04.
Freshwater

Key messages

- Water is an essential resource for human health, agriculture, energy production, transport and nature. Securing its sustainable use remains a key challenge globally and within Europe.

- Currently only 40 % of Europe's surface water bodies achieve good ecological status and wetlands are widely degraded, as are 80-90 % of floodplains. This has a critical impact on the conservation status of wetland habitats and the species that depend on them. Although point source pollution, nitrogen surpluses and water abstraction have been reduced, freshwaters continue to be affected by diffuse pollution, hydromorphological changes and water abstraction.

- Diffuse pollution and water abstraction pressures are expected to continue in response to intensive agricultural practices and energy production. This requires balancing societal demands for water with ensuring its availability for nature. Climate change is likely to change the amount of water available regionally, increasing the need for either flood protection or drought management and making this balance more difficult to achieve.

- Improved implementation and increased coherence between EU water-related policy objectives and measures is needed to improve water quality and quantity. Looking ahead it will also become increasingly critical to address and monitor the climate-water-ecosystem-agriculture nexus and connection with energy needs.

- It is on the river basin scale that effective solutions for water management can be found and essential knowledge is being developed through the implementation of river basin management plans under the Water Framework Directive. Solutions such as natural water retention measures, buffer strips, smart water pricing, more efficient irrigation techniques and precision agriculture will continue to grow in importance. An ecosystem-based management approach, considering multiple environmental objectives and co-benefits to society and the economy, will further support progress.

Thematic summary assessment

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Water ecosystems and wetlands	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Hydromorphological pressures	Deteriorating trends dominate	Developments show a mixed picture	☒ Not on track
Pollution pressures on water and links to human health	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Water abstraction and its pressures on surface and groundwater	Improving trends dominate	Developments show a mixed picture	☒ Not on track

Note: For the methodology of the summary assessment table, see the introduction to Part 2. The justification for the colour coding is explained in Section 4.3, Key trends and outlooks (Tables 4.2, 4.3, 4.4 and 4.5).

04.
Freshwater

4.1
Scope of the theme

Clean water is an essential resource for human health, agriculture, industry, energy production, transport, recreation and nature. Ensuring that enough water of high quality is available for all purposes, including for water and wetland ecosystems, remains a key challenge globally and within Europe. Europe's waters and wetlands remain under pressure from water pollution from nutrients and hazardous substances, overabstraction of water and physical changes. Climate change is expected to exacerbate many of these pressures, which depending on the pressure, may act on groundwater, rivers, lakes, transitional and coastal waters, as well as the riparian zone and wetlands. In return, this reduces the quality of the natural services provided by those ecosystems (Figure 4.1).

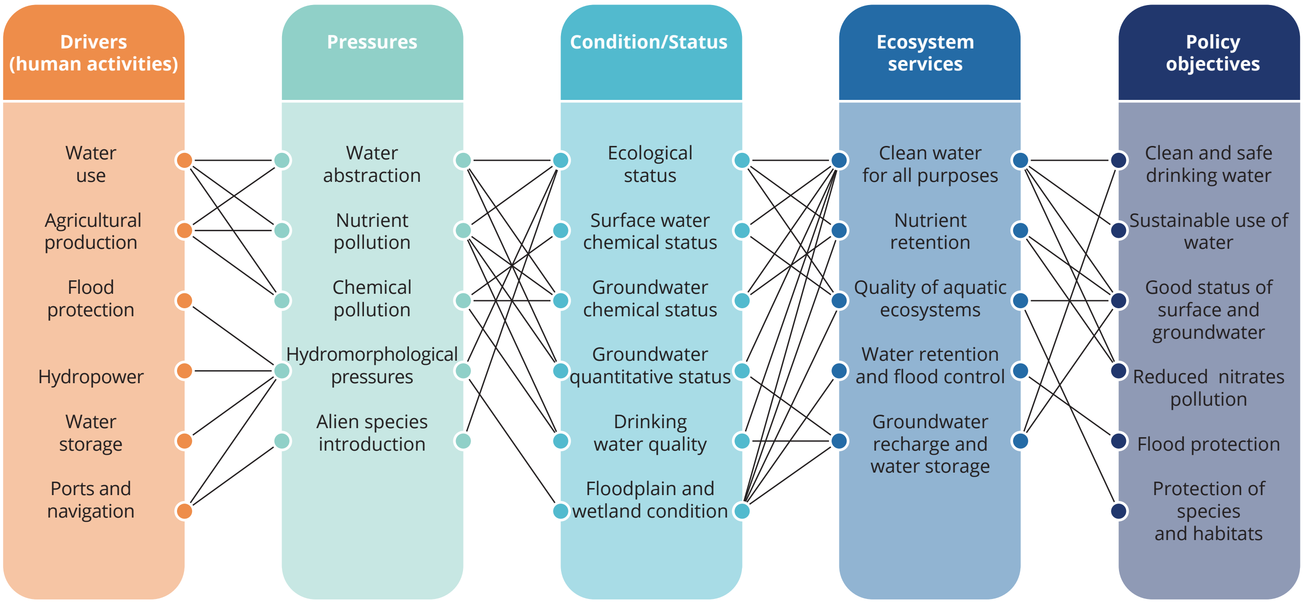
The remaining challenge is to further reduce the many pressures on water. These are linked to intensive agriculture, as well as other human uses that are economically important, but unfortunately also add large pressures to the environment. Improving water status will support improvements in biodiversity (Chapter 3) and in the marine environment (Chapter 6). Finally, Europe indirectly uses freshwater resources in countries outside its boundaries by importing goods with water-intensive production chains (Chapter 1).

Europe's waters are affected by pressures from pollution, overabstraction and physical changes.

4.2
Policy context

Europe's water policy has developed gradually over the last few decades. The first EU policies aiming to improve water quality date back to 1991, with the adoption of the Urban Waste Water Treatment and Nitrates Directives (EU, 1991a, 1991b), both targeting (among other things) reducing pollution pressures on water. In 2000, with the adoption of the Water Framework Directive (EU, 2000), an integrated ecosystem-based approach to managing water was introduced. Public safety and health objectives were secured by the Drinking Water, Bathing Water and Floods Directives (EU, 1998, 2006, 2007), and presently a proposal on the minimum requirements for water reuse is under discussion. While the directives tend to be very specific, the importance of water in relation to biodiversity and marine policies is pursued through the EU biodiversity strategy to 2020 (EC, 2011a) and the priority objectives of the Seventh Environment Action

FIGURE 4.1 **Selection of links between drivers, pressures, condition, ecosystem services and policy objectives**



Note: BOD, biological oxygen demand.

Source: Modified from Maes et al. (2018).

Programme, or 7th EAP (EU, 2013a). Water quantity remains an area of national competence, although issues linked to overall sustainable water use are of transboundary and thus European interest (EC, 2011b). EEA member countries that are not Member States of the EU also implement water policies inspired by the Water Framework and Floods Directives. Switzerland has set binding targets and requirements for its water policy and collaborates with its neighbours to achieve shared objectives through International Commissions for the Protection of the Rhine, Lake Constance and Lake Geneva. Turkey developed a national river basin management strategy for 2014-2023 with a view to ensuring the sustainable management of water resources in line with EU legislation. Iceland has adopted the Water Framework Directive, and it is working towards its implementation, albeit on a different timeline from the rest of the EU and Norway.

Europe's water policy also contributes to United Nations (UN) Sustainable Development Goal 6 (SDG 6) (UN, 2016) (Table 4.1) and to a range of other policies, for example in the areas of biodiversity and nature (Chapter 3), the marine environment (Chapter 6) and chemical pollution (Chapter 10). Conversely, another range of policies also influences freshwater: air pollution policies (Chapter 8), industrial pollution policies (Chapter 12), and sectoral policies (Chapter 13). An overview of environmental pressures stemming from agriculture is covered in Chapter 13. In the context of water it is important to mention that the common agricultural policy (CAP) includes requirements that support achieving environmental objectives. Funding provided under CAP Pillar II potentially supports the Water Framework Directive's objectives. Table 4.1 gives an overview of selected policies on freshwater addressed in this chapter.

4.3
Key trends and outlooks

4.3.1
Water ecosystems and wetlands

► See Table 4.2

In the context of European policy, surface water ecosystems are defined as rivers, lakes, and transitional and coastal waters. In addition many wetlands such as floodplains, bogs and mires depend on the availability of water for their existence. They are often found in the proximity of surface waters or depend on groundwater. These ecosystems provide important regulating ecosystem services, such as water purification, carbon capture

TABLE 4.1 Overview of selected policy objectives and targets

Policy objectives and targets	Sources	Target year	Agreement
Water ecosystems and wetlands			
Achieve good ecological status of all water bodies in Europe	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Protect, conserve and enhance freshwater as well as the biodiversity that supports this natural capital	7th EAP, PO 1 (EC, 2013)	2050	Non-binding commitment
Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	SDG 6.6 (UN, 2016)	2020	Non-binding commitment
Hydromorphological pressures			
To assess and manage flood risks, aiming to reduce the adverse consequences for human health, environment and cultural heritage	Floods Directive (2007/60/EC)	2015	Legally binding commitment
Good hydromorphological status (quality element supporting good ecological status)	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Pollution pressures on water and links to human health			
Achieve good chemical status of all surface and groundwater bodies	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Reducing and further preventing water pollution by nitrates from agricultural sources	Nitrates Directive (91/676/EEC)	N/A	Legally binding commitment
To protect the environment in the EU from the adverse effects of urban waste water through collection and treatment of waste water. Implementation period depends on year of accession	Urban Waste Water Treatment Directive (91/271/EEC)	EU-15: 1998-2005 EU-13: 2006-2023	Non-binding commitments
To preserve, protect and improve the quality of the environment and to protect human health	Bathing Water Directive (2006/7/EC)	2008	Legally binding commitment
To protect human health from adverse effects of contamination of water for human consumption	Drinking Water Directive (98/83/EC)	2003	Legally binding commitment
Eliminate challenges to human health and well-being, such as water pollution and toxic materials	7th EAP, PO 3 (EC, 2013)	2050	Non-binding commitment
Improve water quality by reducing pollution	SDG 6.3 (UN, 2016)	2030	Non-binding commitment
Water abstraction and its pressures on surface- and groundwater			
Achieve good groundwater quantitative status of all groundwater bodies	Water Framework Directive (2000/60/EC)	2015	Legally binding
Water stress in the EU is prevented or significantly reduced	7th EAP; PO 2 (EC, 2013)	2020	Non-binding commitment
Water abstraction should stay below 20 % of available renewable water resources	Roadmap to a resource efficient Europe (EC, 2011b)	2020	
Substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater	SDG 6.4 (UN, 2016)	2030	Non-binding commitment
Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	SDG 6.5 (UN, 2016)	2030	Non-binding commitment

Note: EU-13, countries joining the EU on or after 1 May 2004; EU-15, countries joining the EU (or its predecessors) before 30 April 2004; PO, Priority objective; N/A, non-applicable.

and storage, and flood protection, in addition to providing habitats for many protected species. Hence, achieving good status of Europe's surface waters not only serves the objective of providing clean water but also supports the objective of providing better conditions for some of Europe's most endangered ecosystems, habitats and species, as listed under the Habitats and Birds Directives. Unfortunately, however, both surface water ecosystems and wetlands are under considerable pressure.

Trends in the ecological status of water

The quality of surface water ecosystems is assessed as ecological status under the Water Framework Directive. The ecological status assessment is performed for 111 000 water bodies in Europe and it is based on assessments of individual biological quality elements and supporting physico-chemical and hydromorphological quality elements (definitions can be found in EEA, 2018b and Section 4.3.2). A recent compilation of national assessments, done as part of the second river basin management plans required under the Water Framework Directive (EEA, 2018b; EC, 2019), shows that 40 % of Europe's surface water bodies achieve good ecological status ([1]). This is the same share of water bodies achieving good status as reported in the first river basin management plans. Lakes and coastal waters tend to achieve better ecological status than rivers and transitional waters, and natural water bodies are generally found to have better ecological status than the ecological potential found for heavily modified or artificial ones. Across Europe, there is a difference between river basin districts in densely populated central Europe, where a high proportion of water bodies do not achieve good ecological status, and those in northern Scandinavia, Scotland and some eastern European and southern river basin districts, where more tend to achieve good ecological status (Map 4.1).

40 %

of the surface water bodies in Europe have a good ecological status.

The ecological status assessment is based on the 'one out, all out principle', i.e. if one assessed element of quality fails to achieve good status, the overall result is less than good status. Thus, the status of individual quality elements may be better than the overall status. Overall, for rivers, 50-70 % of classified water bodies have high or good status for several quality elements, whereas only 40 % of rivers achieve good ecological status or better. Since the first river basin management plans, many more individual quality elements have been monitored, improving the confidence of assessments, even if the variability of methods used by Member States remains so large that comparisons have to be made with caution (Table 4.2).

Trends in wetlands

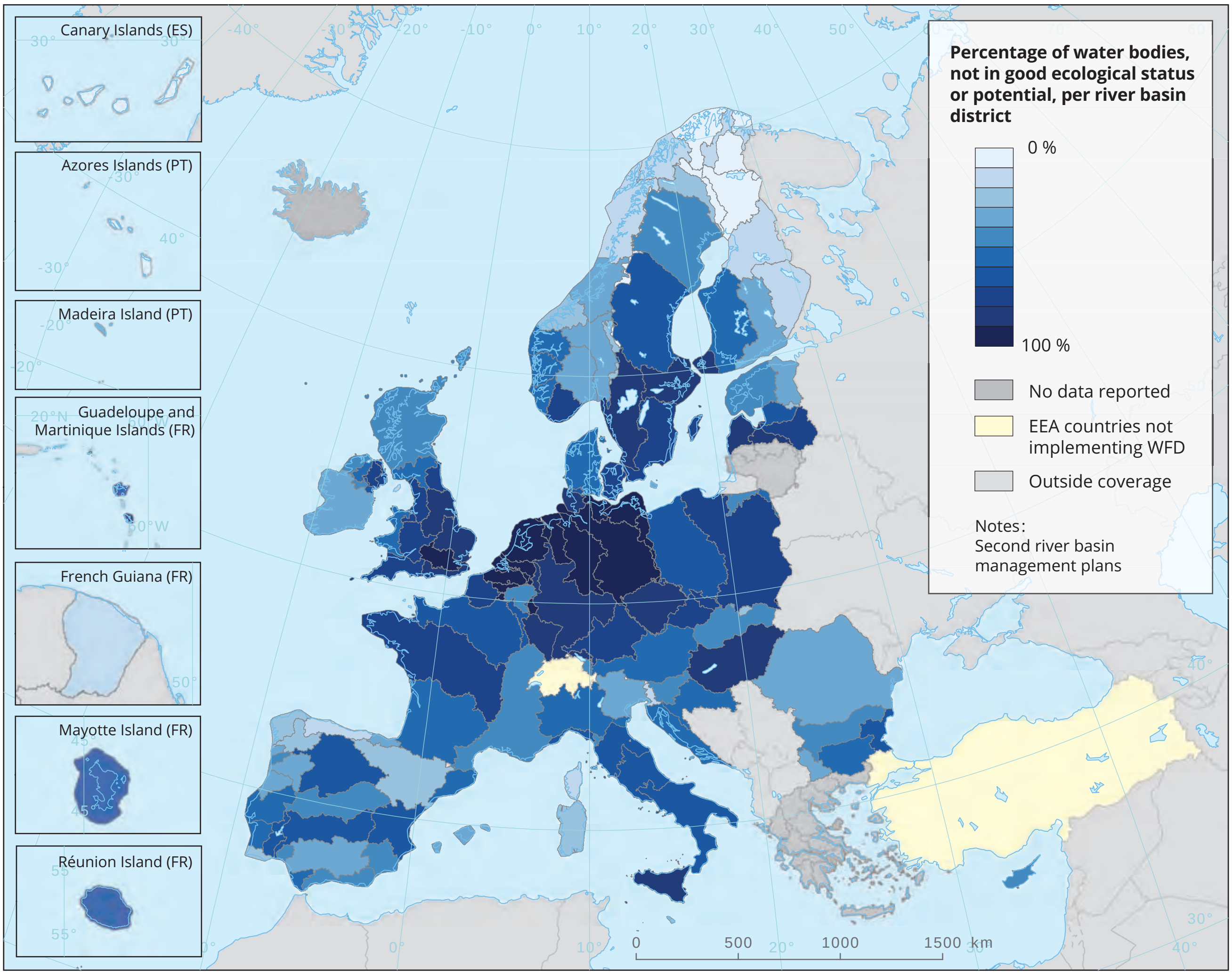
Across Europe, wetlands are being lost. Between the years 2000 and 2018 the already small area of wetlands decreased further by approximately 1 % (Chapter 5). Many wetlands are found in undisturbed floodplains, the areas next to the river covered by water during floods. Scientific estimates suggest that 70-90 % of floodplains are degraded (Tockner and Stanford, 2002; EEA, 2016). As a consequence, the capacity of floodplains to deliver important and valuable ecosystem services linked to flood protection and healthy functioning of river ecosystems has been reduced, ultimately reducing their capacity to support achieving good ecological and conservation status. The conservation status of many freshwater habitats and species listed in the Habitats and Birds Directives is not changing, and it remains predominantly unfavourable or bad (Table 4.2). The habitat group 'Bogs, mires and fens' (different wetland types) has the highest proportion of unfavourable assessments — almost 75 % (Chapter 3). The group 'Freshwater habitats' is also predominantly unfavourable, as are assessments of amphibians (Chapter 3).

Pressures and driving forces

The main reasons for not achieving good ecological status are linked to hydromorphological pressures (40 %), diffuse pollution (38 %) and water abstraction (Section 4.4). The understanding of the links between status and pressures has improved with the development of river basin management plans, and it is expected that the implementation of the Water Framework Directive will increasingly lead to a reduction in the most critical pressures and thus to improved ecological status of surface water bodies (Table 4.2). Freshwater habitats are subject to many of the same pressures as surface water bodies, and they are often very sensitive to overabstraction of water. In reporting under the Habitats Directive for freshwater habitats, changes in hydrology are most frequently reported as being important, as is 'pollution to surface waters' Chapter 3). In parts of Europe where groundwater abstraction is high, the pressure on wetlands

([1]) The WISE WFD database that underlies the WFD visualisation tool is subject to updates. This may lead to values in the visualisation tool differing from those presented in this chapter. The numbers in the text refer to values available on 1 January 2019. Recently, the database has been updated by Norway and Ireland, and these updates are captured in Map 4.1 and Map 4.2 but not in the values provided in the text.

MAP 4.1 **Country comparison — results of assessment under the Water Framework Directive of ecological status or potential shown by river basin district**



Notes: Caution is advised when comparing results among Member States as the results are affected by the methods used to collect and analyse data and often cannot be compared directly.
RBMP, river basin management plan.

Coverage: EU Member States, Norway and Iceland.

Source: EEA (2018e).

TABLE 4.2 Summary assessment — water ecosystems and wetlands

Past trends and outlook		
Past trends (10-15 years)		There has been mixed progress with 40 % of Europe's surface waters in good ecological status and some improvements in individual biological quality elements observed in the past 6 years. The conservation status of freshwater protected habitats and species is not changing, and remains predominantly unfavourable or bad.
Outlook to 2030		Continued progress is expected as implementation of the Water Framework Directive continues. Implementation of available provisions within the Water Framework, Floods, Habitats and Birds Directives to improve the conservation status of water-dependent habitats and species, by increasing the area of natural floodplains and wetlands, will be required to deliver improvements.
Prospects of meeting policy objectives/targets		
2020	⊠	Europe is not on track to meet the objective of achieving good ecological status for all surface waters by 2020. Europe is not on track to meet the 2020 target of improving the conservation status of protected species and habitats (bogs, mires, fens, freshwater habitats and amphibians) and the cumulative pressures remain high.
Robustness		The EEA has collated EU Member States' assessments made under the Water Framework Directive. While each assessment is based on observations and can be considered robust, differences between approaches among EU Member States make comparisons challenging. The considerable loss of floodplains and wetlands is well documented. Outlooks are based primarily on expert judgement and assume that management implemented under EU policies will be effective and lead to some improvement. Knowledge gaps remain large for habitats and species not directly encompassed by EU legislation.

and freshwater ecosystems can be considerable. If they are designated as Natura 2000 sites, freshwater habitats and wetlands are protected through the associated management plans. An analysis of the share of inland surface water covered by protected areas showed that in the majority of European countries it is above the 17 % protection level set out in Aichi biodiversity target 11 (Bastin et al., 2019).

Europe is unlikely to achieve good ecological status for all surface waters by 2020.

4.3.2 Hydromorphological pressures

►See Table 4.3

Hydromorphology is considered a key parameter, because interaction between water, morphology, sediments and vegetation creates habitats that determine the river's ecological status. Hydromorphological pressures (2) are one of the main reasons that surface water bodies fail to achieve good ecological status; it is listed as a significant pressure for 40 % of surface water bodies (see sheet 'SWB pressures' in EEA, 2018e). Most of these pressures stem from physical alteration of river channels or of the riparian zone or shore or from dams, locks and other barriers.

These pressures occur because both the river and its floodplains are subject to a multitude of human uses that have altered their hydrology, morphology and connectivity as well as catchment land use over centuries. These uses are diverse and include increasing efforts to straighten rivers to make them navigable, drainage to gain agricultural land, urban development, and the need for ports, flood protection, water storage, hydropower and cooling water (Table 4.3). Transversal structures in particular (e.g. dams, weirs or locks) act as barriers for movement of sediment and biota. They also hamper the passage of fish, which is particularly important for the life cycles of eel, sturgeon or salmon because migration is part of their reproductive cycles. Fish are one of the biological quality elements assessed in rivers under the Water Framework Directive. Lateral

(2) Hydromorphology is the geomorphological and hydrological characteristic of a water body, which is also a condition for its ecosystem. Hydromorphological pressures are changes in the natural water body due to the human need to control flow, erosion and floods, as well as to drainage, river straightening and harbour construction.

TABLE 4.3 Summary assessment — hydromorphological pressures

Past trends and outlook		
Past trends (10-15 years)		Europe's water bodies have been subject to hydromorphological pressures for centuries. Although the Water Framework Directive has put in place initatives to reduce these pressures, they continue to affect 40 % of water bodies.
Outlook to 2030		Continued progress is expected as implementation of the Water Framework Directive continues. Full implementation of policies to restore rivers and put in place alternative flood protection methods, based on natural water retention measures, will be required to deliver improvements. Climate change may increase the magnitude and frequency of floods, leading to a greater demand for flood protection. It will also increase the demand for renewable energy generation, which is contributing to the expansion of hydropower in parts of Europe, resulting in increased hydromorphological pressures.
Prospects of meeting policy objectives/targets		
2020	☒	Europe is not on track to meet the objective of achieving good ecological status for all surface waters by 2020, and hydromorphological pressures are expected to continue to affect 40 % of Europe's surface waters.
Robustness		Hydromorphological pressures have been assessed by all EU Member States under the Water Framework Directive. While each assessment is based on observations and can be considered robust, differences in approaches make comparisons challenging, and a more detailed and comparable analysis at the European scale is lacking. The available outlook information is limited, so the assessment of outlook relies primarily on expert judgement and assumes that management implemented under EU policies will be effective and lead to some improvement.

connectivity between the river and its floodplain is also of critical importance, enabling floodplains to retain water for natural flood protection (EEA, forthcoming).

It is difficult to assess trends in hydromorphological pressures based on information reported under the Water Framework Directive because the categorisation of those pressures has changed between the reporting of the first and second river basin management plans, and no alternative method exists. However, EU Member States, Norway, Switzerland and Turkey are developing methods for assessing hydromorphological status (Kampa and Bussettini, 2018). At present, 55 different assessment methods are in use across Europe aiming to evaluate the impacts of hydromorphological pressures on the status of water bodies. Relevant measures needed to achieve good ecological status or potential are also considered as part of that work.

Drivers of change and solutions

Awareness is increasing of the important regulating ecosystem services provided by surface waters, floodplains and wetlands that have maintained their natural state to a high degree. Particularly important is the absence of barriers to fish migration, i.e. longitudinal connectivity, and the ability of floodplains to retain and filter water and nutrients, i.e. horizontal connectivity (Box 4.1). Fragmentation of rivers and of riparian habitats also has an impact on invertebrates and mammals. With the introduction of river basin and flood risk management plans, planning tools that support river restoration initiatives are in place and should ensure that more effort is made to restore Europe's rivers in the future. As restoration projects often involve using land differently, it is very important to involve citizens in the planning process. The results are, however, often seen as providing considerable added value, both because the resulting improved ecosystem services reduce management costs and because of the recreational opportunities that are achieved (Chapter 17).

4.3.3 Pollution pressures on water and links to human health

► *See Table 4.4*

Pollution of water with nutrients and harmful chemicals is of concern across

BOX 4.1 **Examples of solutions to hydromorphological pressures**

Removal of barriers

Barriers support hydropower production and water storage, and they may also help to control floods. They are, however, considered a hydromorphological pressure under the Water Framework Directive, and they are identified as one of the most common pressures on rivers in river basin management plans. Barriers disrupt the river ecosystem: they are not easily passable, and they alter flow regimes and sediment loads. The vast majority are small barriers, but the cumulative effects of many smaller barriers can be very large.

Many rivers in Europe have plans to restore populations of salmon, eel and sturgeon, which depend on migration to their headwaters for spawning. Several hundred thousand barriers are found in Europe's rivers, preventing migration. In the past, countries have implemented measures to make barriers passable for fish or to remove them altogether (EEA, 2018b, p. 73). In Estonia, the Cohesion Fund project 'Restoration of habitats in Pärnu river basin', aims to remove seven or eight dams on the river and its tributaries between 2015 and 2023, establishing a 3 000 km network of free-flowing water. In particular, removing the Sindi dam, located close to the river mouth, will make an important contribution to increasing spawning habitats. Many barriers are linked to hydropower production. In Iceland and Norway, most electricity is supplied by hydropower (73 % and 95 %, respectively). However, producing this energy has reduced the salmon population in the affected streams. According to the Norwegian Environment Agency, 23 % of Norway's salmon rivers have been negatively affected by river regulation schemes, the vast majority of which are for producing hydropower (NEA, 2018; Orkustofnun, 2018). Initiatives are in place to reduce the negative impacts, especially in relation to new projects (VRL, 2018). Barriers are also linked to reservoirs storing water between seasons to support crop production.

River restoration projects reconnecting rivers and floodplains

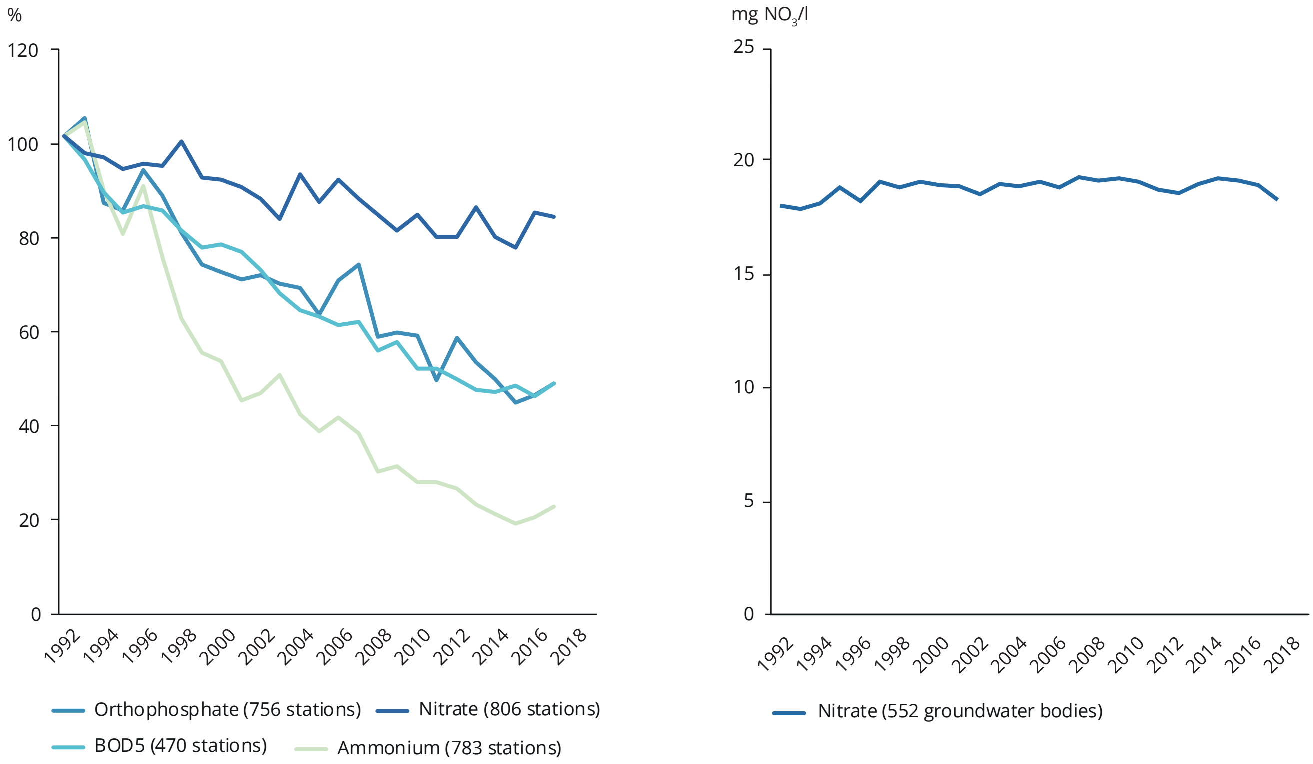
Because of the multiple benefits provided by natural floodplains, European policies encourage river basin management or conservation plans to favour restoration based on natural water retention measures, as well as conservation of existing natural floodplains. The need to change approaches to flood risk management because of the more uncertain future climate is often an underlying motivation; solutions based on natural properties are more cost-effective than structural measures in the long run (EEA, 2017a). Natural water retention measures refer to initiatives in which natural flood protection is provided at the same time as restoring the natural properties and functions of the floodplain, including its connection to the river. The measures can include structural changes to the river and floodplain and changes that involve managing how land is used within the floodplain (EEA, 2018c). Many examples of implemented natural water retention measures can be found on the European Natural Water Retention Measures Platform (NWRM, 2019). ■

Europe. The polluting substances stem from a range of activities linked to agricultural, industrial and household use. Emissions to water occur through both point source and diffuse pathways. Point sources refers to emissions that have a specific discharge location, whereas diffuse emissions have many smaller sources spread over a large area. Emissions into the atmosphere are spread, sometimes over large distances, eventually to be deposited on land or the sea surface (Chapter 8). Such pollutants can be transferred to rivers, lakes, and transitional, coastal and marine water as well as groundwaters. Transformation and storage may occur along the way, altering substances and creating multiyear timelags. Polluted water has an impact on human health and aquatic ecosystems. Faecal contamination from sewage is both unsafe and unpleasant, excess nutrients lead to eutrophication, which causes major disturbance of aquatic ecosystems, and chemicals that are harmful can, when limit values are exceeded, be a serious threat to both human and ecosystem health (Chapter 10).

Trends in nutrient concentrations

Declining concentrations of biological oxygen demand (BOD) and orthophosphate associated with industrial and urban waste water pollution are observed in most of Europe's surface waters (EEA, 2019c; Figure 4.2 and Table 4.4). A similar decline is also observed for other industrial emissions (Chapter 12) and nitrogen surplus has decreased (Chapter 13). However, concentrations of nitrates are declining much more slowly in groundwater and in rivers. These concentrations are more closely linked to agricultural diffuse pollution. The second river basin management plans showed that nitrate was the main pollutant affecting 18 % of the area of groundwater bodies, although 74 % of Europe's groundwater body area achieved

FIGURE 4.2 **Trends in 5-day biological oxygen demand (BOD5), orthophosphate and nitrates in rivers, and concentrations of nitrates in groundwater**



Note: Country coverage: EEA-39 (33 member countries and six cooperating countries).

Source: EEA (2019c).

good chemical status (EEA, 2018b and Table 4.4).

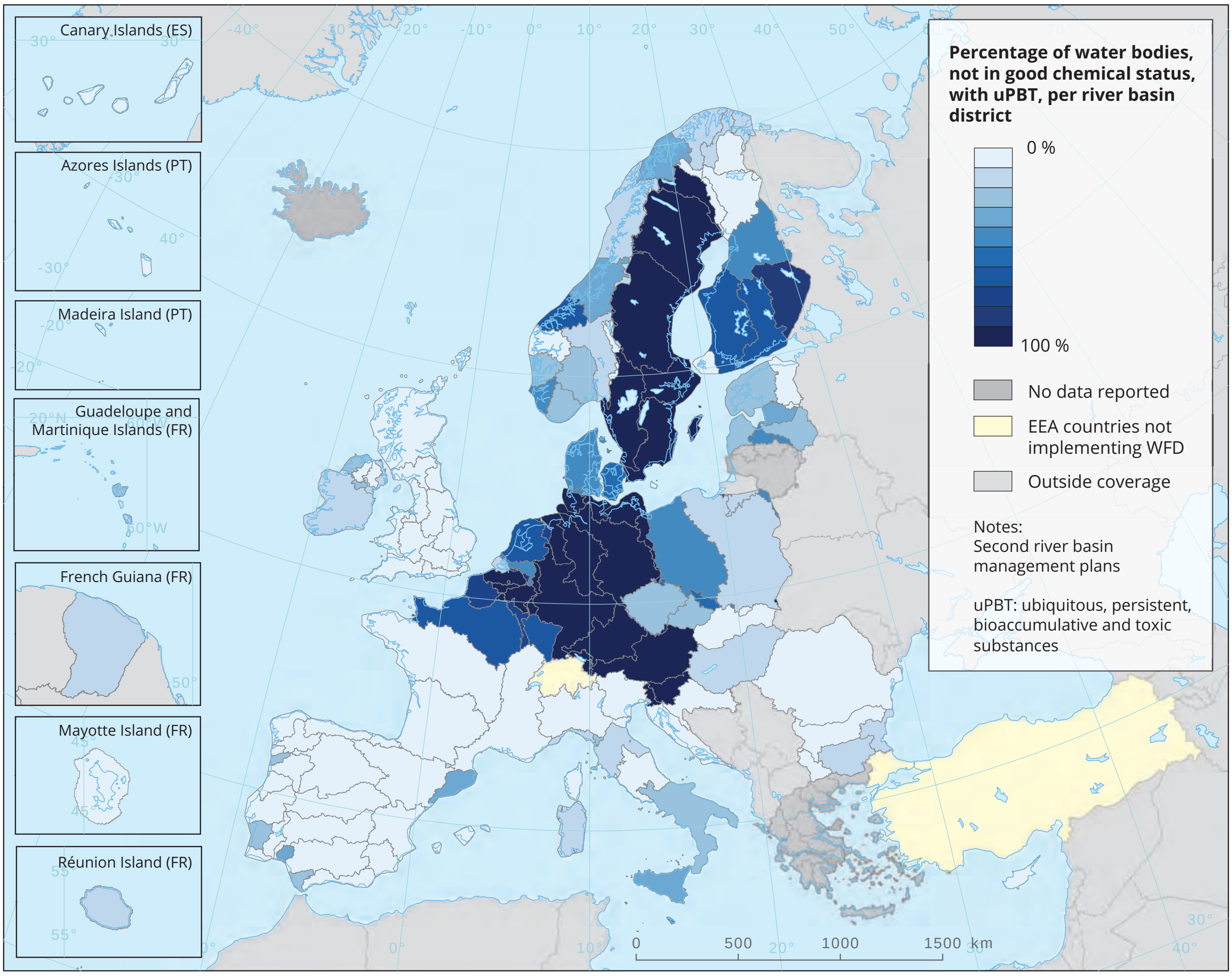
Trends in priority substances

In recent decades, legislation has helped ensure reduced emissions of certain hazardous substances (EU, 1976, 2000, 2010; EEA, 2018b). Under the Water Framework Directive, chemical status is assessed on a list of 33 'priority substances' that pose a significant risk to or via the aquatic environment, as set out in the Environmental Quality Standards Directive (EU, 2008b). The substances or groups of substances on the list include selected existing industrial chemicals, pesticides, biocides, metals and other groups such as polyaromatic hydrocarbons (PAHs), which are mainly produced by burning organic matter, and polybrominated diphenyl ethers (PBDEs), which have been used as flame retardants. While some priority substances occur naturally, most arise through human activities. To prevent further harm, their emissions must be reduced. The use of some of the most toxic substances, such as mercury and persistent organic pollutants, is heavily restricted, through both European legislation and international conventions.

> 38 %
>
> of the surface water bodies in Europe are in good chemical status.

In general, there is better knowledge about priority substances than more recently identified contaminants of concern (Chapters 5, 10, and 12).

MAP 4.2 **Country comparison — percentage of water bodies not achieving good chemical status**



Note: Assessment units are river basin districts. Caution is advised when comparing results among Member States, as the results are affected by the methods Member States have used to collect data and often cannot be compared directly.

Coverage: EU Member States, Norway and Iceland.

Source: EEA (2018d, SWB).

Concentrations in the environment of many 'legacy substances' — those that are no longer manufactured or used — are likely to continue to decline in water because their use has been phased out; however, new substances will emerge, and will need to be assessed and monitored for their risk to humans and the environment. A 2018 EEA report (EEA, 2018a) provides further information on chemicals in Europe's waters; see also Chapter 10 in this report for a broader discussion of chemicals in the environment.

Priority substances in water were assessed as part of the second river basin management plans by comparing the concentration of substances with their environmental quality standards. The assessment showed a relatively small number of substances that are responsible for most of the failures to achieve good chemical status: in particular, mercury, PBDE and PAHs are responsible for causing failure in a large number of water bodies. Overall, 38 % of Europe's surface water bodies achieved good chemical status (Map 4.2 and Table 4.4) (see also EEA, 2018a). The results, however, need to be interpreted with some caution. EU Member States have chosen different strategies for interpreting the results for mercury in their assessments. Mercury and PBDEs are ubiquitous, meaning that they are found everywhere, but only some countries have included them in their assessments. A subset of four of the priority substances and groups of substances, including mercury, is defined by the Environmental Quality Standards Directive as ubiquitous. Their concentrations will decline only very slowly, and their inclusion in chemical status under the Water Framework Directive may mask the trends in status of other substances. If these ubiquitous substances are omitted from the chemical assessment, only 3 % of Europe's surface waters fail to achieve good chemical status (EEA, 2018a, 2018e).

According to the information in the second river basin management plans, many of the priority substances listed do not exceed safety thresholds in the environment, which suggests that restrictions and emission controls, in particular, have been effective in preventing these substances from entering the environment. The chemical status of surface waters under the Water Framework Directive is assessed against a relatively short list of historically important pollutants — the priority substances. However, this misses the thousands of chemicals in daily use. There is a gap in knowledge at the European level over whether any of these other substances present a significant risk to or via the aquatic environment, either individually or in combination with other substances (EEA, 2018b). This discussion is further explored in Chapters 10 and 12, and in a 2018 EEA report (EEA, 2018a).

Drivers of change and solutions

The declining concentrations of BOD and nutrients in surface waters are associated with the considerable investments made in improving urban waste water treatment as a consequence of the Urban Waste Water Treatment Directive. There are still differences in the degree of urban waste water treatment among countries, but they are getting smaller (EEA, 2017b). The proportion of the population connected to urban waste water treatment plants in northern European countries has been above 80 % since 1995, and more than 70 % of urban waste water receives tertiary treatment. In central European countries, connection rates have increased since 1995 and are now at 97 %, with about 75 % receiving tertiary treatment. The proportion of the population connected to urban waste water treatment in southern, south-eastern and eastern Europe is generally lower than in other parts of Europe, but it has increased over the last 10 years and levels are now at about 70 % (EEA, 2017b). In spite of the implementation of urban waste water treatment, 15 % of surface water bodies fail to achieve good status due to point source pollution (see sheet 'pressures' in EEA, 2018e). Europe's bathing waters have also improved. In 2017, 95 % of bathing sites had good and excellent bathing water quality (EEA, 2019b). Water recreation such as beach holidays, swimming, kayaking, canoeing and rafting are of increasing interest to the European public and require safe bathing water. Areas with high ecological integrity have a higher potential for sustainable tourism.

> While water quality continues to improve, Europe is unlikely to achieve good chemical status for all water bodies by 2020.

Concentrations of some priority substances have decreased in surface waters as a result of improved emission controls (Chapter 12). However, although countries appear to have good knowledge of emissions, much of this knowledge does not extend to the European level. The EEA has found that emissions data, especially on emissions to water, reported under the Water Framework Directive or to the European Pollutant Release and Transfer Register (E-PRTR) or to the Water Information System for Europe (WISE), are incomplete and inconsistent, so there is no European-wide overview (EEA, 2018a).

Diffuse pollution remains a problem in Europe. It is mostly due to excessive emissions of nitrogen and phosphorus to water and to both historical and current emissions of mercury to the atmosphere and subsequently surface waters. Chemicals used as pesticides are also recognised as a source of diffuse pollution, although those used as biocides may reach urban waste water treatment plants. In the second river basin management plans, Member States identified that diffuse pollution is a significant pressure, affecting 38 % of surface water bodies and 35 % of the area of groundwater bodies (Table 4.4). The use of nitrogen-based fertilisers in agriculture is a primary cause of diffuse pollution (Chapter 13).

In recent decades, Europe has undertaken to reduce the use of mineral fertilisers in agriculture. As a consequence, the agricultural nitrogen surplus in the 28 EU Member States (EU-28) decreased by 18 % between 2000 and 2015 (EEA, 2019a) , but fertiliser application rates remain high, especially in those countries where agriculture is more intensive. In contrast, the phosphate surplus in the EU-28 increased by 14 % in the

TABLE 4.4 Summary assessment — pollution pressures on water and links to human health

Past trends and outlook		
Past trends (10-15 years)		Water quality has improved, although concentrations of nutrients in many places are still high and affect the status of waters. Drinking and bathing water quality continues to improve and some hazardous pollutants have been reduced.
Outlook to 2030		Continued progress in improving the chemical status of surface and groundwater is expected as implementation of the Water Framework Directive continues. Improvements in urban waste water treatment and industrial pollution will deliver improvements in pollution control, but diffuse pollution is expected to remain problematic. It is likely that pressures from newly emerging pollutants and mixtures of chemicals will be identified.
Prospects of meeting policy objectives/targets		
2020	☒	Europe is not on track to meet the objective of achieving good chemical status for all surface and groundwater bodies by 2020, with diffuse pollution expected to continue to affect 38 % of surface water bodies and 35 % of the groundwater body area. It is acknowledged that this result reflects that countries have taken differing approaches to interpreting the results for ubiquitous substances in their chemical status assessments.
Robustness		The assessment presented here is based partly on observations reported to the EEA as WISE-SoE data flows and partly on information provided as part of the Water Framework Directive reporting. While each assessment is based on observations and can be considered robust, differences in approaches make comparisons challenging, and a more detailed and comparable analysis at the European scale is lacking. The available outlook information is limited, so the assessment of outlook relies primarily on expert judgement and assumes that management implemented under EU policies will be effective and lead to some improvement. Countries have taken differing approaches tow interpreting the results for ubiquitous substances in their chemical status assessments.

shorter period between the reporting periods 2008-2011 and 2012-2015 (EC, 2018a). Today, Member States are implementing a number of measures, many of which are compulsory in nitrate vulnerable zones designated under the Nitrates Directive, both to reduce inputs and to reduce the impacts of a potential surplus. Those measures include farm-level nutrient management, standards for the timing of fertiliser application, appropriate tillage techniques, the use of nitrogen-fixing catch crops, crop rotation and buffer strips ([3]). Manure, and slurry storage and surplus management, as well as reducing the phosphate content of animal feed are also being implemented. In spite of these activities, the European Commission has concluded that further efforts to adapt measures to regional pressures are needed (EC, 2018a).

95 %

of bathing sites in the EU met good and excellent bathing water quality standards in 2017.

4.3.4 Water abstraction and its pressures on surface and groundwater

► *See Table 4.5*

Europe's water abstraction of 243 000 million cubic metres can be split among four main sectors: (1) household water use (14 %); (2) industry and mining (18 %); (3) cooling water for electricity production (28 %); and (4) agriculture (40 %) (Figure 4.3). Geographically there are, however, large differences in the sectors using more water. In western Europe public water supply, cooling water and mining are responsible for the majority of water abstraction, whereas in southern Europe and in Turkey agriculture uses the largest share.

Water is abstracted from surface and groundwater resources (76 % vs 24 %). In total, 89 % of European groundwater bodies achieve good quantitative status. Overall, water abstraction has decreased by 19 % (1990-2015), and on average abstraction corresponds to 13 % of the renewable freshwater

(3) Buffer strips are uncultivated strips along rivers and streams. They are used extensively across Europe as a response to the Nitrates Directive's requirement to reduce pollution. They reduce the movement of sediment, nutrients and pesticides from farmed fields. Their width varies depending on country and the severity of pollution problems.

FIGURE 4.3 **Water use in Europe by economic sector and by source**

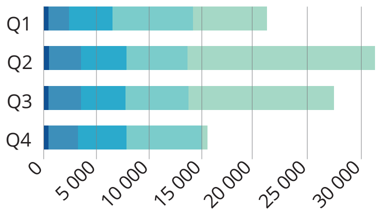
Annual water use by sectors
(%, in 2015)

Service industries	2
Households	12
Mining and quarrying, manufacturing, construction	18
Electricity	28
Agriculture	40

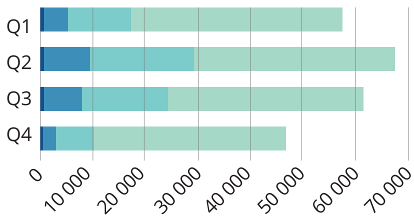
Annual freshwater abstraction by source
(%, in 2015)

Lakes	1
Artificial reservoirs	10
Groundwater	24
Rivers	65

Seasonal (million m^3, in 2015)

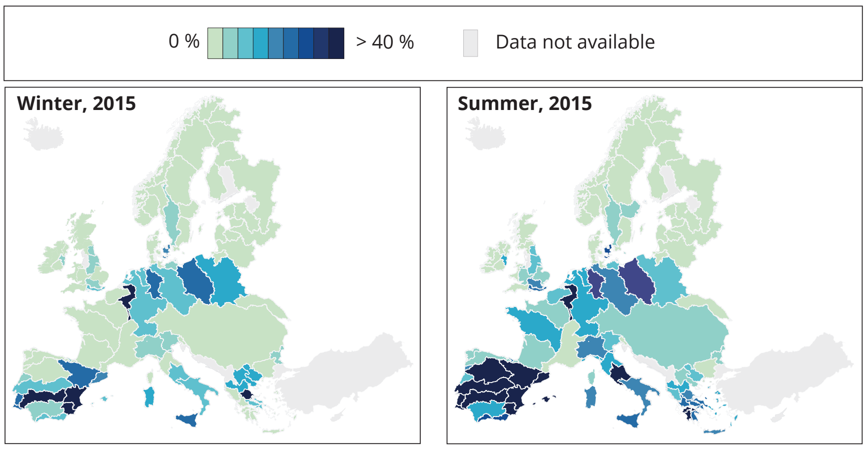


Seasonal (million m^3, in 2015)



In Europe, around 243 000 million cubic metres of water per year are abstracted for different sectors. Around 60 % of the water abstracted is returned to the environment, but it has often been polluted in the process. Water resources and their uses are unevenly distributed across Europe, leading to large differences in water stress.

Water exploitation by river basin



Note: The water exploitation index (WEI+) is a measure of water stress. It measures level of water scarcity by comparing water use with the renewable freshwater resource available. A WEI+ of above 20 % implies that a river basin is under stress, and a WEI+ of more than 40 % indicates severe stress and clearly unsustainable resource use. In summer 2015, 19 % of Europe's area experienced water stress.

Source: EEA core set indicator 018: the use of freshwater resources (EEA, 2018c).

TABLE 4.5 Summary assessment — water abstraction and its pressures on surface and groundwater

Past trends and outlook		
Past trends (10-15 years)		Water abstraction is decreasing and 89 % of Europe's groundwater bodies achieve good quantitative status.
Outlook to 2030		Continued focus on maintaining and improving the quantitative status of groundwater is expected as implementation of the Water Framework Directive continues. However, water stress remains a concern in some regions and the future availability of water will be affected by climate change.
Prospects of meeting policy objectives/targets		
2020	☒	Europe is not on track to meet the objective of achieving good quantitative status of all groundwater bodies by 2020. Water abstraction currently exceeds 20 % of the renewable freshwater resource in 19 % of Europe's area.
Robustness		Good quantitative status is based on EU Member State assessments. While each assessment is based on observations and can be considered robust, differences in approaches make comparisons challenging. Water abstraction is recorded by Member States, whereas water use is attributed to sectors using a model. Outlook information is limited, so the assessment of outlook relies primarily on expert judgement and assumes that management implemented under EU policies will be effective and lead to some improvement.

resource (Table 4.5). These numbers, however, mask large geographical variations. Increasingly, in countries with limited freshwater resources, such as Cyprus, Malta, and Spain, freshwater is supplied by desalinating seawater. The milestone set in the EU Roadmap to a resource efficient Europe, namely that water abstraction should stay below 20 % of available renewable water resources in Europe, was not achieved in 36 river basins, corresponding to 19 % of Europe's territory, in summer 2015. Consequently, around 30 % of the European population was exposed to water scarcity in summer 2015 compared with 20 % in 2014 (EEA, 2018c). In addition, most of the 11 % of groundwater bodies that do not achieve good quantitative status are found in Cyprus, Malta, and Spain, although in the United Kingdom good groundwater quantitative status is not reached for more than 50 % of groundwater bodies for the Thames and Anglian districts (EEA, 2018d, groundwater quantitative status). In these areas more than 20 % of the renewable resource may be used.

Water storage and abstraction places considerable pressure on the environment. While the water used is less than the amount abstracted because some water is returned to the environment, water scarcity still occurs in parts of Europe, both in the summer and in the winter (Figure 4.3). The underlying causes of water scarcity, expressed by the water exploitation index, differ: in western Europe it is primarily linked to cooling water needed for energy production and industry; in southern Europe water scarcity is linked to agriculture.

89 %

of groundwater bodies in the EU are in good quantitative status.

Climate change projections suggest that Europe will face changes in the temperature of water and in precipitation in the future (Chapter 7). Dry parts of Europe will become drier, wet parts will become wetter, and the seasonality and intensity of precipitation may change. Flood frequencies could change in response to altered precipitation patterns.

Europe is thought to have adequate water resources, but water scarcity and drought is no longer uncommon. In Europe, water scarcity can arise both as a consequence of the water demand for human activities and as a consequence of reduced meteorological inputs. Water scarcity is becoming increasingly frequent and widespread in Europe, and it is expected to get worse as changing seasonality precipitation decreases and temperatures increase in response to a changing climate. This will also make the environmental pressures of water abstraction worse, and the demand to better understand and manage the climate-water-ecosystem-agriculture nexus is likely to increase in the future.

4.4 Responses and prospects of meeting agreed targets and objectives

Enough water of good quality is a fundamental objective of Europe's environmental policy as well as for achieving the UN Sustainable Development Goals. In Europe this is supported through the comprehensive policy framework which includes setting legally binding objectives for Europe's water and for managing and reducing environmental pressures from hydromorphology, pollution and water abstraction. This policy framework will also support the delivery of Europe's contribution to SDG 6 on water.

In 2015, the second cycle of developing river basin management plans was finalised. Subsequently, the results were reported to the EU, and a comprehensive analysis of these results is presented in a 2018 EEA report (EEA, 2018b). A parallel process for the reporting of the first flood risk management plans under the Floods Directive has also taken place (EC, 2019). The European Commission is also developing a proposal for the Drinking Water Directive, to secure better protection of human health and to meet SDG 6, and an evaluation of the Urban Waste Water Treatment Directive, to align it with other policies to realise the potential for energy savings.

The Water Framework Directive and the Floods Directive operate on the scale of river basins. Water within a river basin is connected, and hence any decision that influences water quantity or quality in one part of the district can influence water in another part. Managing water quality and quantity requires detailed knowledge of water abstraction, land use and other pressures on the river basin scale. This knowledge is being developed as part of the implementation of river basin management plans under the Water Framework Directive and flood risk management plans under the Floods Directive. It is on this scale that effective solutions for water management can be found for Europe's 110 000 water bodies distributed across 180 river basins. River basin management plans already encompass transitional and coastal waters; they provide an effective means of regulating land-based pollution of the sea, especially with regard to nutrient and hazardous substance pollution.

Freshwaters remain significantly affected by diffuse pollution, hydromorphological changes and water abstraction.

Already, the process of developing river basin management plans has provided a better understanding of the status, the pressures causing failure to achieve good status, and the measures implemented to generate improvement. Member States have implemented measures that improve water quality and reduce pressures on hydromorphology. This knowledge is essential for achieving future improvements.

The analysis of the river basin management plans shows that Europe is on the way to achieving good status for water, but it also shows that the target of achieving good status for water in 2015 was not achieved. An initial analysis of flood risk management plans also shows that flood risk in Europe is being reduced and that many countries have plans for implementing natural water retention measures that will support hydromorphological improvements.

In recent decades, legislation has helped to ensure reduced emissions of certain hazardous substances (Section 4.4.3). However, there is a very large number of chemicals in use (Chapter 10) and only a few are listed as priority substances under the Water Framework Directive. The watch list, established under the Priority Substances Directive (EU, 2013b), provides a mechanism for gathering information on harmful substances for which information on concentrations in the aquatic environment is lacking.

One of the major successes for water quality has been the reduction of nutrient, certain hazardous substance and microbial pollution in rivers, lakes, and transitional and coastal waters following the implementation of urban waste water treatment, industrial emission controls and restrictions of chemicals. Although the Urban Waste Water Treatment Directive in particular is still not fully implemented in all countries, its effectiveness is clear. Where urban waste water treatment has been implemented, concentrations of nutrients, hazardous substances and microbial pollution in water have been reduced. This also supports achieving improved drinking water and bathing water quality, which in return support a high level of human health across Europe. Options for increased reuse of urban waste water are being considered by the European Commission (EC, 2018b). The EU supports the development of drinking water, urban waste water treatment and flood protection infrastructure through the European Regional Development Fund and the Cohesion Fund.

In contrast, it has proven much more complex to reduce diffuse pollution. The Nitrates Directive supports reducing diffuse nutrient pollution, which is one of the most commonly cited pressures on Europe's surface and groundwater bodies. In areas designated as nitrate vulnerable zones, the Nitrates Directive requires management of fertiliser use, and of manure and slurry storage and use, with the aim of reducing emissions. Efforts have, however, not yet been enough to sufficiently reduce diffuse pollution. Reducing diffuse pollution is a major societal challenge. It involves reducing atmospheric pollution and pollution from multiple small sources, and it applies to both nutrients and hazardous substances. Altering agricultural diffuse pollution requires steps to be taken at farm level to reduce pollution, which requires both farm-level investments and sometimes accepting reduced crop yields (Chapter 16). The new

CAP reform, which is currently being negotiated between the European Commission, Council and Parliament, contains several elements that could support achieving better progress to this end. For example, the proposed CAP reform requires EU Member States to increase their ambition to achieve the objectives of the Water Framework and Nitrates Directives compared with the 2014-2020 programming period, including by stimulating national coordination with environmental authorities. However, the final details of the new CAP could still change considerably (Chapter 13).

The EU Blueprint to safeguard Europe's water resources (EC, 2012) points to the insufficient use of economic instruments as one of several reasons for management problems not being adequately addressed. The fitness check of the Water Framework and Floods Directives, currently undertaken by the European Commission, includes the objective of enabling a discussion with all stakeholders. Input will encompass how the directives have brought about changes in the management of water and improvements in the state of water bodies and in the strategies to reduce the risk of flooding across the EU. The fitness check tackles both the functioning and the interactions of the directives, as well as the costs and benefits that the various stakeholders attach to them.

Chemical pollution remains an issue. Although legacy contaminants are declining, little is known about new substances. The large number of potentially hazardous chemicals makes monitoring programmes across Europe highly variable, and hence it is difficult to make a consistent assessment of chemical pollution on the European scale (Chapter 10).

Furthermore, the freshwater policy framework emphasises the integrated role of freshwater in achieving both biodiversity and marine environmental policy goals. Improving the status of water will also support achieving good conservation status of species and habitats under the Habitats and Birds Directives (EEC, 1979, 1992) and the good environmental status of marine waters under the Marine Strategy Framework Directive (EU, 2008a), especially for descriptors of eutrophication and hazardous substances. Many of the habitats and species protected under the Habitats and Birds Directives depend on the adequate availability of water and on good ecological and chemical status of surface waters. For example, 39 floodplain habitats and 14 bog, mire and fen habitats are listed in Annex I of the Habitats Directive. In many cases, the availability of surface- or groundwater is critical to achieving good conservation status. Thus, a clear link exists between the objectives of those directives. Similarly nutrient and chemical pollution in the marine environment often stems from land-based activities that need to be managed through river basin management plans under the Water Framework Directive. The Marine Strategy Framework Directive common implementation strategy has been very explicit on the need to develop this link to avoid having separate processes for the two directives, and this was further supported by Commission Decision (EU) 2017/848 on methodological standards (EU, 2017). However, while the requirements to link the directives are in place, and some coordination is likely to occur within Member States, the explicit outcome of this activity is not fully known at the European level. There are few mechanisms in place to insist on developing cross-policy strategies.

As it is anticipated that climate change impacts will increase towards 2030, water will also be affected, placing an additional demand on effective water management tools. Pricing and metering of household water are important instruments supporting the Water Framework Directive, and they need to be adapted to agricultural water abstraction to ensure efficiency gains such as those that can be obtained through optimising irrigation. It is also important to have a strategy in place for keeping saved water for the environment, rather than for increasing agricultural production. In parts of Europe, leakages from the public water supply system can be as much as 30 %, and reducing these is an obvious efficiency gain. As European policymakers strive to develop a sustainable strategy for water management, the development of new reservoirs or transfer of water between basins is only in line with the Water Framework Directive if their ecological status has not deteriorated (EU, 2000, Article 4.7). Instead, drought management strategies need to be developed, as part of river basin management and in response to climate change.

Projected climate change is likely to significantly affect water temperatures and quantities. Southern Europe is likely to struggle more with water scarcity and drought issues in the coming years, whereas precipitation is projected to increase in northern Europe. Thus, protecting people and their economic and cultural assets from flooding will continue to be of major importance. Improved flood risk management, as required by the Floods Directive, in combination with green infrastructure and nature-based solutions (Chapter 17), which both reduce flood risk and improve ecosystems, is a tool for achieving benefits and policy objectives for both people and nature. However, it remains unclear whether adaptation is happening fast enough to ensure sufficient capacity to cope with future climatic changes. As water has a profound influence on ecosystems, it will become increasingly critical to address and monitor the climate-water-ecosystem-agriculture nexus (Chapter 16), including in the light of other uses. It would be a missed opportunity for Europe not to consider the full extent of these links.