Europe in the context of vulnerability: EEA 2012 state of water assessment. EEA report 11/2012. Office for Official Publications of the European Union, Luxembourg
- Vogt J (2011) Developing the European Drought Observatory (EDO). <http://www.isprambiente.gov.it/files/ec-expert/vogt.pdf>
- Vogt J, Barbosa Ferreira P, Hofer B, Singleton A (2011) Developing a European drought observatory for monitoring, assessing and forecasting droughts across the European Continent. In Geophysical Research Abstracts (13)
- Water Scarcity and Droughts Expert Network (2007) Drought management plan report: including agricultural, drought indicators and climate change aspects. http://www.magrama.gob.es/imagenes/en/090471228012641f_tcm11-17923.pdf. Accessed 12 Dec 2015
- Wilhite DA, Svoboda MD, Hayes MJ (2007) Understanding the complex impacts of drought. A key to enhancing drought mitigation and preparedness. *Water Resour Manage* 21:763–774
- Wilhite DA, Sivakumar MV, Pulwarty R (2014) Managing drought risk in a changing climate: The role of national drought policy. *Weather Clim Extremes* 3:4–13