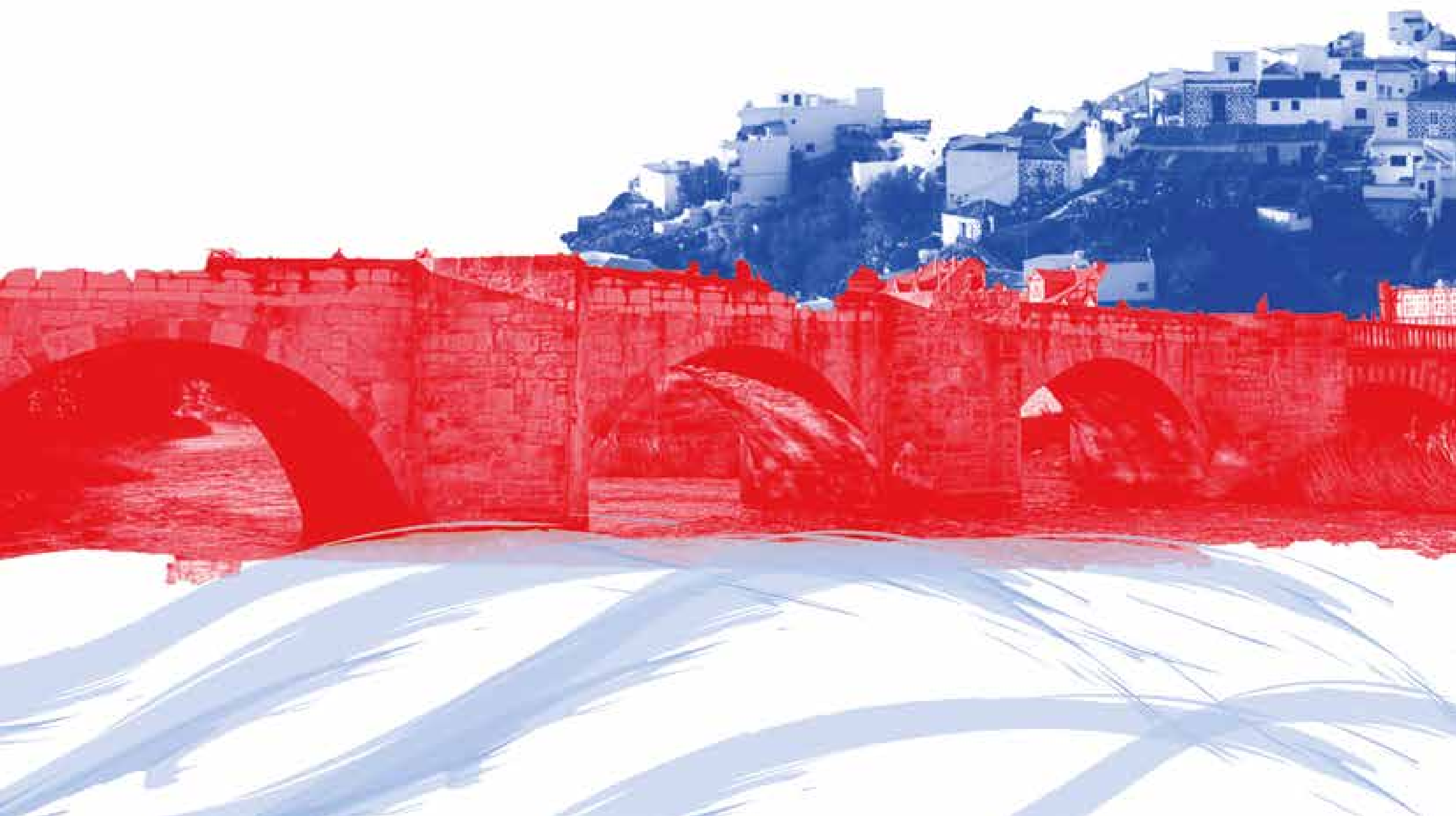
GOBIERNO DE ESPAÑA
MINISTERIO DE DERECHOS SOCIALES, CONSUMO Y AGENDA 2030
DIRECCIÓN GENERAL DE AGENDA 2030
AGENDA 2030
REDR Red Española de Desarrollo Rural

TICK-TOCK: WATER IS FINITE

STATE OF WATER RESSOURCES IN SPAIN



Contact

Website | redr.es
Email | redr@redr.es
Twitter | @redespanola
Instagram | @redespanola
LinkedIn | RedEspanolaDesarrolloRural
Facebook | RedEspanolaDesarrolloRural

Appropiations

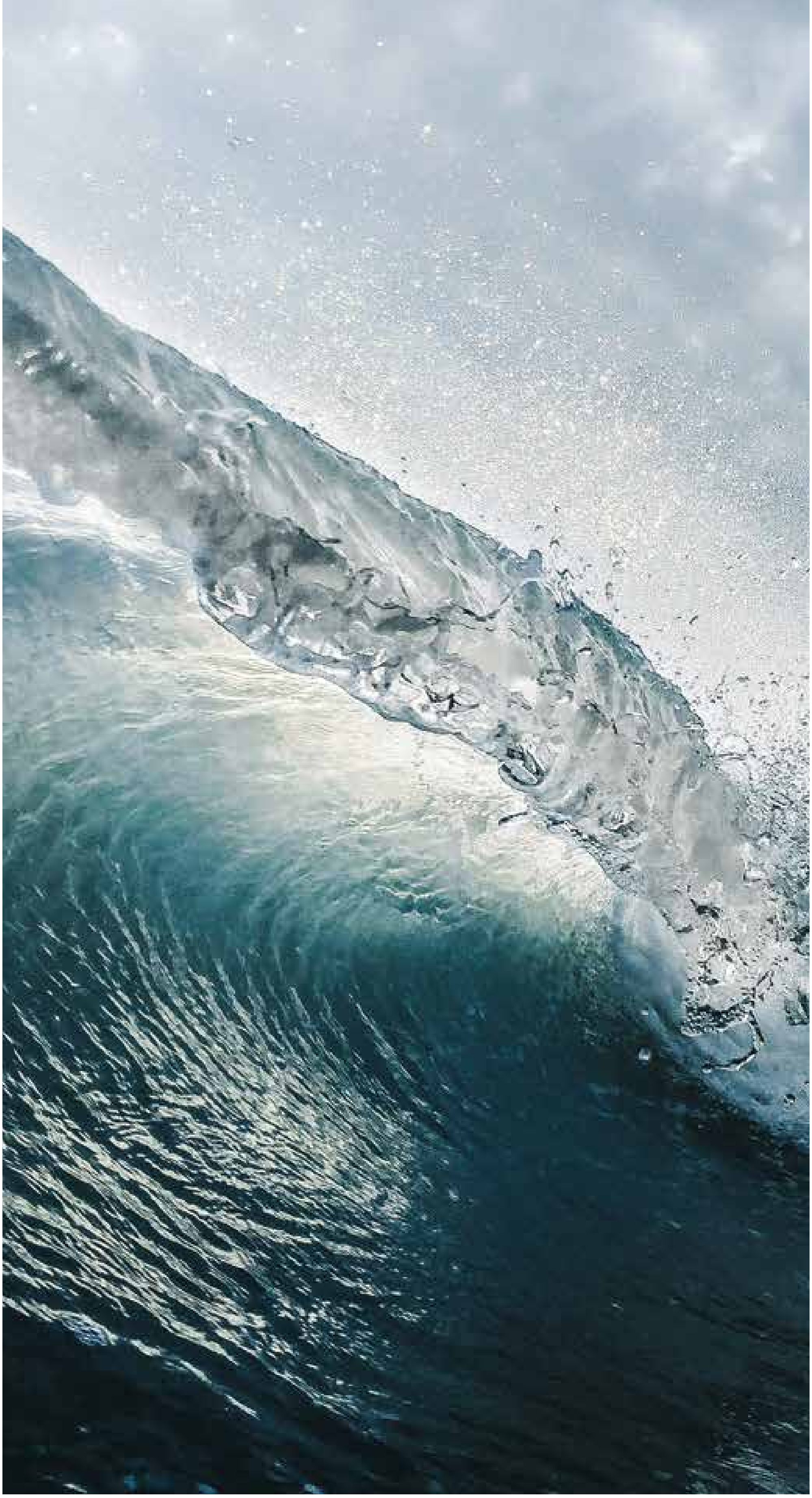
Executive management:
María José Murciano Sánchez
Data technician:
Marina Gallego González
Design and layout:
Sarah Catherine Gravina Owens

Tick-tock: finite water: State of water resources in Spain

End date: January 2024

"This publication has been produced with the financial support of the Ministry of Social Rights, Consumer Affairs and 2030 Agenda. The content of this publication is the sole responsibility of the grantee entity and do not necessarily reflect the opinion of the Ministry of Social Rights, Consumer Affairs and 2030 Agenda"

Index



Introduction

Global context

Water is the basis of all life, we depend on it to survive. It is also the foundation of any ecosystem and plays a crucial role in adapting to climate change, dampening its effects. But the role of water is not only vital, it is also **transversal.** It is a resource **that affects all aspects of our development and is a source of economic and social growth.**

But despite being such an essential good, it is also limited. The Earth is often referred to as the 'Blue Planet', as water occupies more than two-thirds of its surface. However, only 3% of this water is fresh. And of this reduced volume, most are inaccessible in glaciers and deep subsoil, leaving only less than 1% of the planet's water, available in the form of rivers, lakes, wetlands or aquifers (Abou-Shady, Siddique, and Yu 2023; United Nations, s. f.-b; WMO, s. f.).

This resource is also an increasingly scarce resource, since remaining constant, the population has doubled in recent decades, and with it has increased its demand for fresh water, causing per capita availability to decrease. Socio-economic growth, which has multiplied by 4 in the last 50 years, together with population growth, has been reflected in an **increase of 1% per year** in water use, (Figure 1) concentrated mostly in countries with lower incomes and / or emerging economies (Brondizio et al. 2019; United Nations 2023c).

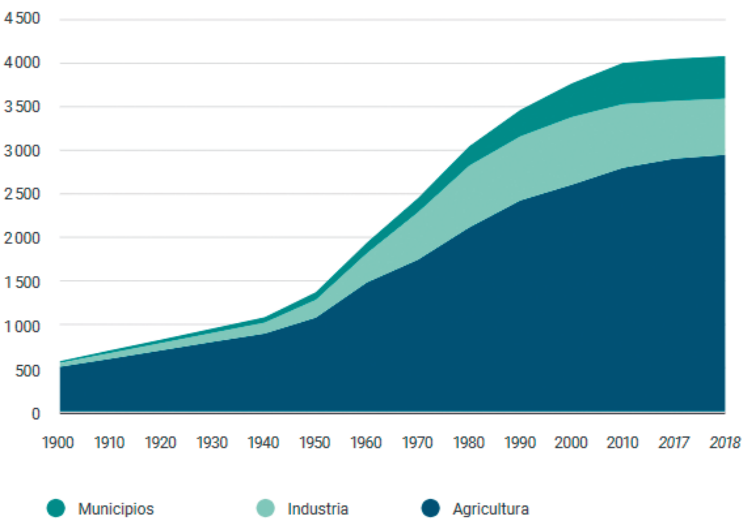


Figure 2: Evolution of water abstractions worldwide,, 1900-2018 (km³/year). United Nations (2023c, fig. P1, p.12).

If the current trajectory continues, it is estimated that **by 2030 the difference between the demand and availability of water for supply will be 40%** worldwide.

Already today, water security is a problem faced by billions of people, with more than **40%** of the population living in water-scarce areas. **1 in 4 people** lack access to safe water and sanitation services, and **80%** of people without access to these basic services live in rural areas (UNEP 2023; World Bank 2022).

Pressure on water resources is amplified by mismanagement

and lack of cooperation and coordination at both national and international level (60% of global freshwater flow is transboundary) (World Bank 2022). Unsustainable practices such as overexploitation, pollution or urbanization contribute to poor water status. For example, 48% of wastewater worldwide is released untreated, polluting the environment and reducing the availability of water resources (UNEP 2023).

In this context, groundwater is a strategic resource, being the largest freshwater reservoir on the planet after ice and snow. **99% of fresh water in liquid form is underground** (United Nations 2022). This source, from which half of the water for domestic use and 43% of the water for irrigation is extracted worldwide, is seriously threatened by overexploitation and pollution (Rodella, Zaveri, and Bertone 2023), with 30% of the aquifers globally having suffered an accelerated decline in the last 40 years (Jasechko et al. 2024).

The alteration in land use has meant a rapid decline in biodiversity and ecosystem functions, on which the whole of humanity depends. **75% of the land surface has been altered, 66% of the oceans** suffer from negative impacts, half of the coral reefs have already disappeared, more than **85% of the wetlands** have been lost and **1 million species** are at risk of extinction (Brondizio et al. 2019), with **27% of freshwater species being threatened** (IUCN, s. f.).

The deteriorating situation of water resources is being exacerbated by the effects of climate change. Climate

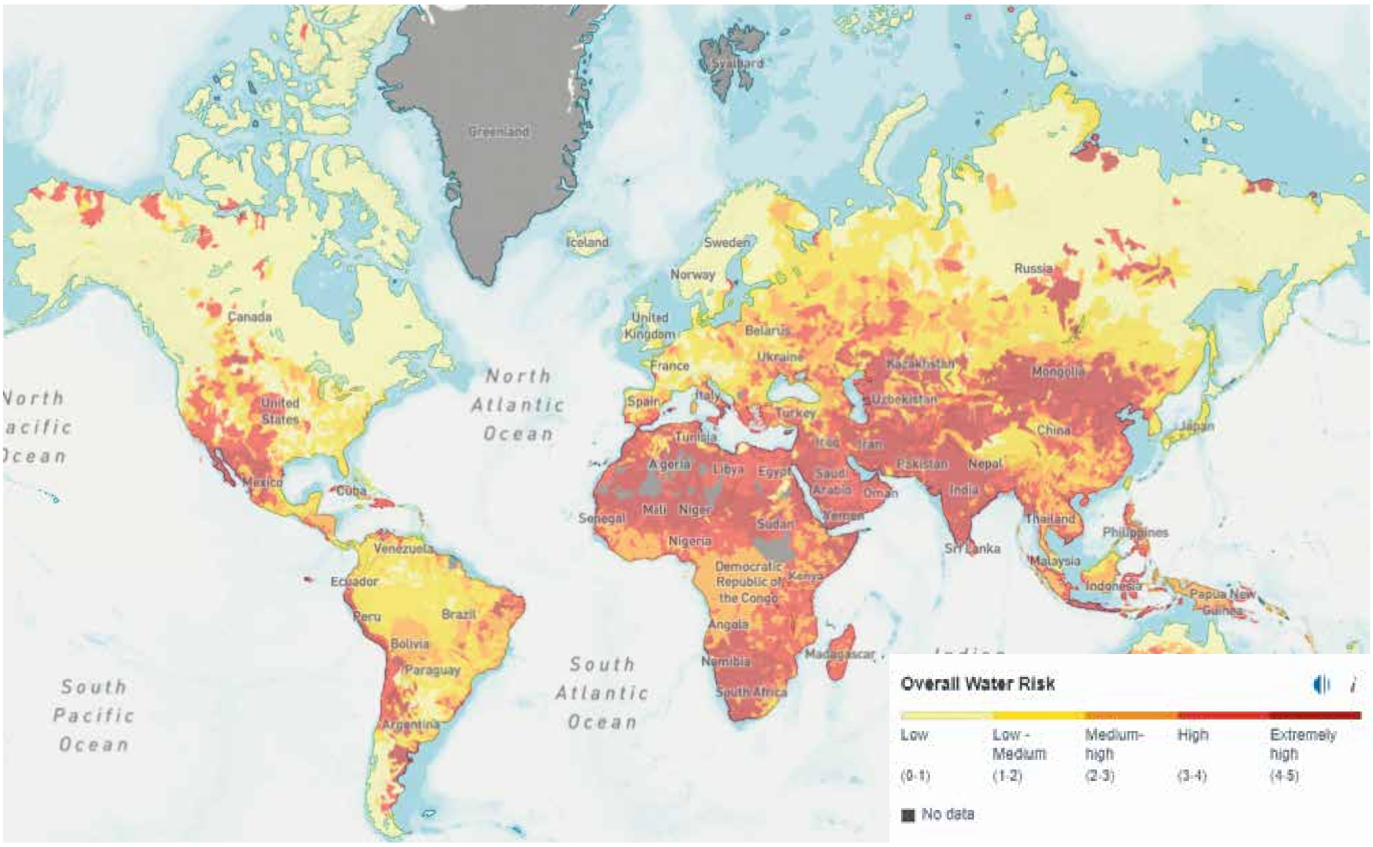


Figure 2: World map of water stress by country. Recovered from : Wri/aqueduct

change already affects all regions of the world, leading to extreme events such as heat waves, floods, fires or droughts. These widespread adverse impacts have caused extensive loss and damage to nature and people, particularly affecting the poorest and most vulnerable communities (IPCC 2023; United Nations 2020; 2023b).

The growing trajectory of global warming in the last 30 years has culminated with **2023 being the warmest year on record**, with an anomaly of almost 1.5oC above pre-industrial levels. In addition, the concentration of greenhouse gases such as CO2 or methane has reached peak levels in 2023 (Copernicus 2024).

As a result of the pressure that all these factors exert on water resources, a quarter of the world's population lives in countries suffering from extreme water stress (that is, they use more than 80% of their renewable water resources), with the Middle East and North Africa being the most affected regions (Figure 2). These numbers are expected to continue to grow, with an additional 1 billion people facing extreme water scarcity conditions in 2050 (Kuzma, Saccoccia, and Chertock 2023; United Nations 2023d).

The window of action to ensure a sustainable future for all is closing by leaps and bounds. Human and ecosystem losses and damage can be prevented and reduced if rapid, deep and sustained mitigation and adaptation measures are put in place affecting all systems and sectors. These types of

Spain is ranked 29th in the `water stress ranking´carried out by the Institute of World Ressources (WRI)

feasible and effective actions already exist, but they depend on factors such as financing, technology or international cooperation. That is why curbing climate change and the water crisis facing **the planet requires multi-level, cross-border, inclusive and sustained governance that recognises the value of water and ensures water security, sustainability and climate resilience** (IPCC 2023; Water Europe 2023).

Water in Europe

Water ressources

In Europe, most fresh water is extracted from surface sources. 75% of water resources are taken from rivers and reservoirs, and the remaining 25% is obtained from groundwater (Figure 3) (EEA, s. f.-d).

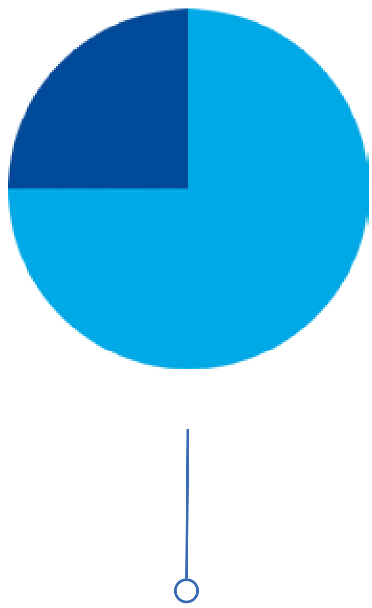
But of the surface **water bodies** that run through the European territory, **60% do not reach good ecological** status due to impacts such as pollution by organic and chemical agents, acidification or alteration of habitats. In fact, 34% of European surface waters suffer from hydromorphological alterations, due to anthropogenic pressures. Similarly, poor water quality, at 62 per cent, is often attributed to atmospheric deposition, diffuse pollution from agricultural sources or the discharge of wastewater.

For **groundwater bodies**, 75% of these bodies have good chemical status. Nitrate pollution is usually the predominant cause of the poor chemical status of these waters, affecting 18% of groundwater.

Regarding the quantitative status, it is rated as good in 90% of the underground masses. Although in some countries such as Malta, Cyprus or Spain, the overexploitation of these waters is significant (EEA, s. f.-c).

Although renewable water resources in Europe are relatively abundant, demand for water has grown continuously over the last 50 years due to economic and population growth, leading per capita at European level (EEA 2023a).

Figura 3. Distribution of water resources in Europe (EEA,).



This demand in freshwater is mainly divided between the **industrial sector (45%), the agricultural sector (30%) and the supply to the populations (25%)** (FAO 2022; United Nations 2023c).

The extraction of these resources has increased mainly in southern Europe, by 30% for industrial cooling in the energy sector, and by 9% for agriculture since 1990. However, the increase in the use of renewable energy sources, such as solar or wind, has contributed to a significant reduction in water consumption for the energy sector. This, along with improvements in water use efficiency and socio-economic¬changes, led to a 17% reduction in water extraction between 2000 and 2017 (EEA, s. f.-d).

At European level, the distribution of water resources varies considerably between regions. Thus, southern Europe is particularly affected by increasing water scarcity, especially in the summer months, when extraction increases motivated by tourism, municipal and agricultural use (EEA, s. f.-d).

The European Environment Agency (EEA 2023a) estimates that **one third of the European territory is exposed to water stress conditions**, with 30% of the population being directly affected. Currently in Europe there are 51.9 million people and €995 billion of economic activity exposed to water scarcity, although only **Spain faces severe water scarcity**, with 3.3 million people and €75 billion of economic activity exposed to it (Bisselink et al. 2020).

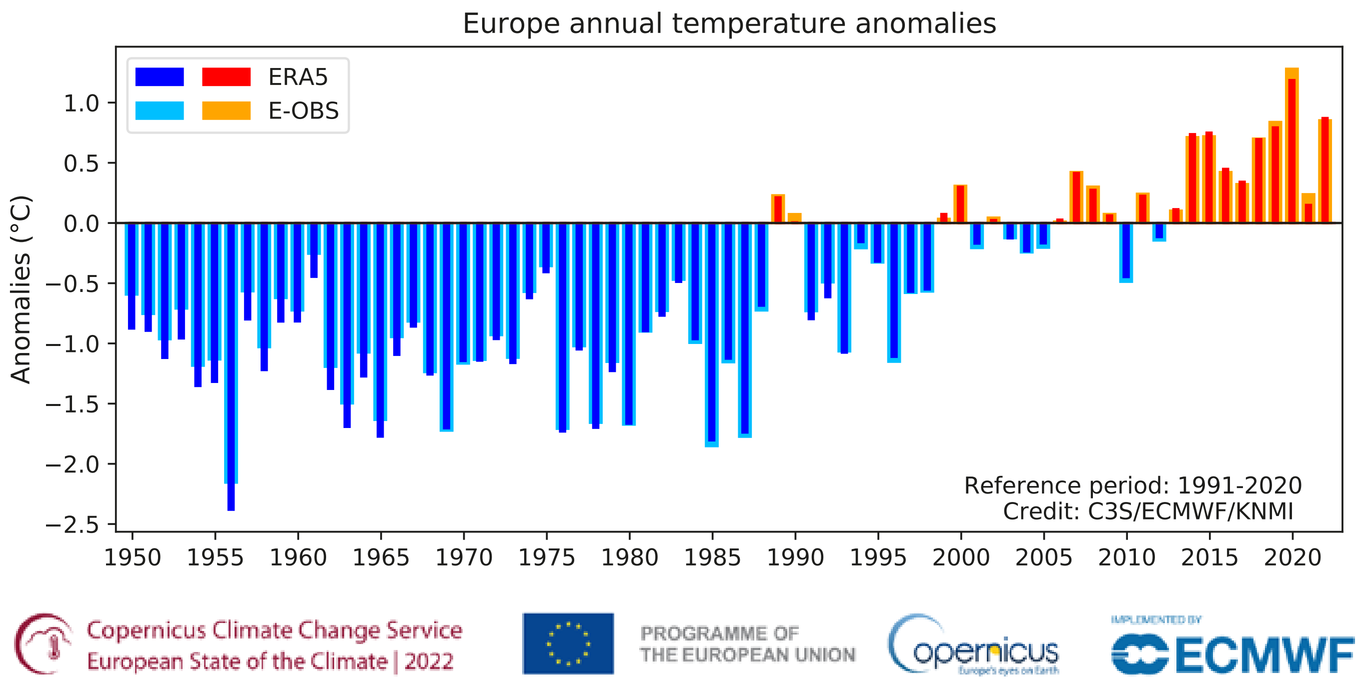


Figure 4:Annual temperature anomalies from 1950 to 2022, compared to the reference period 1991–2020 .(Copernicus 2023).

Today, only droughts already generate damage of up to €9,000 million per year, in addition to damage to ecosystems and the services they provide (EEA 2021c). Moreover, these damages are expected to increase to €25 billion if global warming of 1.5°C is reached, or to €31 billion and €45 billion under the 2°C and 3°C warming scenarios, respectively. And, as the climate changes, so does the availability of water resources, becoming even scarcer in arid areas (EEA 2023b).

Climate change is having a direct impact on Europe's water resources, contributing to more intense and prolonged droughts, which mostly affect the southern regions of the continent. Mediterranean countries already face water scarcity conditions, which have been accentuated by global warming (Bisselink et al. 2020).

Some of the consequences that climate change is having in Europe are (Copernicus 2024):

· 2020 was the hottest year in Europe since there was a record, followed by 2023.

· Summer 2022 was the warmest in Europe on record, reaching 1.4°C above average (Figure 4).

· The temperature of European lakes is rising by 0.33°C every decade.

· 2022 was recorded as the driest year, with more than 60% of rivers with below-average discharges and the presence of extreme droughts.

· Seawater in Europe reached maximum temperatures in 2022. The Mediterranean Sea suffered extreme waves of carlor, reaching 3°C above average, and 4.6°C at some points.

· High temperatures and drought have increased the risk of wildfires, especially during the summer. Spain and the south of France have been particularly affected.

· The Mediterranean region is considered a "hot spot of climate change", where changes in precipitation patterns and rising temperatures are transforming the environment, making it conducive to the arrival of species that can function as vectors of diseases, which poses a new risk to human health.

2030 Agenda & SDG 6

The first advances in the international fight against climate change date back to 1979, with the first **World Climate Conference,** where climate change was identified as an urgent global problem and governments were called upon to meet this challenge (UNFCCC, s. f.-c). But it was not until 1997 that the United Nations Framework Convention on Climate Change (UNFCCC) approved the **Kyoto Protocol,** active since 2005, which committed industrialized countries to limit and reduce greenhouse gas emissions by at least 5% (compared to 1990) (UNFCCC, s. f.-b).

Given the inadequacy of these measures to slow the advance of climate change, a new international treaty was signed in 2015: **The Paris Agreement.** 196 parties committed to limiting global warming below 2°C, preferably to 1.5°C (compared to pre-industrial levels). In this way, every 5 years, the linked countries must submit national plans to combat climate change, increasingly ambitious in terms of emission reductions (UNFCCC, s. f.-a).

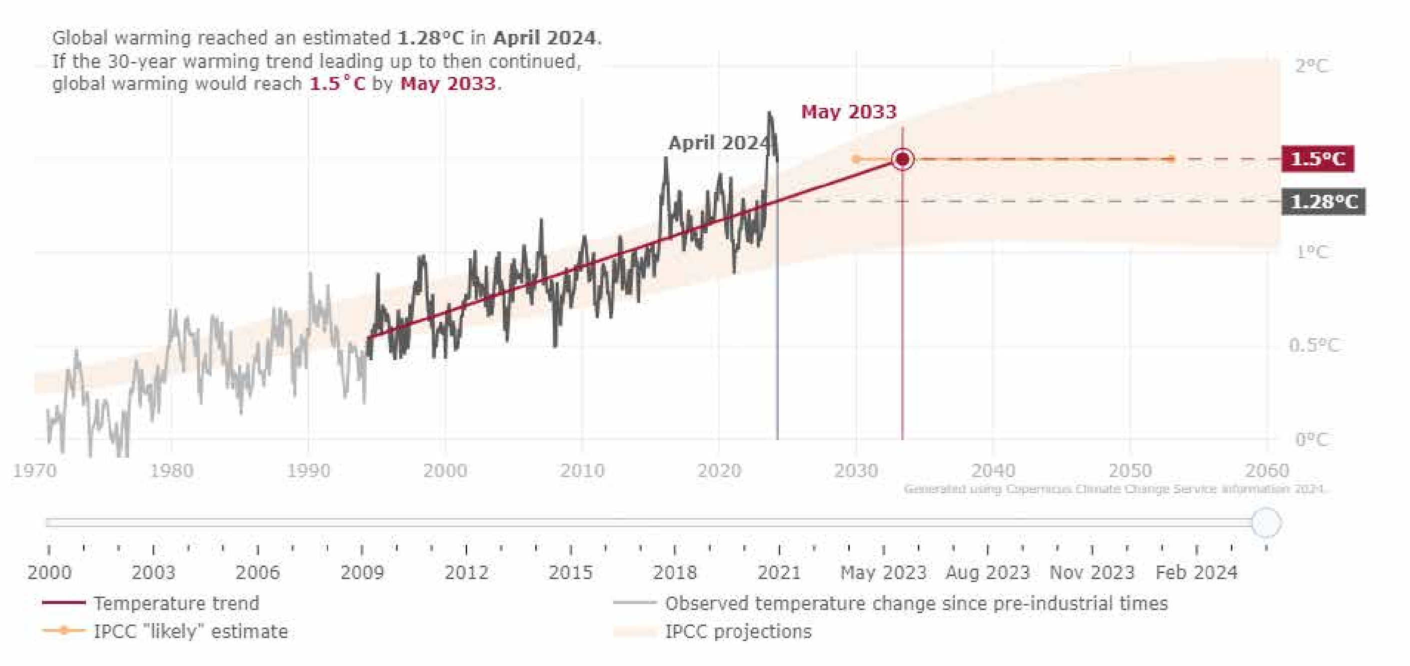


Figure 5: Temperature increase trajectory (Global temperature trend monitor, Climate Data Store, Copernicus).

How close are we to achieving global warming of 1.5°C?

The 1.5°C limit agreed in the Paris Agreement may seem a distant reality, but nothing is further from reality: **global warming in 2023 was 1.48°C above pre-industrial** levels, with 50% of days exceeding 1.5°C. December as a whole recorded a warming of 1.78oC, and 2023 has been the hottest year on record. If we continue on this trajectory, it is estimated that we **will reach 1.5°C above pre-industrial levels by 2033** (Figure 5) (Copernicus 2024; s.f.).

Likewise, in 2015, United Nations Member States adopted the **2030 Agenda for Sustainable Development,** an action plan to end poverty, protect the planet and improve the lives and prospects of people around the world. This universal agenda is made up of 17 **Sustainable Development Goals** (SDGs) and 169 associated targets that member countries commit to implement by 2030 (United Nations 2015).

In turn, the United Nations General Assembly established a set of 232 global indicators of the 2030 Agenda with which to monitor the progress of the SDGs (United Nations 2017). Each year, the 193 countries acceding to the UNFCCC meet to assess progress at the **Conference of the Parties (COP).**

The last edition, **COP28**, took place at the end of 2023 in Dubai. At COP28, the Global Stocktake of the Paris Agreement was carried out, the conclusion of which was overwhelming: **Much remains to be done to limit global warming to 1.5˚C.**

To demonstrate their commitment to changing this trajectory, the 197 countries attending, plus the EU, signed the Dubai Agreement. Under the umbrella of this pact, the parties recognize the need to rapidly and sustainably reduce greenhouse gas emissions, which **is the beginning of the end of fossil fuels**. The agreement represents an ambitious set of bases, where in addition to decarbonisation, it highlights the fight against water scarcity, urging parties and actors to act towards the adaptation and mitigation of the effects of climate change on water resources, and the conservation and restoration of ecosystems (UNFCCC 2023; COP28 KAU 2023).

Water is central to sustainable development and the eradication of poverty and hunger, and as such has a **cross-cutting role in the 2030 Agenda**. This value of water is reflected in all the Goals of the 2030 Agenda, either **directly or indirectly** (Figure 6) (Ligtvoet et al. 2023).

Specifically, water resources are addressed in **SDG 6**. This objective is to ensure the availability and sustainable management of water and sanitation for all. Reflecting **the human right to water and sanitation**, recognized in 2010 by the United Nations General Assembly in resolution 64/292 (United Nations 2010).

SDG 6 translates into 8 targets (Figure 7), which are monitored through 11 indixes (United Nations 2023a).

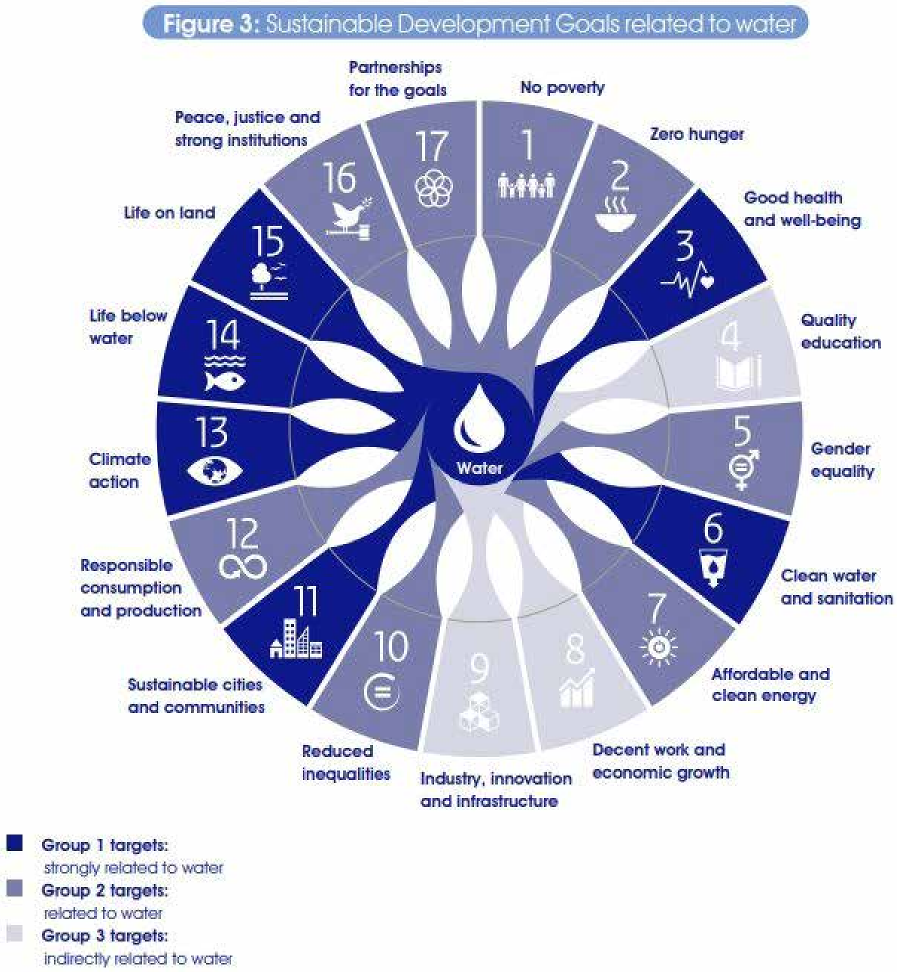


Figure 6: SDGs and their relationship with water. Ligtvoet et al. (2023, p. 12).

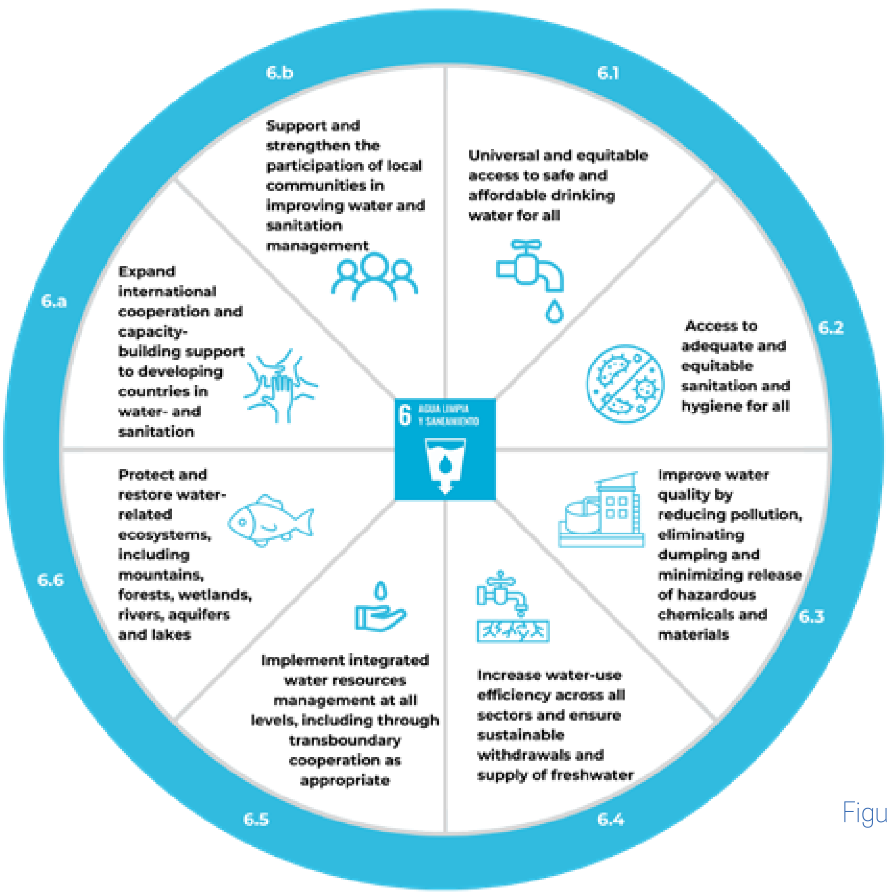


Figure 7: SDS 6 targets. Own production

Other Sustainable Development Goals closely related to water resources are (United Nations 2023d):

SDG 3: Ensure a healthy life and promote well-being for all in all ages.

Health and well-being are unattainable without access to water and sanitation. Contaminated water causes 505,000 deaths from diarrhoeal diseases each year (WHO, s. f.). This goal is committed to reducing deaths caused by unsafe water.

SDG 11: Making cities more inclusive, safe, resilient and sustainable.

More than half of the world's population lives in cities. As a result of rapid urbanization, more and more people are living with inadequate water and sanitation systems. More than 32 billion cubic meters of water are lost each year to leaks in the world's urban distribution networks, which could supply 200 million people (Kingdom, Liemberger, and Marin 2006).This goal is committed to reducing the people affected and the economic losses caused by water-related disasters.

SDG 13: Take urgent action to combat change climate change and its effects.

Due to global warming generated by human activity, 2023 reached the record as the warmest year on record (Copernicus 2024). This climate change manifests itself through water, and has aggravated extreme hydrometeorological phenomena, i.e. water-related natural disasters (Seung-soo 2018). Nine out of 10 (90%) natural disasters are related to water (World Bank, s. f.; IUCN, s. f.).This goal is committed to strengthening resilience and adaptive capacity to climate change.

SDG 14: Conserve and sustainably use the oceans, seas and marine resources.

Covering 70% of the Earth's surface, oceans are essential for life: They regulate the climate by absorbing heat and emissions, provide us with oxygen, natural resources and food, and are key to the global economy. In addition, about 80% of life on Earth is found in the oceans. Warming, acidification, plastic pollution or overfishing are some of the most pressing threats to ocean health (Jaksha 2013). 30-50% of vulnerable marine habitats have already been lost (Our Shared Seas 2021; Brondizio et al. 2019). This objective is committed to reducing marine pollution and acidification, while protecting marine ecosystems and improving their conservation.

SDG 15: Manage forests sustainably, fight against desertification, halting and reversing land degradation and halt the loss of biodiversity

Forests cover 30% of the earth's surface and are home to 80% of biodiversity. However, in the last two decades 100 million hectares of forest area have been lost. In addition, there are an estimated 1 million endangered species (United Nations 2023d) and the Living Planet Index indicates a 69% decline in vertebrate populations over the past 50 years (WWF 2022) (Figure 8).

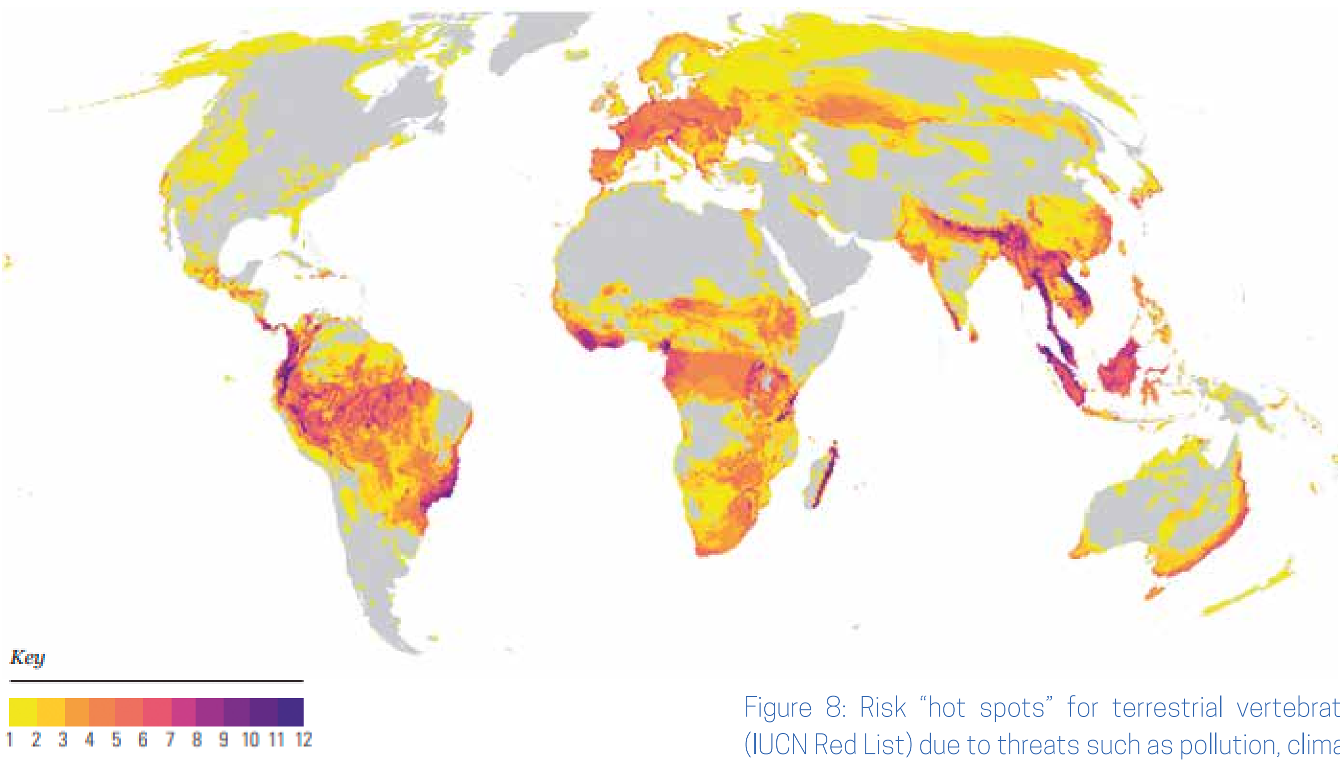


Figure 8: Risk "hot spots" for terrestrial vertebrates (IUCN Red List) due to threats such as pollution, climate change, deforestation, invasive species, hunting or agriculture (WWF 2022).

Progress of the 2030 Agenda

Halfway through the deadline for the 2030 Agenda, the UN estimates that, **at the current pace, none of the goals can be achieved in time.** Only 18% of targets are on track globally, while 15% are falling back, and the remaining 67% are stagnant (Figure 9) (Sachs et al. 2023).

Progress on the Sustainable Development Goals varies widely between regions and countries with different purchasing power. Thus, according to the latest Sustainable Development Report published in 2023 by the UN Sustainable Development Solutions Network (SDSN), where they use the 'SDG Index' to quantify the progress of each country, 20 European countries are in the lead, with Finland obtaining the highest score, 86.8. **Spain stands out in 16th place** among the 163 countries on the list, with an index of 80.4 (Sachs et al. 2023), showing an increase in the score compared to the previous year (79.9) (Sachs et al. 2022).

Of the goals set by the United Nations, **Spain is on track in 61.1% of them.** It is particularly prominent in SDG 5 on gender equality, where it is making good progress (Figure 10).

Progress of the SDGs at the global level

Figure 9: Global SDG progress at the equator of the 2030 Agenda. Sachs et al. (2023, fig. 2.1, p. 24).

Progress of the SDGs in Spain

Figure 10: Progress of the SDGs in Spain at the equator of the 2030 Agenda. Sachs et al. (2023, country profiles: Spain, p. 440).

Progress on SDG 6

Despite some progress (Figure 11), millions of people around the world continue to lack access to safe drinking water, sanitation and hygiene (United Nations 2023d).

Spain has shown moderate progress over the past year, and is on track for most of the indicators for this objective (Figure 11). However, there are two indicators that still present significant challenges for the country (Sachs et al. 2023):

· Addressing water stress and water scarcity (freshwater abstraction intensity and per capita consumption): freshwater abstraction must be proportional to that of available water resources. That is, it is necessary to take into account the fresh water available, for its subsequent extraction for use in different sectors.

· Protect ecosystems and the quality of water bodies.

With the intention of alleviating the slow progress of SDG 6, and promoting effective action and collaboration of member countries, the UN General Assembly declared the period 2018-2028 as the **Water Action Decade** (United Nations 2018).

As objectives for this decade, it was proposed:

1. Promote sustainable development.
2. Promote existing programs and projects.
3. Incentivize actions in order to meet the 2030 Agenda.

1.600M

At this rate, by 2030, 19% of the world's population (i.e. 1.6 billion) will still not have access to safe drinking water and we will not have met SDG 6 (United Nations 2023a)

26%

26% of the population (2,000 M) do not has access to drinking water, and 8 of every 10 of these people live in rural areas (United Nations 2023a)

Status of SDG 6 indicators at global and national levels

	UN Water		INE
	Global	**Spain**	**Spain**
6.1.1. Drinking Water: Proportion of popula-tionusing safe managed drinking water supply services	**73%** of the po-pulation in 2022	**100 %** in Spain 2022	INE 2021, **84,4%.**
6.2.1.a. Sanitation: Proportion of population using safe managed sanitation services	**57%** of the population in 2022	**90%** in Spain 2022	INE 2016, **97%.**
6.2.1.b. Hygiene: Proportion of population with access to handwashing facilities with soap and water	**75%** of the population in 2022	No data	No data
6.3.1. Waste Water: Proportion of wastewater treated appropriately	**58%** in 2022	**80%** in Spain 2022	INE 2016, **81,25%**
6.3.2. Water Quality: Proportion of good water bodies	**60%** in 2020	**sin datos**	INE 2021, **61,54%.**
6.4.1. Efficiency: Change in the efficient useof water resources over time	Increased by **9%**, to 19 $/m^3 in 2020	**36.23 $**/m^3 in Spain 2020	No data
6.4.2. Water stress: Water stress level: fres-hwater extraction in proportion to available freshwater resources	**18%** in 2020	**43,25%** in Spain 2020	INE 2015, **20,60%**
6.5.1. Water Management: Degree of implementation of integrated water resources management (0-100)	**54%** in 2020	**87%** in Spain 2020	No data
6.5.2. Cross-border: Proportion of surface areaof transboundary basins subject to opera-tional arrangements for water cooperation	**58%** in 2020	**100%** in Spain 2020	No data
6.6.1. Ecosystems: Change in the extent of water-related ecosystems over time	**21%** in 2020	**19%** in Spain 2020	No data
6.a.1. Cooperation: Volume of official deve-lopment assistance for water and sanitation as part of a government-coordinated spending plan	decreased by **15%**, 7,8 b$ in 2021	No data	INE 2021, 23,30 M€.
6.b.1. Participation: Proportion of local administrativeburdens that have established operational policies and procedures for local community participation in water and sanita-tion management	**25%** of coun-tries in 2021	No data	INE 2021, **100%**

Figure 11: Status of SDG 6 indicators at global and national levels (UN Water, s. f.-b; s. f.-a; INE 2021)

On 22 March 2023, World Water Day, the **UN 2023 Water Conference** was inaugurated as a tool to review the progress and prospects of the Decade of Action for Water, as it is already in Ecuador. One of the main outcomes of the Conference was the **Water Action Agenda**. This Agenda is a compilation of more than 700 voluntary commitments, key to accelerating the progress of Sustainable Development Goal 6 in this second half of the Decade of Action for Water and the 2030 Agenda (Kőrösi 2023).

Summary of the commitments of the Water Action Agenda

Integrated water and change policies climate change at the global and national levels in 2030.

Global Information System support for water management, climate and soil, to achieve resilience socio-economic, sustainability green, and social inclusion in 2030.

Early Warnings for all, to help safeguard lives and properties, by 2027.

Overcoming dependence on consumption water for economic growth and power as soon as possible.

Redefining financial principles for making our economies smart on water, climate, soil and ecosystems, while focusing in the population.

A Global Education Network Water to increase the capacity of institutions and the population, with a focus on helping countries in development.

Inclusive, coherent and cross-border support between countries.

An institutional structure of the UN to support this transition, managed by a Special Envoy to ensure that water is always present in the political agenda.

European regulation and strategies

European regulatory framework

Since 2000 (revised in 2019), hydrological planning in the member countries of the European Union has been governed by **the Water Framework Directive (WFD)**. **The purpose of this Directive is to achieve the good status of water bodies and their associated ecosystems and to prevent their deterioration.** To this end, it promotes a sustainable use of water based on the long-term protection of available water resources (MITECO 2022c). As it is a directive, the member countries were required to transpose the WFD into national legislation, so that this integral perspective in the management of water resources was reflected in their Watershed Plans. These plans must be renewed every 6 years after a period of public consultation, together with the National Flood Plans (covered by the Floods Directive (Directive 2007/60/EC) or Floods Directive).

The WFD is supported by the **Water Directive Underground** (Directive 2006/118/EC), or Groundwater Directive (GWD) and the Environmental Quality Standards Directive (EQSD). These two directives lay down the procedures for completing the WFD on groundwater and surface water quality, respectively (European Commission, s. f.-i).

The European regulatory framework also includes **specific policies** (Figure 12) on bathing water quality (Directive 2006/7/EC or Bathing Water Directive), drinking water (Directive (EU) 2020/2184 or Drinking Water Directive), nitrates (Directive 91/676/EEC or Nitrates Directive), waste water treatment (Directive 91/271/EEC, or Urban Waste Water Treatment Directive, UWWTD), and water regeneration (Regulation (EU) 2020/741, or Water Reuse Regulation). With regard to marine waters, the European tool to protect and preserve the good condition of our coasts, seas and oceans is the Marine Strategy Framework Directive (MSFD). To ensure the protection of saltwater bodies shared by different countries, in Europe there are four Regional Conventions of the Sea, in two of which Spain is involved: the Mediterranean Action Plan (MAP) adopted by the Barcelona Convention and the OSPAR Convention for the Protection of the North-East Atlantic.

In the current state of climate emergency that the planet is in, it is essential to preserve and protect natural resources to ensure that they continue to sustain us in the future. In this context, and because the future of Europe depends on the health of the planet, EU states are committed to achieving climate neutrality (zero emissions) by 2050. This objective was reflected in the European Climate Law (Regulation (EU) 2021/1119, or European Climate Law), adopted in 2021, which provides the legal framework to steer Europe towards the green transition (European Parliament 2021).

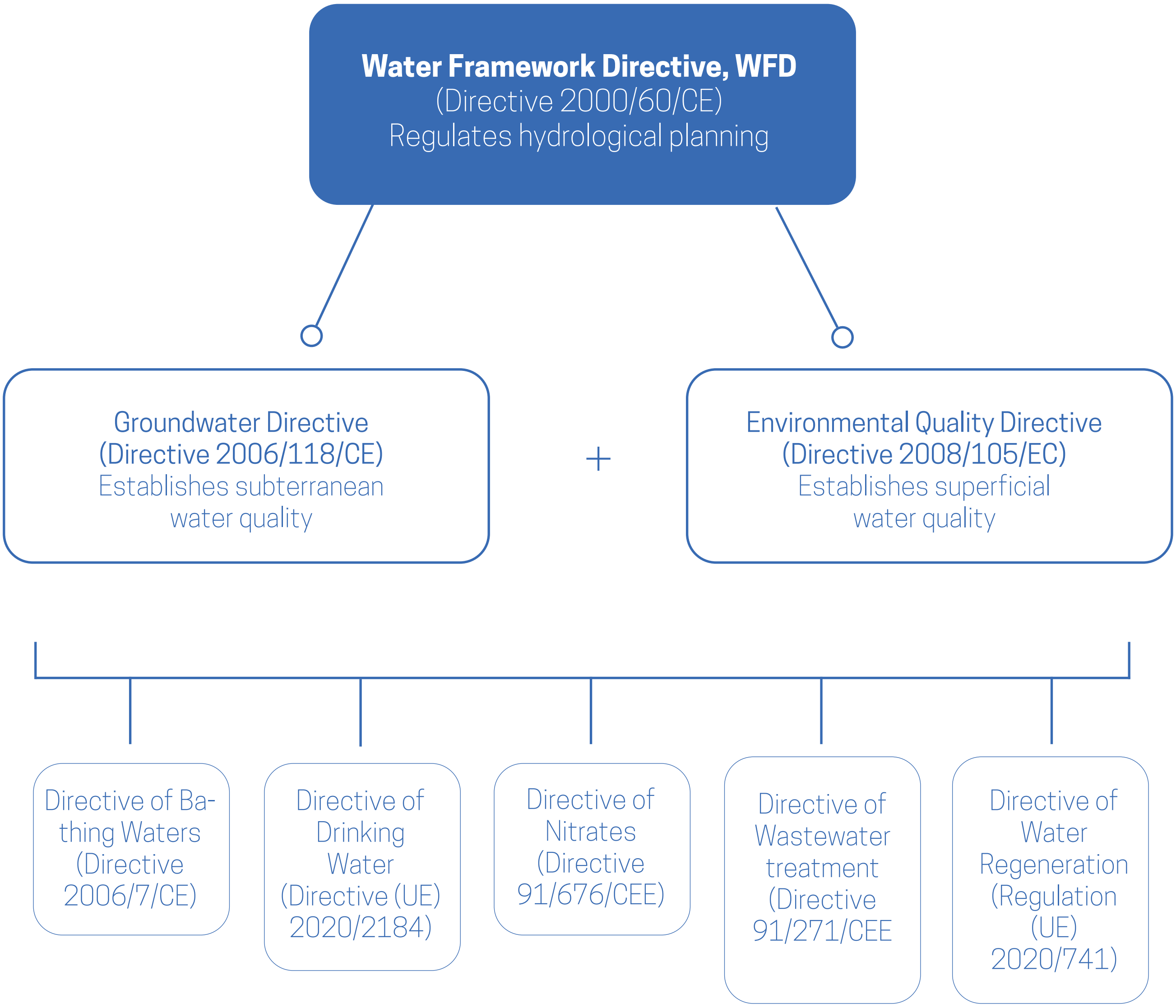


Figure 12: European regulatory framework on water.

With regard to marine waters, the European tool to **protect and preserve the good condition of our coasts, seas and oceans** is the Marine Strategy Framework Directive (MSFD). To ensure the protection of saltwater bodies shared by different countries, in Europe there are four Regional Conventions of the Sea, in two of which Spain is involved: the Mediterranean Action Plan (MAP) adopted by the Barcelona Convention and the OSPAR Convention for the Protection of the North-East Atlantic.

All these directives complement the WFD and must be included in the national regulations of each country (European Commission, s. f.-h).

European regulation and strategies

European funding

Spain is a leading country in the use of European funds for implementation, innovation and research on water issues.

EU water research and innovation activities cover a wide range of issues, including (European Commission, s.f.-h):

· Amount and availability of water
· Water quality and pollution
· Protection and restoration of aquatic ecosystems
· Water management and governance, including circular water use

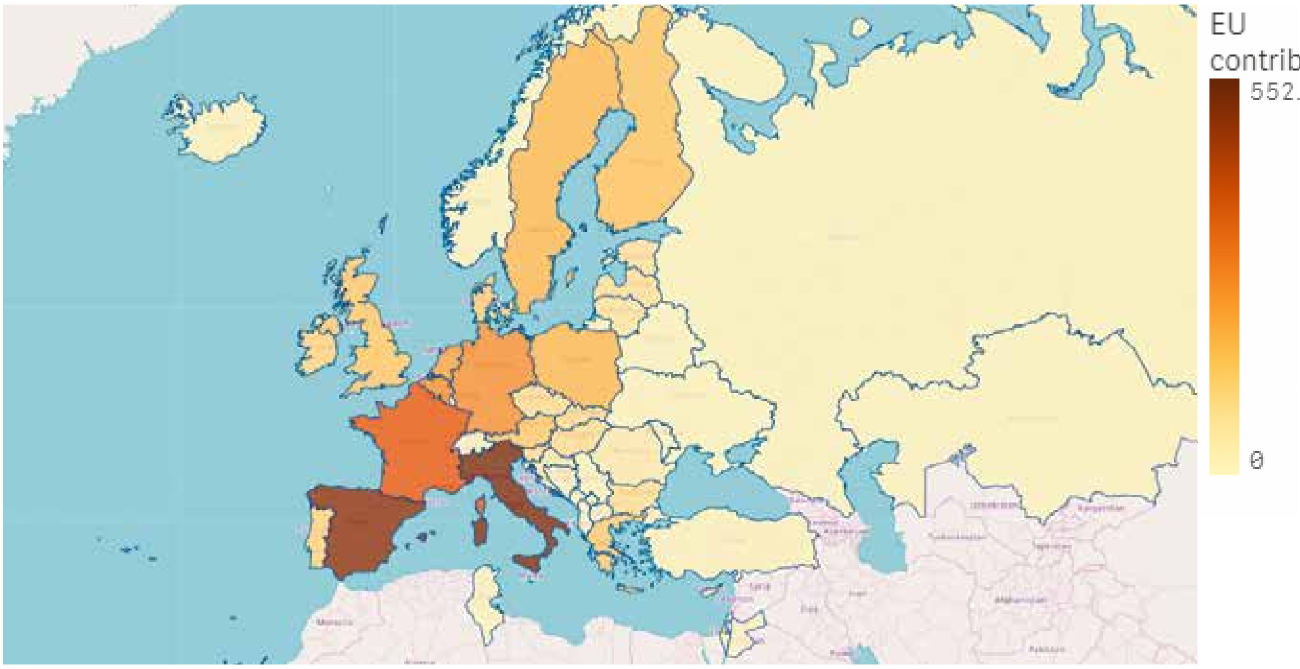


Figure 13: Investment in the LIFE programme at European level. European Commission (2024, LIFE Project Portfolio).

The European Commission offers different funding opportunities that can be used to cover these research and innovation activities and projects:

1. LIFE Programme

The LIFE programme is an instrument of the European Union **to finance projects in the field of the environment and climate action**, in operation since 1992. It is one of the main contributors to the objective of sustainable economy and climate neutrality. The European Climate, Infrastructure and Environment Executive Agency (CINEA) is responsible for the implementation of the LIFE Programme. This programme is in turn divided into 4 sub-programmes where water is a cross-cutting theme:

- **Nature and Biodiversity.** It covers Natura 2000 management and development projects, including the protection of freshwater ecosystems.
- **Circular Economy and Quality of Life.** They highlight initiatives for the recovery and reuse of water resources and by-products.
- **Mitigation and Adaptation against Climate Change.** Projects to combat drought, desertification and floods stand out here.
- **Energy Transition.** In it we find digitalization projects, efficient technologies and renewable energies in the water sector.

Spain leads the list of European countries that benefit from this instrument (Figure 13), receiving a total of € 475.2 million, and having participated since 2015 in 493 projects (32% of CINEA projects). 64% are currently ongoing, with 2023 being the year in which the most LIFE projects have started (68) (European Commission 2024c).

Water resources appear as a recurring theme, with 19% of LIFE projects (and 22% of LIFE funds received) in which Spain participates dedicated to it. In fact, wastewater treatment is the topic to which more LIFE projects have destined our country (European Commission 2024c).

The Autonomous Communities with the largest participation in the Life Programme are the Community of Madrid (233 projects – 47.3%), Catalonia (147 projects – 30%), and Valencia (107 projects – 21.7%) (Figure 14). They are also those that have more projects on water issues, although the Region of Murcia is the one that has allocated more of its projects to water (37%) (European Commission 2024c).

Figure 14: Investment in the LIFE programme by Autonomous Community. European Commission (2024, LIFE Project Portfolio).

Natura 2000 is the largest internationally coordinated network of protected areas in the world. The Network extends along the land and sea territory of EU member countries and is of vital importance for the protection of biodiversity. Habitats and species protected by the Natura 2000 network are established in the European regulatory framework, under the Habitats Directive (92/43/EEC) and the Birds Directive (79/409/EEC). Member states are responsible for selecting these spaces and taking conservation actions (Rincón et al. 2021). Currently, the Network has almost 28,000 designated spaces, which corresponds to **18% of the territory of the EU** (European Commission, s. f.-a).

In Spain there are 1,858 Natura 2000 protected areas, representing **28% of the Spanish land territory** (near the 30% target set by the 2030 Biodiversity Strategy), and 12% of marine water bodies (EEA, s. f.-a).

Spain is the 5th European country with the highest number of Natura 2000 sites (Rooms 2023). It is up to the Autonomous Communities to declare these spaces, with Andalusia having the highest number (MITECO 2022a). Of the total number of Spanish Natura 2000 sites, 800 have been funded by the LIFE Programme to date (European Commission 2024c).

Horizon Europe

Horizon Europe is the **European Union's framework programme for research, development and innovation** (R&D&I) for the period 2021-2027 to help the EU make the transition to a prosperous and sustainable future (like its predecessor Horizon 2020). It is structured in three funding pillars (MICIN, s. f.):

1. Excellent Science (research in science and support for the development of research staff).
2. Global Challenges and European Industrial Competitiveness (research on societal challenges and industrial technological development).
3. Innovative Europe (market making innovation and growth of innovative SMEs).

To date, Spain has received a total of €9,170 million (9.8% of the total) for its 26,801 participations (26% of the total) in the Horizon Programmes. **It is the second European country that has received more of these funds in innovation and research.** More than half of these shares are distributed between Madrid (7,436 – 27.75%) and Catalonia (6,926 – 25.84%) (European Commission 2024b; 2024a).

In addition, within Horizon Europe, different missions are identified with which to classify the objectives of research and innovation projects. Highlights include the Climate Change Adaptation Mission, the Climate Neutrality and Smart Cities Mission, or the Water and Ocean Restoration Mission (European Commission, s. f.- b).

With 1,160 participations in 408 of the 841 projects of this last mission, for the protection and restoration of water bodies, Spain stands out as the European country with the highest number of participations, grouped again, mostly in the Community of Madrid (276) and Catalonia (257) (European Commission 2023a).

HORIZON EUROPE

Did you know that? The ESI Funds are the main EU financial support for the energy transition, through aid for the installation of energy renewables and efficiency gains energy in homes and businesses.

Structural and investment funds

The Structural and Investment Funds (SIFs) are the EU's largest set of investment instruments and are at the heart of its growth strategy. The different ESI Funds are:

- European Regional Development Fund (ERDF)
- European Social Fund (ESF)
- Cohesion Fund (CF)
- European Agricultural Fund for Rural Development (EAFRD)
- European Maritime and Fisheries Fund (EMFF)

These funds support **the territorial, economic and social cohesion of the member countries**, and are characterised by their flexibility to adapt to the different crises, thus betting on a more resilient Europe.

In this line, the last financial framework (2014¬2020) of the ESI Funds opted for sustainable and smart growth, allocating 26% of the budget to climate action. Actions implemented to achieve a climate-neutral, clean and circular economy include energy transition, circular economy, risk prevention (fires, floods), environmental protection, clean mobility and research and innovation. Supporting the digitalisation of businesses and the rural environment, or improving the management of 20% of agricultural land in the EU to improve biodiversity conservation and ecosystem restoration are some measures to be highlighted (European Commission 2021).

Do you know the Local Action Groups?
In rural areas, LAGs are the main facilitators of the territory. Its involvement with the implementation of initiatives and policies related to the good use, consumption and management of water is key to achieving solutions adapted to the territory and the demands of the population. LEADER and the LAGs, through the EAFRD, have managed to launch numerous projects in favour of the protection and conservation of water resources.

Specifically, the **EAFRD** has allocated 58% of its budget to these goals of sustainable growth and adaptation to climate change. This is because at least 30% of the funding for each Rural Development Programme drawn up by Member States and regions must go towards measures for the environment and climate change (European Commission 2021).

On the other hand, 5% of the EAFRD budget is allocated to the **LEADER** programme, a European initiative that seeks to boost rural areas through a sustainable bottom-up methodology. LEADER functions as an instrument through which Local Action Groups (LAGs) can design and implement strategies, make decisions and allocate resources for the development of their rural areas hand in hand with sustainability.

The success of LEADER and LAGs has led to the possibility of using other ESI funds for their implementation, such as the EMFF, ERDF and ESF, in addition to the mandatory contribution of 5% of the EAFRD (ENRD 2021; MITECO, s. f.-h).

Regulations and management

State Framework

The basic legislation on water management in Spain is the **Water Law** of 1985, recast in 2001, and adapted to the European Water Framework Directive (WFD) in 2003. The purpose of this law is the regulation of the Public Hydraulic Domain (DPH) and the use of water, as well as the protection of inland, coastal and transitional waters (Murillo, Gracia, and Baccour 2023; MMA 2000).

The latest amendment to the Water Law (Royal Decree Law 4/2023) contains a major modification of the legal regime of water reuse in order to encourage the use of reclaimed water promoted from the European Union (BOE 2023b).

The Water Law establishes that all inland waters (both surface and groundwater) **are in the public domain, so that individuals only acquire the right harvesting, not water ownership** (MMA 2000).

DPH is constituted by inland waters (both surface and groundwater), natural current channels, reservoir beds and lakes.

Along with the **Regulation of Hydraulic Public Domain** (RDPH), the different uses and uses of DPH are established and regulated. Which are divided into (MITECO, s. f.-j):

- **General Common Uses**: they can be carried out by the entire population without prior authorization. Use of surface water (drinking, bathing, domestic uses, and watering livestock) without altering the quality and flow of water.

- **Special Common Uses:** They can also be carried out by the general population, but due to their intensity or danger, they require a prior responsible declaration (navigation, jetties, etc ...).

- **Private uses:** a legal title is granted to an individual for the sole use of the DPH. But ownership remains with the state. They can be by legal provision or by administrative concession.

Motivated by the Recovery, Transformation and Resilience Plan (PRTR) and the digitization PERTE, in **the latest amendment to the Regulation** on the Public Hydraulic Domain (Royal Decree 665/2023), highlights the promotion of digitalization in the management of water resources, administrative simplification and adaptation to European regulations and climate change. It also includes an improvement in the management of discharges and the urban hydrological cycle, promoting sustainable drainage systems; and new developments such as the fight against diffuse groundwater pollution (BOE 2023a).

Likewise, hydrological planning is established through Hydrological Plans by river basins (without administrative limits). In turn, these Basin Hydrological Plans are coordinated by the National Hydrological Plan. **The River Basin Bodies** are the entities responsible for the preparation, monitoring and review of river basin management plans. According to the DMA the hydrological planning

Although not required by the WFD, in Spain plans undergo a Strategic Environmental Assessment (Moya et al. 2018).

process must be completed every six years. **The Third Cycle Hydrological Plans** (2022-2027), approved in January 2023, which define the lines of action to manage water resources in Spain until 2027, are currently in force.

The National Plan for Purification, Sanitation, Efficiency, Saving and Reuse (DSEAR) is a water governance instrument, which establishes a critical analysis regarding the difficulties faced by the public administration in the sectors of purification, sanitation and wastewater reuse in Spain. Improved procedures for compliance with hydrological planning in the areas of purification, sanitation and reuse of reclaimed wastewater have been included in the third cycle management plans. Proposals on the restoration of rivers and aquifers, the protection of groundwater are also addressed; o the assessment of the effects and risks of climate change on water resources and ecosystems in each demarcation, including the development of climate change adaptation plans in river basin bodies (MITECO 2021a; BOE 2021).

News that include the Third Cycle Plans with respect to the previous ones:

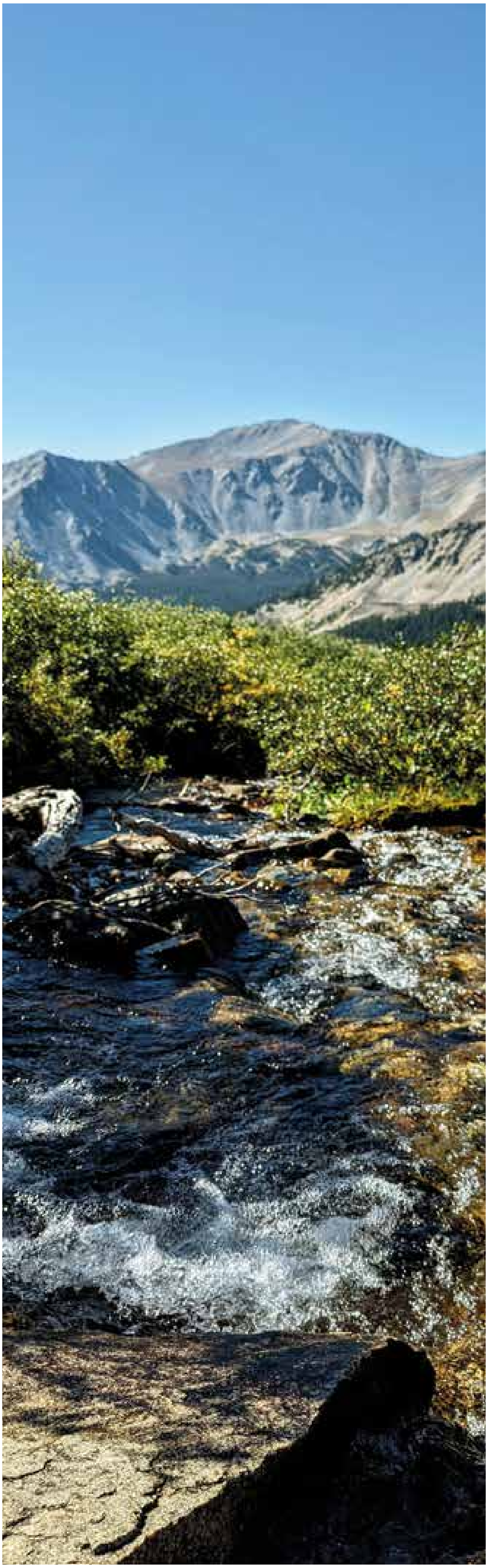
With an investment of €22 billion and 6,500 measures, the new hydrological planning **provides greater protection for water bodies and associated protected areas**. It also defines ecological flows that ensure the protection of waters, their ecosystems and diversity. And it not only establishes the volume of water available in each demarcation, **but how to prioritize its uses and manage drought events**. In this way, in line with European policies, river basin management plans incorporate for the first time climate scenarios marked by the effects of global warming, and foresee additional water sources such as desalinated or reused water (MDSA 2021; 2023).

In the planning context established by the WFD, 25 **river basin districts** have been defined in Spain by Royal Decree 125/2007, each with a river basin management plan (MITECO 2022c). We found three types of Hydrographic Demarcations (MMA 2000; MITECO 2022c) (Figures 15 and 16):

Inter-community demarcations: where the territory of a river basin district extends over more than one Autonomous Community, the responsibility for water, and therefore the preparation of the river basin management plan, lies with the State, and is exercised through the River Basin Confederations (basin body). There are 11 cases of inter-community demarcations: Miño- Sil, Western Cantabrian, Douro, Tagus, Guadiana, Guadalquivir, Segura, Júcar, Ebro, Ceuta and Melilla. Unique case of the Spanish part of the Eastern Cantabrian Hydrographic Demarcation: integrates inter-community basins (State competence, promoter CH Cantabrian), and Basque intra-community basins (competence of the Basque Government through the Basque Water Agency).

Unique case of the Spanish part of the Eastern Cantabrian Hydrographic Demarcation: integrates inter-community basins (State competence, promoter CH Cantabrian), and Basque intra-community basins (competence of the Basque Government through the Basque Water Agency).

Intra-Community demarcations: where the territory of the river basin district is entirely within an Autonomous Community. The competences in water matters, and therefore in the preparation of the hydrological plans correspond to the Autonomous Community itself if it has assumed this in its Statute of Autonomy, to through the competent water



River basin distric: the land and marine area composed of one or more neighbouring river basins and the transitional, groundwater and coastal waters associated with those basins (MITECO, f.-e).

Watershed: as the area where all the waters belonging to the same natural drainage network (currents, rivers and lakes flowing into the sea through a single mouth, estuary or delta) converge. The river basin as a resource management unit is considered indivisible (MITECO, s. f.-d).

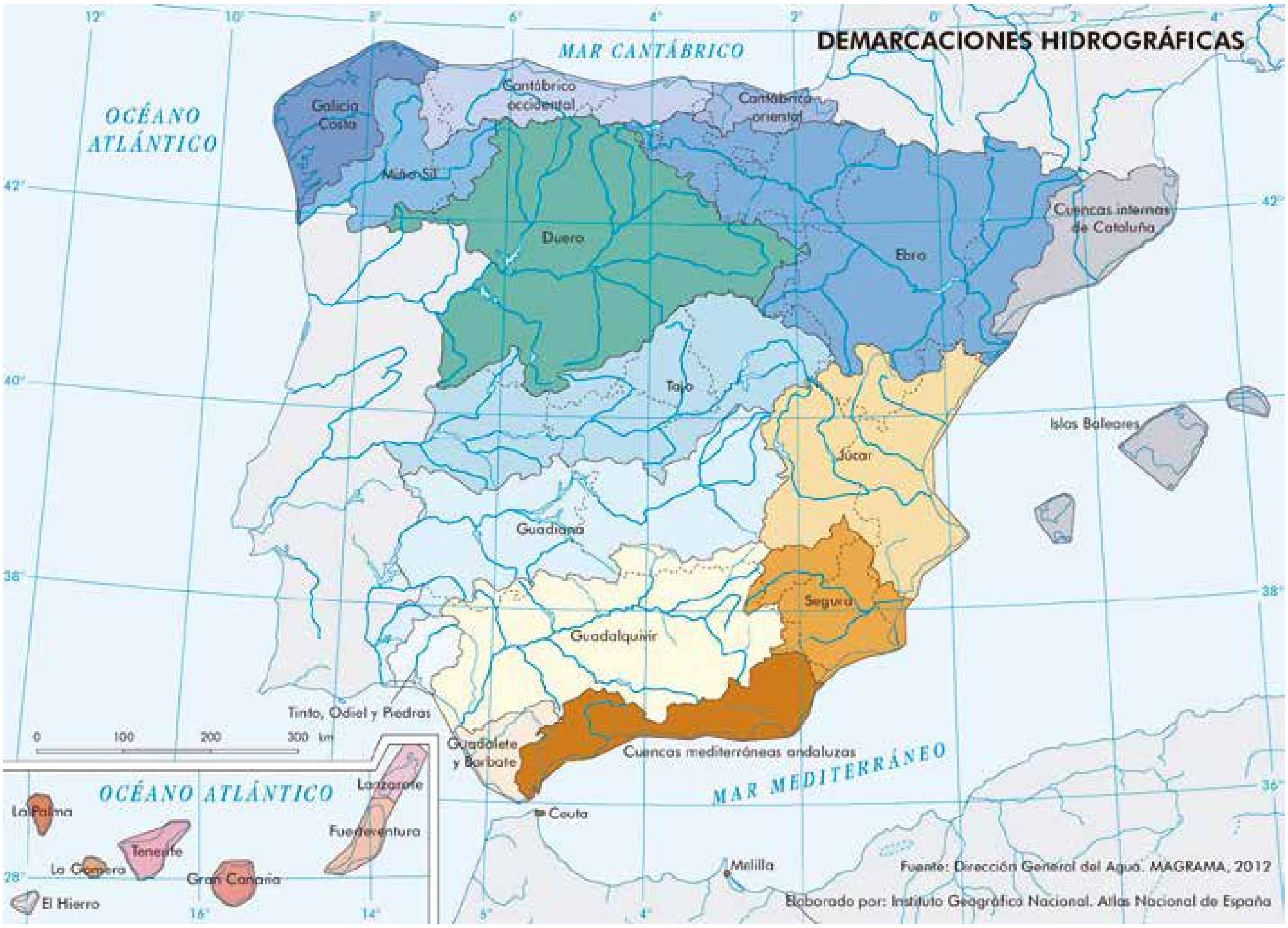


Figure 15: Map of Hydrographic Demarcations and Provinces of Spain (Geoportal of the Ministry for the ecological transition and demographic challenge).

administration body. The Autonomous Communities may adopt State law with the necessary amendments to take account of its specific features. There are 13 cases of intra-Community demarcations: Galicia - Galicia Costa; Andalusia Andalusian Mediterranean Basins, Guadalete and Barbate, Tinto, Odiel and Piedras; Catalonia - River Basin District of Catalonia; Balearic Islands; and each of the Canary Islands.

International Demarcations: those shared with another Member State of the European Union. The Hydrological Plan of the Spanish side is prepared in coordination with the neighboring states through international conventions and agreements. Portugal: Albufeira - Miño-Sil, Duero, Tajo and Guadiana Convention; France: Toulouse - Eastern Cantabrian and Ebro Agreement.

The hydrological plans

- They arise as a result of the European Water Framework Directive.

- They are cyclical in nature, being renewed every 6 years.

- These are documents, prepared by the river basin bodies, which set out the guidelines to be followed for water management in each river basin district.

- They establish the regulatory framework through which environmental objectives are achieved and the available resources are known.

- It has a great participatory character.

- The RBMPs are currently in their third hydrological planning cycle for the period 2022-2027.

Name of the river basin district	Organism promoting the Hydrological Plan
Miño – Sil	Miño Hydrographic Confederation - Sil
Galician Coast	Augas de Galicia, Xunta de Galicia
Eastern Cantabrian	Cantabrian Hydrographic Confederation Basque Water Agency, Basque Government
Western Cantabrian	Western Cantabrian Hydrographic Confederation
Duero	Duero Hydrographic Confederation
Tajo	Tagus Hydrographic Confederation
Guadiana	Guadiana Hydrographic Confederation
Guadalquivir	Guadalquivir Hydrographic Confederation
Cuencas Mediterráneas Andaluzas	Ministry of Sustainability, Environment and Blue Economy, Junta de Andalucía
Guadalete y Barbate	Ministry of Sustainability, Environment and Blue Economy, Junta de Andalucía
Tinto, Odiel y Piedras	Ministry of Sustainability, Environment and Blue Economy, Junta de Andalucía
Segura	Segura Hydrographic Confederation
Júcar	Júcar Hydrographic Confederation
Ebro	Ebro Hydrographic Confederation
Distrito de Cuenca Fluvial de Cataluña	Catalan Water Agency, Generalitat de Catalunya
Balearic Islands	Directorate-General for Water Resources, Balearic Government
Gran Canaria	Gran Canaria Island Water Council
Fuerteventura	Fuerteventura Island Water Council
Lanzarote	Lanzarote Island Water Council
Tenerife	Tenerife Island Water Council
La Palma	Island Water Council of La Palma
La Gomera	Island Water Council of La Gomera
El Hierro	El Hierro Island Water Council
Ceuta y Melilla	Guadalquivir Hydrographic Confederation

Figure 16: River basin districts and promoting bodies. CEDEX (2020, fig. 204, p. 127).

Intercommunity   Intracommunity   Shared with France   Shared with Portugal

Regulations and management

Governance

Water, because of its transversal role, involves both public, private and non-profit actors in decision-making and project execution. In addition, hydrological boundaries and administrative perimeters do not usually coincide. **That is, water management is multilevel**. This added difficulty is why the OECD maintains that **"water crises tend to be fundamentally governance crises"**. For this reason, the OECD designed in 2015 the 'Water Governance Principles', a guide to address current and future water policy challenges, based on bottom-up decision-making.

These principles recognise that there is no one-size-fits-all solution to global water challenges, but that governance responses must be tailored to the territorial specificities of, and within, each country. To date, more than 170 stakeholders have endorsed the OECD Principles, including Spain.

Good water governance translates into sustainable and integrated water resources management based on cooperation and transparency (OECD 2018).

The OECD defines water governance as the " Fan of Rules, Practices and Processes (formal and informal) political, institutional administrative and through which they are taken and implement decisions, actors can articulate their interests and that their concerns are taken into consideration, and the policyholders decisions are accountable for their management of the water".

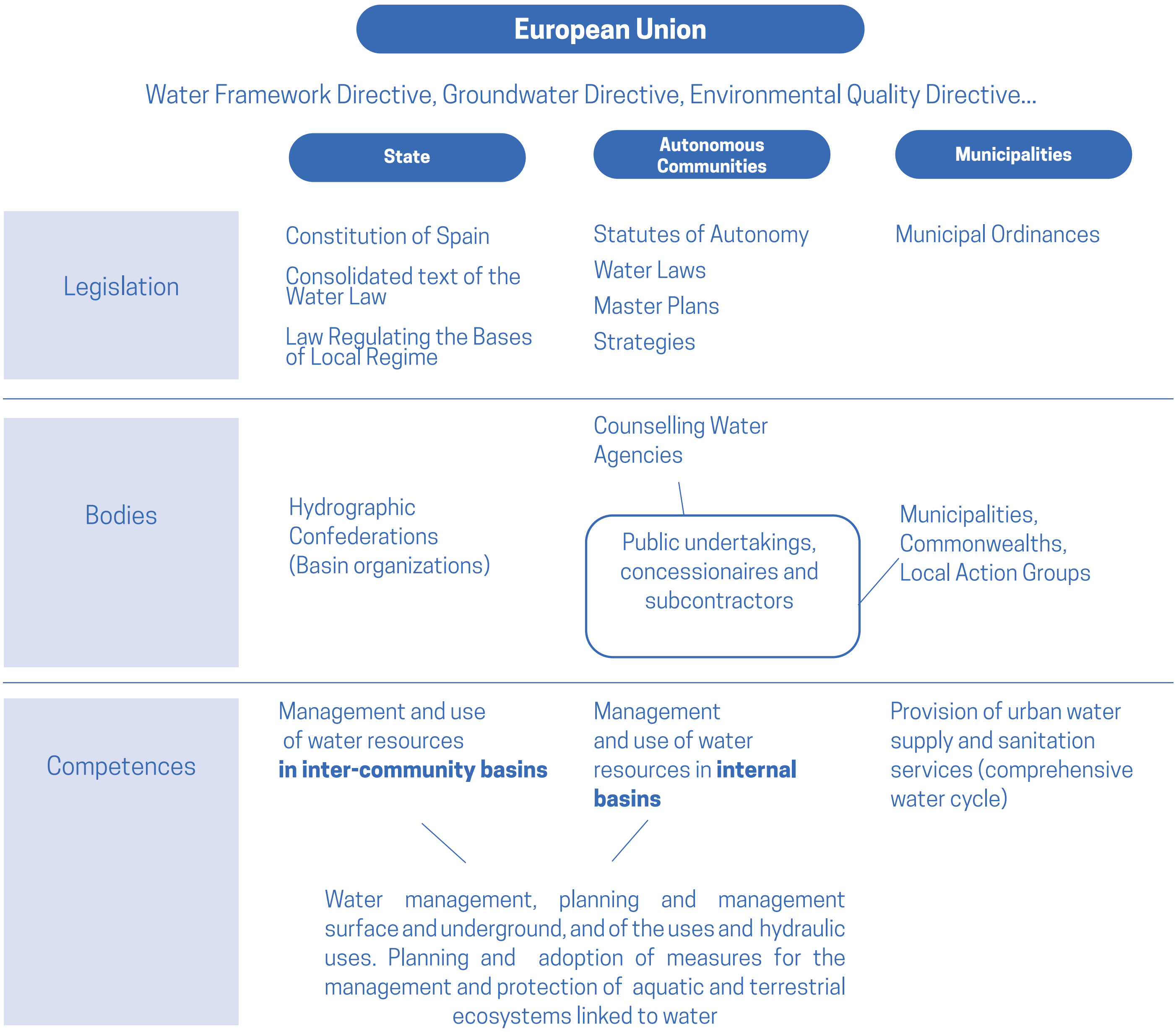
Although in Spain the water sector is highly regulated, it presents a great fragmentation in terms of its competences (Figure 17), since in addition to being a multilevel water management, a multitude of actors intervene in it. **We find, therefore, concurrent competences, which make necessary an effort of cooperation and coordination between all the administrative levels involved** (MITECO 2020a).

As dictated by both the Spanish Constitution and the Water Law, *the State has exclusive competence over the legislation, management and concession of water resources and their use, provided that the waters will flow through more than one Autonomous Community (inter-community waters)*
(BOE 2001; 1978).

Of these State powers, those that are not strictly legislative are exercised by the river basin bodies of the inter-community river basins. In addition, the Water Law and the National Hydrological Plan regulate and condition water policies not only at the level of the state and basin organizations, but at the level of all the Autonomous Communities.

Likewise, for waters that run entirely through a single Autonomous Community (intra-Community or internal waters), the competences in water matters may be assumed by the Autonomous Community itself, if it has assumed this in its Statute of Autonomy. That is why most of the Autonomous Communities have a water law that regulates the

Figure 17: Institutional competences on water (MITECO 2020a; Catalan Competition Authority 2022).



exploitation of water resources, supply and sanitation of the territory. To facilitate the monitoring of the legislative framework, the Communities usually also have an attached public law entity that centralises management (MITECO 2022c; MMA 2000; MITECO 2020a).

Finally, according to the Law Regulating the Bases of Local Regime of 1985, the domestic supply of drinking water and sewerage is municipal competence, regardless of its size and economic situation (BOE 1985). That is, **it is the municipalities that are responsible for guaranteeing access to drinking water, and therefore those responsible for the management of the urban water cycle in their municipality.**

However, the legislation also recognizes the possibility of establishing mechanisms for cooperation between municipalities. For example, if all parties agree, the provincial councils have the power to decide on the provision of water services in municipalities with less than 20,000 inhabitants, being able to implement forms of shared management through associations of municipalities, consortia or other cooperation networks. This way of managing urban water services may be of particular interest to smaller municipalities, since it is more economical (Rubio and Gómez 2020).

Water in Spain

Water ressources

Runoff refers to the flow of water from rain (or thaw) that remains on the surface or subsoil after undergoing the process of evaporation and meeting the needs of living beings. It is a measure of the renewable resources of a basin.

Spain is a country with a wide climatic diversity and strong geographical contrasts, which conditions the distribution and availability of the territory's water resources. Consequently, the country is characterized by a great irregularity in its water resources. This irregularity is not only reflected in the rainfall regime, with marked periods of drought and episodes of flooding, it is also present on a geographical scale (Figure 18).

There is a geographical gradient between the regions of the north and northwest, with an abundance of water resources, with respect to those of the south and east, which show greater water scarcity (MITECO 2022e; MMA 2002).

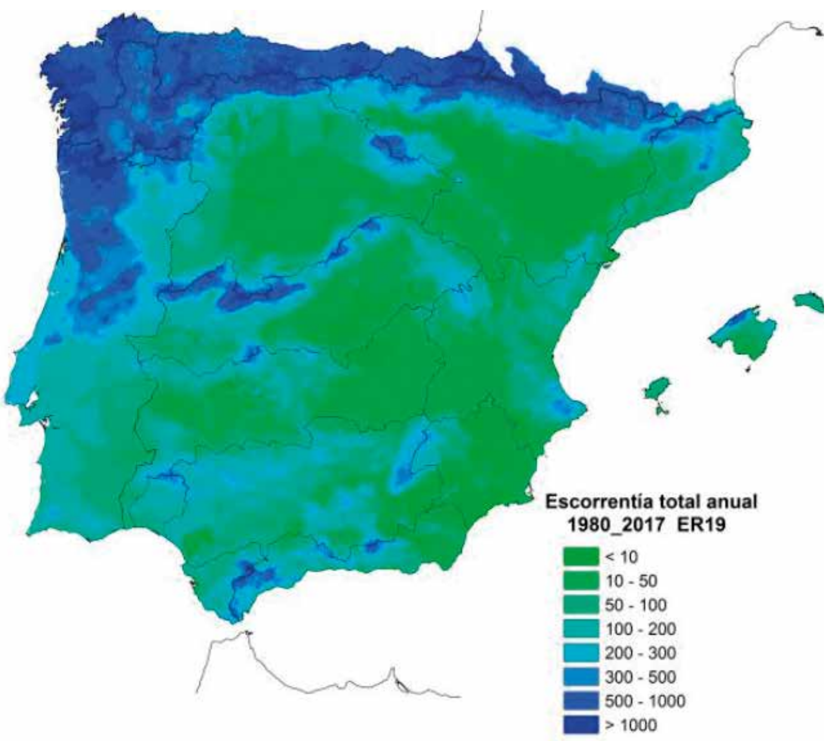


Figure 18: Map of spatial distribution of total annual runoff (mm) CEDEX (2020, fig. 204, p. 127).

This particular geographical configuration has given Spain a **great natural wealth**, being one of the main centers of biodiversity in Europe.

However, it also makes **the region particularly vulnerable to changes in climate and rainfall patterns.**

Global warming has brought with it unstable seasonal patterns, rising temperatures and decreased rainfall, which has intensified the already irregular situation of our water resources.

Extreme weather events such as droughts, heat waves, floods and fires have become more frequent and prolonged, directly affecting water scarcity.

In this context, **the Mediterranean region is particularly sensitive to the effects of climate change**, most pronounced in the arid and semi-arid areas of the country. These regions are also those that support greater water extraction and support the development of key sectors of the economy, such as agriculture, forestry, or tourism. These socio-economic characteristics inherent in Spain are closely dependent on climate, so the effects derived from climate change not only represent a challenge at the level of water resources or biodiversity, but also at the level of society as a whole (MITECO 2022e; 2020b; MDSA 2023).

Citizen survey of the Citizen`s Observatory of Drought

37%

For 37% of the people surveyed, climate change tops the list of global problems that we must face.

9/10

9 out of 10 answered that their environment was affected by the increase in temperature (91%), the alteration of the season cycle (88%) and drought (88%).

77%

Only 30% think that we are before an irreversible situation, while 77% think that changing our lifestyle can help solve the problem.

Source: Citizen survey of the Citizen´s Observatory of Drought, 2022. (Lafuente et al. 2023)

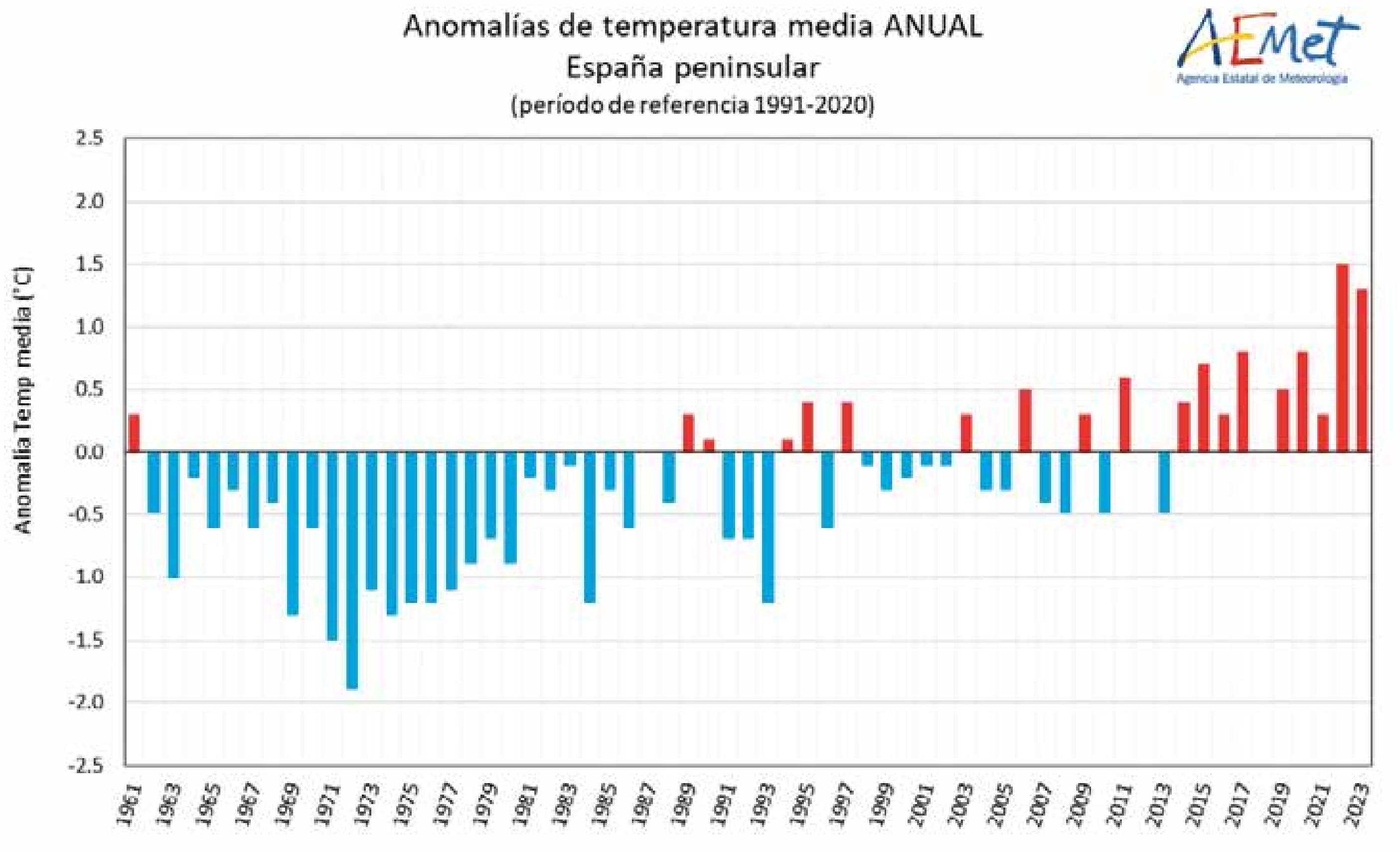


Figure 19: Average annual temperature anomalies in Spain until 2023. (AEMET 2024).

It is expected that in Spain the temperature will increase to 1oC in the short term, and from 2 to 3.8oC throughout the 21st century (Martín and Segrelles 2022). In fact, **2022, closely followed by 2023, has been the warmest year in Spain since there was a record** (1961 by the AEMET), with an average temperature on the peninsula of 1.6oC above the annual average. Although in many regions the thermal anomaly reached +2oC. **August 2023 stands out as the warmest in the historical series, reaching more than 45oC in several areas of the country** (Figure 19) (AEMET 2023; 2024).

Given the alarming situation facing Spain, in January 2020, the Government declared the **climate and environmental emergency**, which was followed by the various reforms, plans and strategies to address the effects of climate change and curb the deterioration of ecosystems and the status of water bodies (La Moncloa 2020). In addition, all Autonomous Communities have put in place similar mechanisms. In 2023, 6 have an existing climate change law, 9 have climate change strategies, and in 4 of them the law is in the process of being implemented (see section 'Autonomous Communities') (MDSA 2023; Adaptecca, s. f.).

Although **droughts** are a normal and recurrent component of climate, they have been intensified by the effects of climate change and inadequate management of water resources. As part of the integrated management of water resources, periods of water scarcity must be considered in the general framework of hydrological planning. In addition, framed in the context of the hydrological plans, the current **Special Drought Plans** (SDPs) for inter-community demarcations, for

the management of situations of prolonged drought, were approved in 2018. In the case of inter-community schemes, the Autonomous Communities concerned adopted their own plans. The SEPs seek to minimize the environmental, social and economic impacts of possible drought situations, optimizing the management of available water resources (MITECO, s. f.-f).

For the past three years, **annual precipitation has been below average.** In 2023, precipitation was 16% lower than the average. In fact, 2023 was very dry, with 17.1% of the territory suffering prolonged drought, and 22% in an emergency situation due to drought. **Areas of Catalonia, Valencia and Andalusia** have been particularly affected by water scarcity (MITECO 2024).

Spain has one of the highest rates of water exploitation in Europe, and is one of the European countries with the greatest tendency to water stress. It is, as recently published by the WRI (World Resources Institute), among the 21 countries with high water stress worldwide (that is, it uses 40 – 80% of its water resources) (Kuzma, Saccoccia, and Chertock 2023).

The country has a fragile balance between available water and water for agricultural, consumption or industrial use, among others (MITECO 2022e). When the balance between water demand and the capacity of the natural resources available to meet them is broken, this triggers water scarcity or water stress (European Commission, s. f.-j).
The United Nations Convention to Combat Desertification (UNCCD) defines desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, such as climatic variations and human activities" (BOE 1994). According to this definition, more than two thirds of the Spanish territory are potentially affected by this process, as they fall into these risk categories (MAGRAMA 2016).

74% of the Spanish territory is susceptible to desertification (MITECO 2022b).

There are several factors that influence this process of degradation of the environment. In the case of Spain, the geographical situation and climatic conditions are interrelated, with anthropogenic factors such as the management and unsustainable uses of resources. To these 'traditional' factors is added the threat of climate change, which, by contributing to the expansion of semi-arid climates, favours the process of desertification (MAGRAMA 2016; MITECO 2022b).

As a country affected by desertification, and following the UNCCD, **Spain adopted in 2008 the National Programme of Action against Desertification** (PAND) with the aim of identifying the factors contributing to desertification and the practical measures needed to combat it and mitigate the effects of drought. Given the need to adapt the PAND to a new international agenda, for the protection of the environment and sustainable development, the National Strategy to Combat Desertification (ENLD) was approved in June 2022. This strategy thus establishes a new framework for policies and initiatives related to desertification in Spain. It includes actions to prevent and reduce desertification and restore degraded areas; improving coordination and governance in combating desertification; and to improve the knowledge and participation of society (MITECO 2022b; MARM 2008).

59%

59% say that in Spain there is water enough

But only 22% are in favor of reducing the consumption

22%

Source: Citizen survey of the Citizen of Drought Observatory, 2022 (Lafuente et al. 2023).

Water in Spain

Water resources

Origin

Of the ecosystems that make up the Spanish land territory, only 0.7% rivers, lakes and wetlands, while the 40.5% are agroecosystems (holdings agricultural) (EEA, s. f.-a).

The water resources from which Spain is supplied may originate from natural sources such as surface water and groundwater, or from alternative sources such as water from desalination.

For the 2020/2021 hydrological year, 71.59% of the water used for consumptive uses was of surface origin, while 23.12% was of underground origin, and the remaining 5.12% came from other sources (desalination, regeneration or transfers from other demarcations) (Figure 20) (MITECO 2022c). According to AEAS (the Spanish Association of Water Supply and Sanitation), in 2022 65% of the water collected for supply (human consumption) was from surface water, 26% from groundwater, and the remaining 9% from desalinated water (AEAS - AGA 2022).

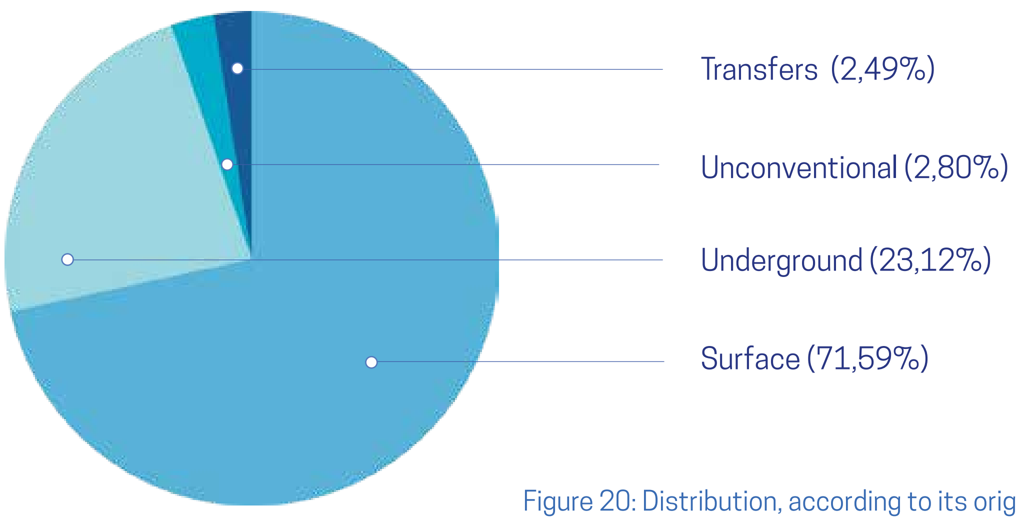


Figure 20: Distribution, according to its origin, of the water used to meet the demands in the year 2020/21 (Monitoring Report of Hydrological Plans and Water Resources in Spain. Year 2021).

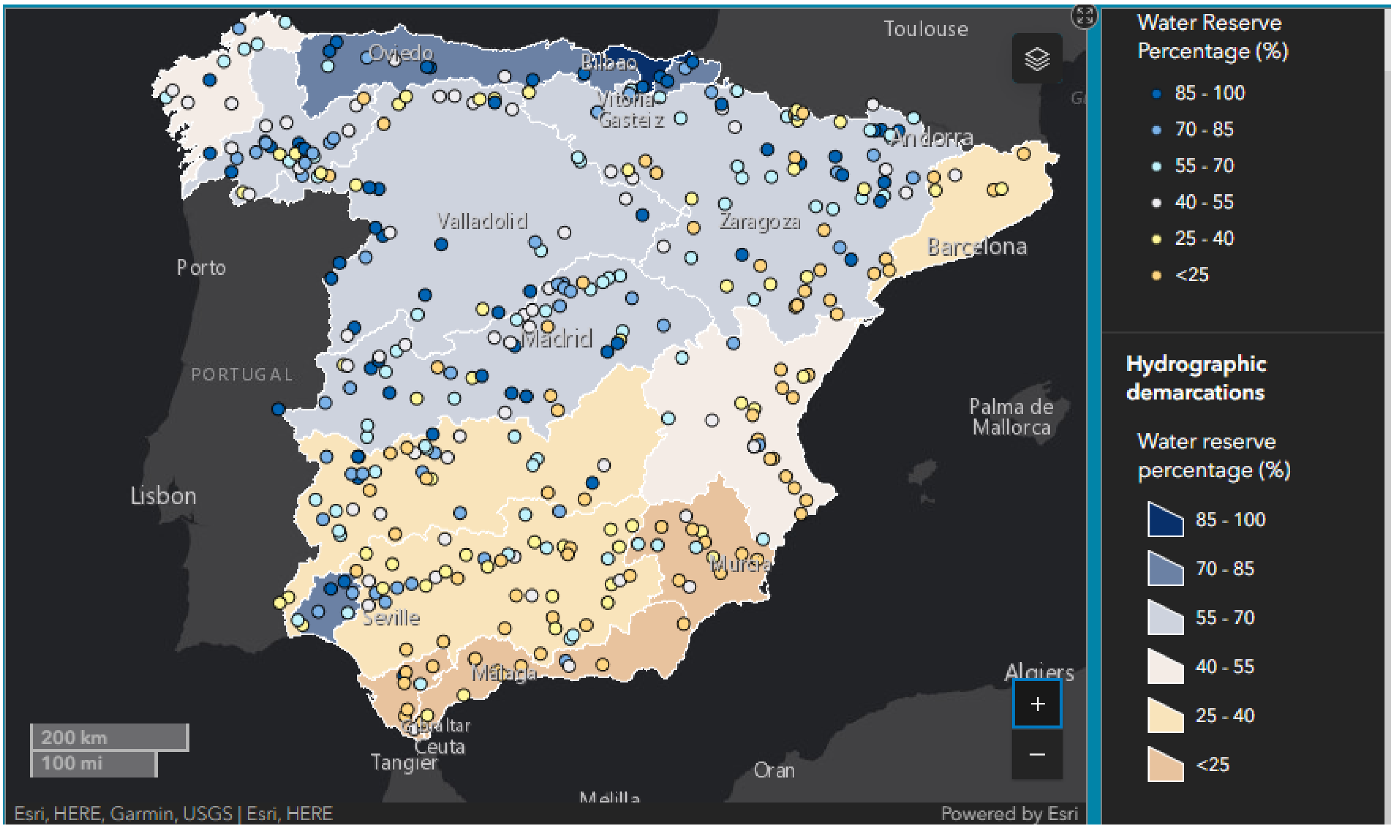


Figure 21: Map of water reserve for consumptive use by river basin district (Weekly Hydrological Bulletin, MITECO).

Surface waters are bodies of inland water that run along the surface of the territory, and whose origin is usually the precipitation of the basins. Within these waters we can differentiate different systems, such as rivers and lakes. In general, the **more than 5,400 surface water bodies** in the country are exploited through reservoirs and dams that allow capturing and regulating the flow of water (MITECO, s. f.-g).

The current volume of water stored in the reservoirs, **or total water reserve,** at the peninsular level is 50.5% (includes both reservoirs for consumptive use and for hydroelectric use). This capacity of reservoir water is below the average of the last 10 years, of 55.9%. With respect to the water reserve for consumptive use (agricultural, supply, industrial uses...), **the reservoir water** is still lower, with a capacity of 38.4%.

The most alarming river basins are (Figure 21):

- **The Internal Basins of Catalonia**, with a reserve of 16.25%
- **The Segura Basin**, with a reserve of 18.42%
- **The Guadalquivir Basin**, with a reserve of 21.03%
- **The Andalusian Mediterranean Basins**, with a 18.31% reserve
- **The Guadalete - Barbate Basin**, with a reserve of 14.60%

Several of these reservoirs are in a critical state, below 10% of their capacity (MITECO, s. f.-b; s. f.-a).

*As at 8 October 2024

Figure 22: Groundwater in Spain (Geoportal MAPA and MITECO).

On the other hand, **groundwaters** are those that pass under the surface of the soil. The extraction of these waters for their use is usually done from the exploitation of aquifers, geological formations of permeable material that allow the filtration and storage of water inside.

In Spain there are more than **800** groundwater bodies (Figure 22), mostly located in the Ebro Basin (MITECO, s. f.-g; 2022(c).

However, despite the strategic role of groundwater bodies, especially in low rainfall regions, 25.25% of **Spanish aquifers**, that is, **1 in 4, are overexploited.** This excessive extraction affects more than 50% of the underground masses in the Segura basins, and about a third in the Andalusian Mediterranean Basins, those of the Guadalquivir, those of the Júcar and those of the Balearic Islands (MITECO, s. f.-g).

This intensive exploitation is often due to the lack of proper monitoring of water bodies (absence of rainfall sensors measuring the water level of the aquifer), or illegal extractions (Greenpeace 2022). Although the latest official figures published date back to 2006, where the existence of 510,000 illegal wells in Spain was acknowledged, it is currently estimated that the figure is more than one million (WWF/Adena 2006; Luchena 2022). Some of the negative consequences derived from this exploitation are (Jasechko et al. 2024; M. B. Martínez et al. 2022):

- **The reduction of the contribution of water to rivers and wetlands**, ecosystems that are often supplied by groundwater, and consequent loss of biodiversity. Some examples are those of Doñana, Daimiel or the Mar Menor.

- Pollution and saline **intrusion of coastal aquifers**. This situation already affects 13% of groundwater bodies.

- Land collapse or **sinking**, as emptied aquifers can no longer support the weight of the upper layers.

- In some cases, the continuous extraction of groundwater can cause earthquakes due to pressure changes, which is called **induced seismicity** (S. Jayaraman 2021).

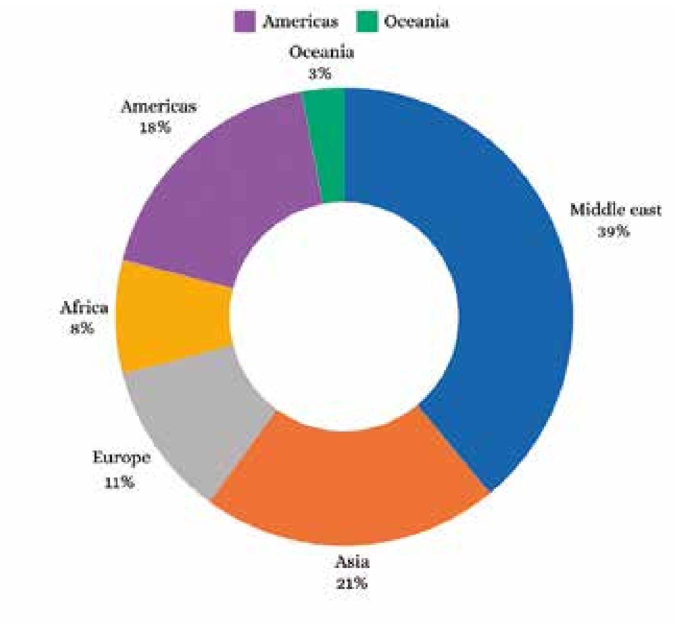


Figure 23: Desalination capacity by geographical region (Europe 11% global). Eke et al (2020, fig. 1 and 2, p. 4).

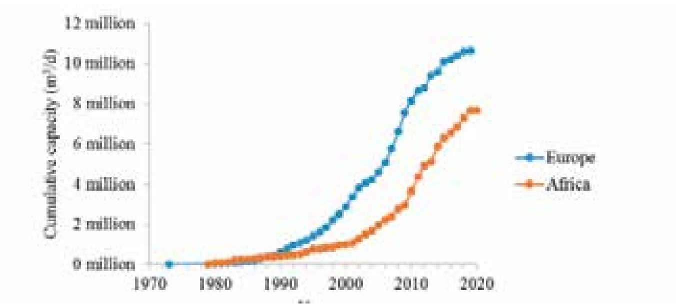


Figure 24: Growth trend in Europe in recent decades. Eke et al (2020, fig. 1 and 2, p. 4).

The water crisis facing Spain, exacerbated by climate change and the intensive exploitation of water resources, has made it necessary to find **alternative ways to increase the availability of water.**

In addition to conventional water resources such as surface and groundwater abstraction, the existence of non-conventional sources such as the desalination of marine and brackish waters or the reuse of reclaimed water should be highlighted.

Desalination, which consists of extracting salt from seawater or brackish water to obtain fresh water, has become popular in recent years, growing by 7% a year since 2010. There are currently around 18,000 desalination plants globally, with the Middle East region having the largest production capacity (39%). However, in recent decades, Europe has experienced rapid growth (1,600%) (Figures 23 and 24). European companies such as GDF Suez, and Spanish companies such as Acciona or Saycr, are among the main contributors in large-scale desalination at a global level (Eke et al. 2020; Mr Z. Martínez 2020).

It is estimated that, **on a global scale, 59% of desalinated water is used in the supply of drinking water, 36% in industry, and 2% in irrigation**, although in Spain, the proportion of desalinated water destined for the latter use is higher (Eke et al. 2020).

In this context, Spain stands out as a pioneering country in Europe, building the first desalination plant in Lanzarote in 1964. It is also one of the countries with the largest installed desalination capacity worldwide, and the first in Europe, with 42% of this capacity gathered in the Segura Basin (Senán-Salinas et al. 2021). Currently it is estimated that **in Spain there are more than 770 desalination plants, where Torrevieja stands out, the largest desalination plant in Europe** (D. Z. Martínez 2020).

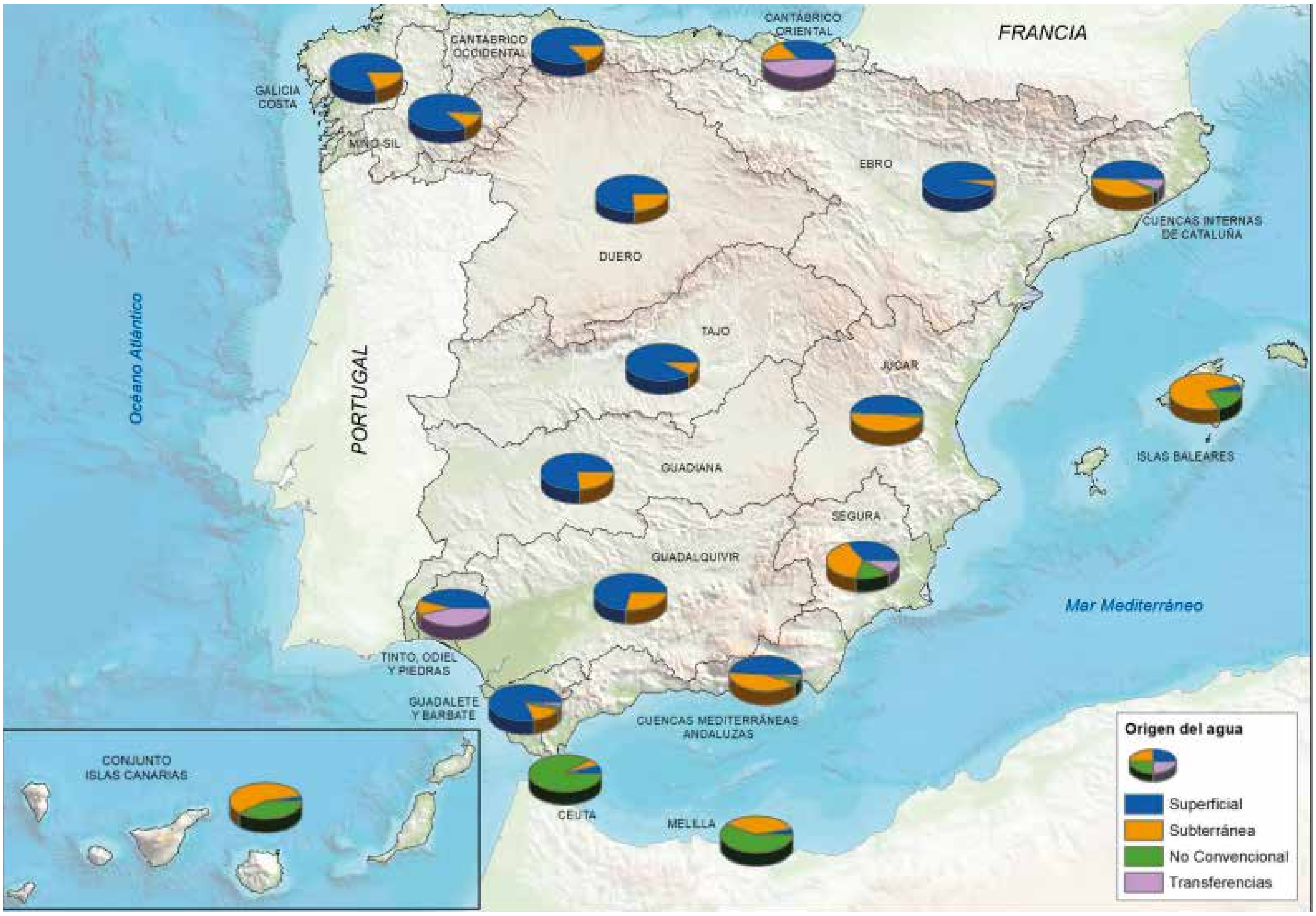


Figure 25: Distribution according to their origin, of the water used to meet the demands in 2020/2021, for each river basin district (MAPA and MITECO, s. f.).

Despite this leading role in desalination, desalination plants in Spain operate on average at one fifth of their installed capacity (as Gonzalo Delacámara, director of the IE Centre for Water & Climate Adaptation and expert in water management, has pointed out on several occasions) (Serraller 2023; Acosta 2017; Information 2017; Velázquez-Gaztelu 2019). This is mainly due to the high cost associated with desalination, associated with the high energy consumption necessary to generate the appropriate pressures to separate salts from water. However, recently the emergence of more efficient technologies is reducing the production costs of this resource.

Another drawback that is associated with desalination **is the concern regarding the salt or brine rejection that is generated in the production process**. It is water with a very high concentration of salts that is normally discharged back into the marine environment. That is why desalination plants are subject to environmental feasibility studies, and must have designs that optimize the dilution of brine in the environment in the most efficient way possible, to avoid a negative impact on the marine ecosystem and its biodiversity (D. Z. Martínez 2020).

Water desalination is particularly important in tourist areas of the country, such as the Canary Islands, the Balearic Islands and the Mediterranean coast (Figure 25). For example, **in Ibiza, one of the islands that attracts the most seasonal tourism, 63% of the water supplied is desalinated, while in Formentera, it is 100%** (GOIB 2023).

Another example is that of Catalonia, where normally only 5% of the water resources for supplying the metropolitan area of Barcelona come from desalination. But as a result of the water scarcity that has been going on for three years (Generalitat de Catalunya 2023), in 2023 58% of the water came from unconventional sources (33% desalinated water and 25% reclaimed water) (AEDyR 2023).

Water resources

State

At present, **the number of masses in poor condition has increased** compared to the previous hydrological planning cycle. Most river basin districts have more than half of their surface or groundwater bodies in poor condition. Nationally, **43.62%** (2,330 out of 5,341) of surface waters do not achieve good ecological or global status. On the other hand, **43.91%** (353 of 804) of the underground ones do not achieve good condition either (Figure 26) (MITECO, s. f.-g; 2021b).

This reality is a major challenge that the third cycle management plans (2022 - 2027) have to face. Therefore, this new planning has as a priority the achievement of good status of water bodies, especially in those related to Natura 2000 sites. The new plans in force show that, if the established measures are implemented, it is possible to achieve good status for the vast majority of water bodies (99% of surface water bodies and 85% of groundwater bodies) by 2027.

In the case of groundwater bodies, being conditioned by the slow recovery of aquifers, they require more time to reach good status, although measures are expected to be already in place and having an effect by 2027 (MITECO 2021b).

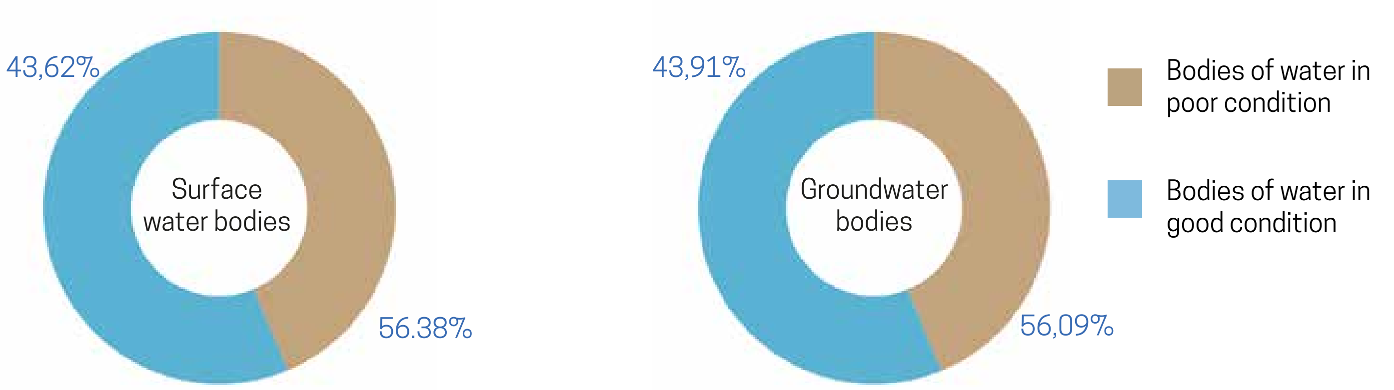


Figure 26: State of surface and groundwater in Spain (hydrological plans and programmes of measures, MITECO).

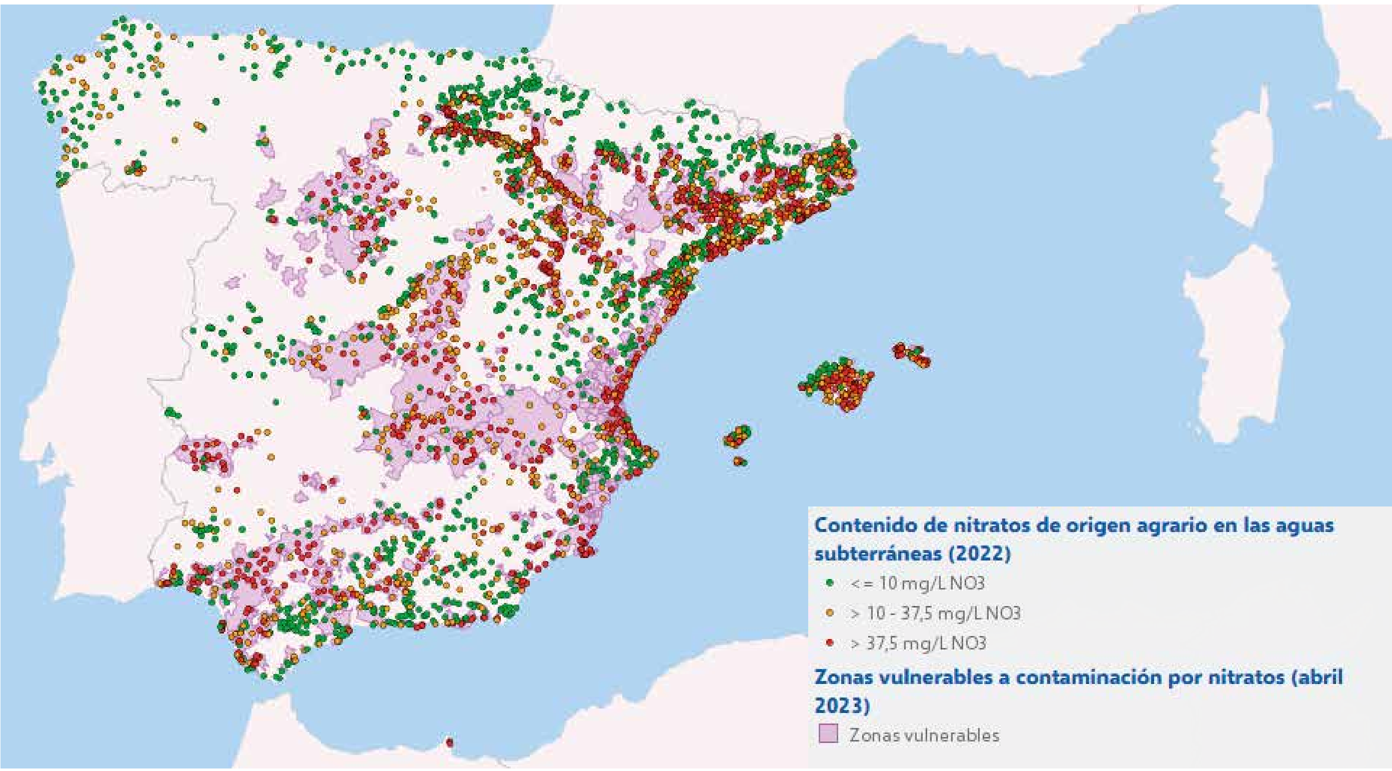


Figure 27: Nitrate vulnerable zones (MAPA and MITECO, s. f.).

Eutrophication and the example of the Mar Menor

One of the most frequent water quality problems in Spain is eutrophication (Figure 27). This condition causes an excessive proliferation of algae that alters the physical-chemical characteristics of the water, preventing photosynthesis below the surface and preventing the existence of numerous species, thus causing the collapse of biodiversity and the ecosystem. Eutrophication is due to excessive inputs of nutrients, such as nitrogen and phosphorus, to water bodies. These polluting discharges often come from wastewater treatment plants, industrial processes, or intensive farming areas (Burkholder, Tomasko, and Touchette 2007).

One of the most worrying cases of advanced eutrophication at the national level is that of the **Mar Menor lagoon**, in the Region of Murcia. Currently the ecosystem of this salt lagoon has lost the ability to regulate due to the excessive contribution of pollutants and nutrients that it receives from the watershed for decades. The eutrophication events suffered have caused the massive death of its biodiversity (fish, molluscs, crustaceans, meadows of Marian plants ...).

These are a series of priority interventions aimed at reversing the deterioration of the lagoon and restoring its ecological balance, with an initial budget of €484.42 million until 2026. Among its lines of action are the restoration of the ecosystems of the lagoon and associated, the conservation of biodiversity, or the improvement of the management, monitoring and surveillance of the Hydraulic Public Domain. All this accompanied by regulatory reforms to avoid pollution by agricultural nitrates.

As of September 2023, 95.8% of the policy framework had already started, with 11.7% of the budget implemented. An example of the measures carried out was the detection of more than 7,000 hectares of illegal irrigation, which were sent to the Autonomous Community for restitution to their original state. Currently the Mar Menor lagoon shows apparent stability, but is threatened by an upward trend in the temperature and pH of its waters, something that if continued could lead to the collapse of biodiversity once again (MITECO 2022d; 2023a).

Another pollutant of increasing concern to the scientific community is micro (5mm – 1 um) and nanoplastics (<1um). With nearly 400 million tons of plastic produced globally each year, these small pieces of plastic have a widespread presence. It is common for them to become part of wastewater from homes, industries, and urban runoff. And even though sewage plants remove some of the microplastics contained in these waters, many micro and nanoplastics end up being released to water bodies. Or in the case of sludge that is reused in agriculture, they end up in the soils.

It is estimated that more than 30 million tons of plastic are dumped into water and soil each year. Consequently, these plastics become part of the waters from which the population is supplied. A recent study found that, on average, 1 liter of bottled water contains 240,000 plastic particles. That is why more and more experts are investigating the adverse effects that these tiny plastics can have on human and ecosystem health (Obermaier and Pistocchi 2022; CUIMC 2024; Qian et al. 2024).

Finally, it is important to mention that another factor that contributes to the poor state of water bodies, especially surface ones, are hydromorphological alterations, which arise as a result of different anthropogenic activities (port facilities, recreational activities, water regulation and supply, energy production ...). It is estimated that around 30% of surface water bodies suffer some form of hydromorphological impact, resulting in the loss of biodiversity and ecosystem services, necessitating their renaturalisation (MITECO 2022e; s. f.-c).

Water in Spain

Integral water cycle

The integral water cycle is the path that water takes from being captured in the raw state in nature until, after being used in the supply and sanitation networks, it is again integrated into the natural environment. This cycle is comprised of several phases (Figure 28) (PwC 2018; Catalan Competition Authority 2022; Ministry of Health 2022).

1. The first step is **water harvesting**. The water resource is obtained from natural sources, collected from surface sources such as rivers, lakes or reservoirs, from underground sources (aquifers) or even from the sea. This first phase of the integral cycle is also called "**high water**". Typically it is the river basin bodies (the river basin confederations in the case of intercommunal river basins, or the regional water ministries and agencies in the case of internal river basins) that manage and regulate these abstraction activities, storage in reservoirs and transport of water to municipalities. It is also at this stage of the cycle where water is extracted for agricultural consumption, large industries or power plants.

The rest of the phases after the catchment are considered as "low water", and the municipalities are responsible for the management. In the "low" water phases, the private sector has a greater presence, around 50%, as it not only provides services, but also manages infrastructure in many cases through concessions, or participations in joint ventures.

2. Next, the captured water must be treated for later use and consumption. In this **treatment phase**, the water is transported to the Drinking Water Treatment Stations, ETAP (or desalination plants,

Integral water cycle

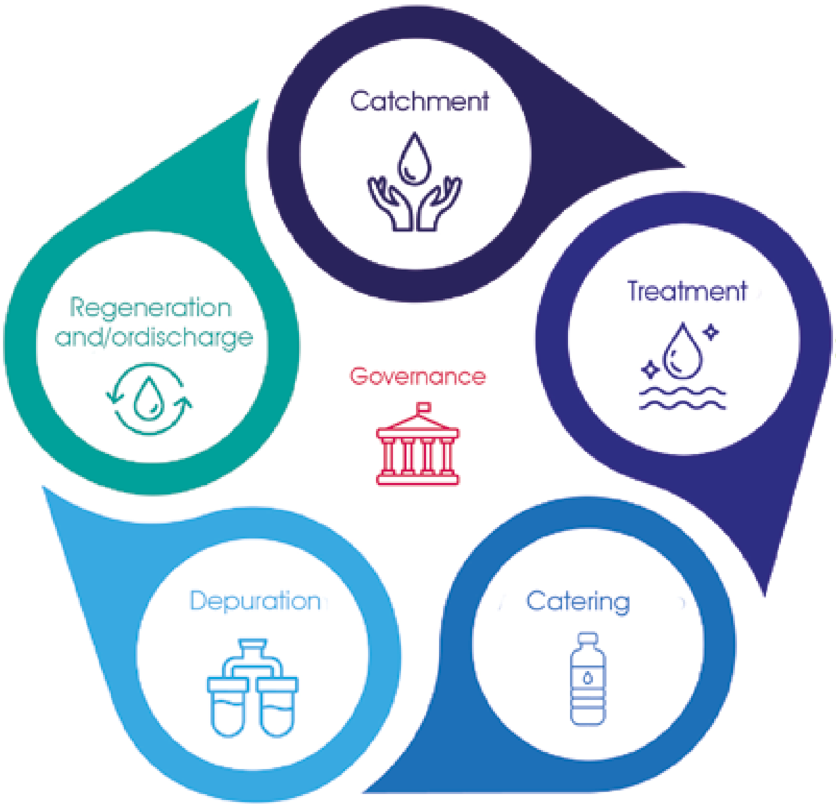


Figure 28: Integral water cycle. Own elaboration.

in the case of seawater), where various physico-chemical processes are carried out with which its purification is achieved, that is, that it is safe for the health of consumers. It is estimated that Spain has around 1,640 PATS (AEAS - AGA 2022).

3. Once treated, **the supply** phase begins, where the water is distributed to the consumer (for domestic use, economic and municipal activities) through the supply networks. These supply networks have a total of 248,245 km, and supply a total of 4,057 hm3 of drinking water per year. It is estimated that 67.4% of **urban water** is for domestic use, 11.9% is intended for industrial and commercial consumption and the remaining 20.7% is designated for other uses (such as municipal or institutional activities) (AEAS - AGA 2022).

i

The water sector is a major energy consumer (consuming 4% of the total electricity generated worldwide (IDAE 2010)). But in turn, water can also be used in this first phase of uptake to produce hydraulic energy. **Spain is one of the most dammed countries in the world, with more than 1,200 dams**, of which 40% correspond to hydroelectric reservoirs, one of the highest proportions in Europe and the world (in 2022 Spain ranked sixth in energy generated with this technology) (Van Hove et al. 2019; 2023 electricity grid).

4. After using them, the wastewater passes to the sewerage and sewerage network, which comprises a total of 189,203 km, through which it is transported to the Wastewater Treatment Stations, WWTP. In this **purification** phase the water is treated by chemical and biological processes for its subsequent use or discharge. It is estimated that in Spain there are more than 2,200 WWTPs, which purify a total of 4,066 hm3 of wastewater per year (AEAS - AGA 2022).

5. As a last step in the integral water cycle, the treated wastewater can receive an additional (tertiary) treatment that allows its quality to be adapted to future uses. The water that receives this tertiary treatment is called **reclaimed water.**

i

According to data published by WISE Freshwater (the European Water Information System), in Spain 84% of wastewater is treated according to Community legislation (EEA, s. f.-b).

Integral water cycle

Challenges

Despite the fact that the quality of water and sanitation services is usually satisfactory, especially in large cities, the integral water cycle continues to present a series of challenges in our country. Some problems to highlight are:

Coordination and management. The water sector is very complex, since there is a wide diversity of policies related to water (territorial planning, nature conservation, industry, energy, agriculture...). Dialogue between administrations with competences in the different sectoral policies is therefore essential for a coherent and synergistic implementation of water policies. But in many cases there is no inter-administrative, cross-cutting and effective coordination, resulting in a lack of clarity and homogeneity. This heterogeneity in the integral water cycle often means that the quantity, quality or service of water is not guaranteed (Gaya 2020).

Transparency, accountability and citizen participation. Transparency is an essential condition in a public service such as water. The lack of transparency and access to information about this service makes it difficult to manage and control it effectively. Transparency is also essential for proper citizen participation. But for citizens to exercise their right to participate in the evaluation of implemented water policies, accountability mechanisms are necessary. Access to up-to-date information on the entity providing urban water cycle services, as well as agreements, should therefore be ensured taken, works awarded, tenders and investment plans. On the other hand, information on the actual water consumption and the total extraction that is made of the flows must also be made public, without forgetting the state of conservation and hydraulic performance of the networks (MITECO 2020a; Rubio and Gomez 2020; PwC 2018).

Delays in the adequacy of supply and sanitation systems.
The Spanish supply and sanitation systems have had to adapt to the progressive Community requirements in terms of quality, quantity and guarantee of service, but in many cases they still have significant delays. It is common to find obsolete or deteriorated facilities resulting in high water losses.

Water and sanitation networks suffer from slow and continuous deterioration, but being buried and inaccessible may not be perceived by citizens and administrations until it is too late. In the medium term, this wear and tear on infrastructure leads to an ever-increasing reduction in service. In the case of supply networks, in the form of water losses or intrusion of pathogens into pipes; while in sanitation and purification systems it can mean a lower capacity of the networks, or even pollution of the water by infiltration, by discharges or by volumes greater than their capacity. However, in the long term, when the state of deterioration is greater, the consequences can become catastrophic, potentially resulting in supply disruption (Gaya 2020; Rubio and Gomez 2020).

Currently, the renewal rate of the supply and sanitation networks in our country is 0.2% and 0.4% respectively, well below the ideal 2%, which contributes to their progressive aging (Figure 29). And, the investment to guarantee the services of the integral water cycle is below 50% of what is required to face these future challenges (AEAS - AGA 2022). It is common that the difficulties of financing the maintenance and updating of these infrastructures make it not a priority to prevent water from being lost through networks. That is why strengthening the financing of water cycle management must be a priority, so that efforts to ensure sustainable supply and sanitation networks are something constant, and not punctual (Gaya 2020).

According to the latest data from the National Institute of Statistics (INE 2022), the actual or physical losses of water supplied at national level were 15.5% in 2020. If apparent losses (i.e. those due to measurement inaccuracies or unauthorised consumption) are also taken into account, the volume of unrecorded water over that supplied reached 25.1%.

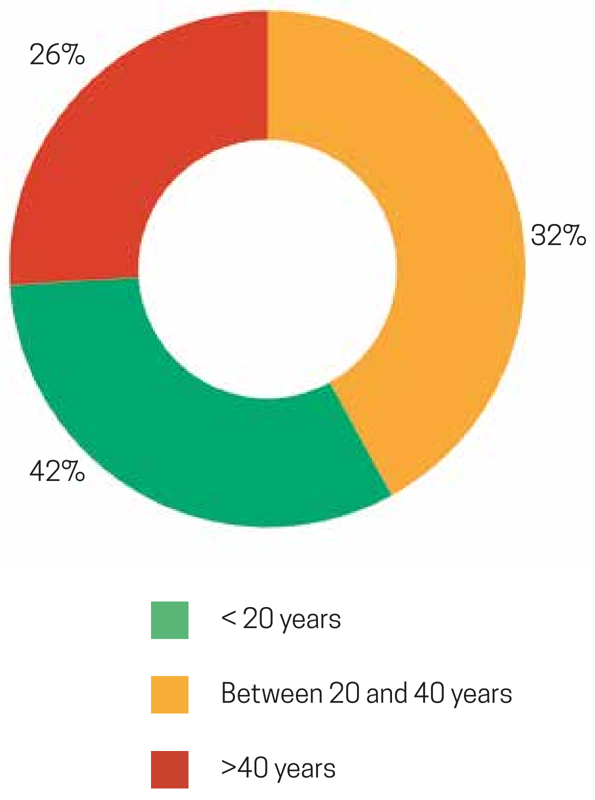
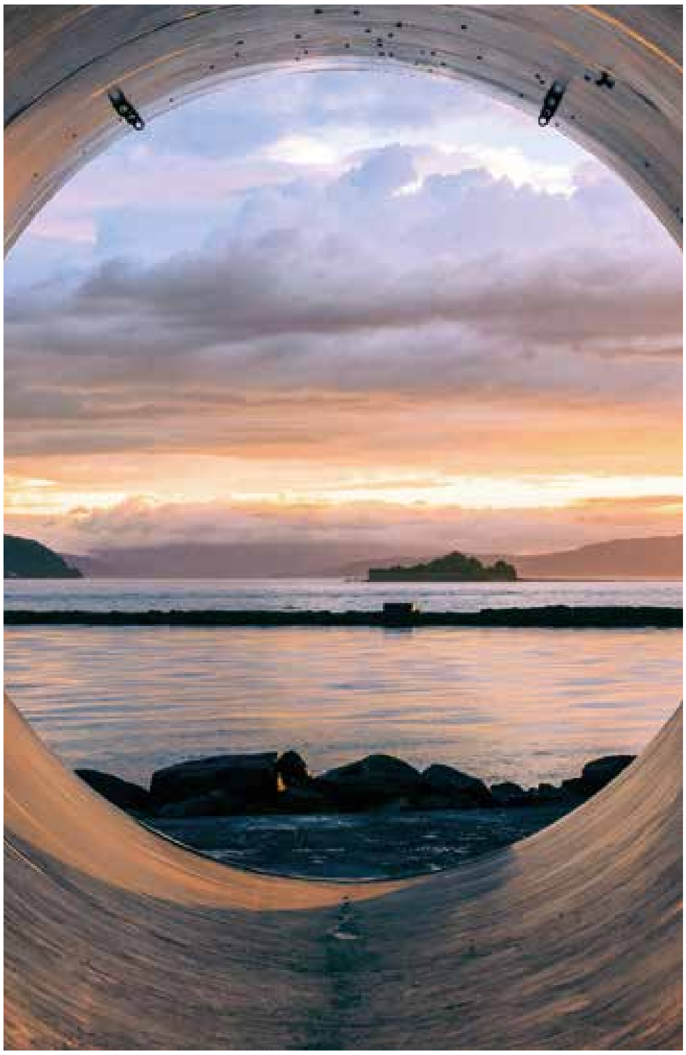


Figure 29: Ageing of supply and sanitation networks. Own production (AEAS – AGA 2022).



Challenges in small and medium municipalities. One of the most recurrent problems faced by the water sector is the economic limitation of many small municipalities, which prevents them from providing a service of the integral cycle of quality water. Lack of investment in small and medium-sized agglomerations makes it difficult to modernise or install adequate supply and sanitation facilities. Network losses resulting from poor infrastructure conservation status, poor drinking water quality due to outdated technologies, or untreated wastewater discharges are therefore common (Rubio and Gómez 2020).

Another element to consider is that of municipalities with a high seasonal population. In Spain there are more than 580 municipalities with less than 20,000 inhabitants that receive a number of visitors five times greater than their registered population. This fact has a wide influence on water consumption throughout the year, generating a very pronounced irregularity in demand. It should be noted that, for the most part, the municipalities concerned are concentrated in inland areas. The challenge of seasonal tourism has to be considered when proposing solutions in the field of the water sector.

Finally, the role of the phenomenon of rural depopulation should be highlighted. In small municipalities where the population suffers a progressive decline, their technical and financial capacity also declines.

Currently 53% of the Spanish territory is comprised of sparsely populated areas (a total of 4,375 municipalities), where 5.48% of the population resides.

Consequently, there are many municipalities that have very basic water services, lack a sewage treatment plant, or have obsolete infrastructure that they cannot maintain. The situation is especially serious in micromunicipalities, that is, those with less than 50 inhabitants, which total more than 400 at the national level (Rubio and Gómez 2020).

Water in Spain

Integral water cycle

Opportunities for improvement and recommendations

It is increasingly clear that a fundamental change in the way water is valued and managed is required, accompanied by innovations and technological and digital advances. Only in this way will it be possible to ensure that this resource is distributed in a safe, predictable, equitable and sustainable manner.

Firstly, **the governance** framework of the integrated water cycle must respond to the demand for improvement of supply and sanitation services established by Community legislation. But the efficient implementation of this management is not possible without transparency, accountability and citizen participation. Likewise, the successful and sustainable regulation of water resources requires effective coordination between the different sectors and administrations involved in water policies, so that both water and other resources (territory, soil, energy) are integrated into the water cycle (MITECO 2020a; Gaya 2020).

Secondly, in a scenario where water for consumption is increasingly scarce, circularity in the use of natural resources is an imperative necessity. The current model of water resource consumption has great potential to transition to a **circular economy system** that makes efficient and sustainable use of water. From its uptake to its return to the natural environment, the integral water cycle offers numerous opportunities for recirculation of resources. Beyond the conventional supply-sanitation cycle, the possibility of integrating circularity in the water sector should be considered, so that the 'waste' generated in the different cycle phases – sludge, membranes, brines, wastewater – are transformed into valuable resources to give a second life (Gaya 2020; Van Hove et al. 2019).

1. Nature-based solutions

The path to the sustainable and effective transformation of the integral water cycle involves reformulating the relationship of urban areas with water. In this context, Nature-based Solutions, SbN, although still little widespread in Spain due mainly to their ignorance, are a great alternative. NBS are **solutions that use or mimic natural processes to improve water availability, improve water quality, and increase resilience to natural disasters**, while contributing to sustainable development (CBD 2018; WWAP/UN-Water 2018; TNC and MITECO 2019; Beceiro, Brito, and Galvão 2022).

Some examples of these solutions are the adoption of green-blue infrastructure, or **Sustainable Urban Drainage Systems, SuDS**.

The latter are elements that participate in the drainage of cities, and not only reduce the flow produced by rain, they also reduce the pollutants that it drags. With this, the SuDS manage to avoid the risk of flooding and filter the contamination of rainwater. Permeable pavements, flood parks, bioretention cells, or green roofs are some of these solutions that provide a natural filtering of water (García-Haba et al. 2022; Avellán, s. f.).

In the 2016 amendment to the Regulation of the Public Hydraulic Domain (PHDN) was included in the Article 126b(7) the obligation to use SuDS in the new urban developments (BOE 2016).info

2. Digitization

On the other hand, digitalisation is already a cross-cutting tool with which to boost sustainable development and address the water deficit (MITECO 2020a).

We can define digital water technologies as those that use digital systems (such as sensors, software, data analysis tools) to manage and monitor water resources (PTEA 2023).

The digitalisation of the water sector has transformative potential in water management and efficient use, as these new technologies (Water Europe 2021; Stein et al. 2022):

- Improve and streamline administrative procedures through automation.
- facilitate availability and access to information and knowledge, contributing to more transparent management.
- They promote dialogue, coordination and homogenization among the actors involved in water policies, thus helping to address the fragmentation and lack of standardization of the sector.
- They allow easy monitoring of the state of water resources and monitoring of environmental parameters, as well as anticipating possible drought or flood scenarios against which to plan in advance.
- Through the sensorization and integration of data they allow the detection of failures, leaks or risks in the infrastructures. It also facilitates the transition towards the decarbonisation of the water sector, through energy optimisation.

Spain has already taken the first steps towards the digital transition of the water sector, through initiatives such as the PERTE Digitalization of the Water Cycle.

3. Unconventional sources

In addition to conventional methods of abstraction, the existence of unconventional water resources such as the desalination of marine and brackish waters or the reuse of reclaimed water should be highlighted. For the proper implementation of an integrated water resources management framework, it is essential to consider these alternative water sources. The development and implementation of such non-conventional methods is booming as **they have the capacity to contribute to a circular water economy and sustainable and adequate management of water resources**. In fact, they represent a significant part of the water resource in some of the country's river basin districts (MITECO 2022c).

Desalination. Desalination involves extracting salt from seawater or brackish water. The product of this process is mainly fresh water, but also a series of by-products that can be given a second life. Brine or saline residue, and reverse osmosis membranes are some of these byproducts (AEDyR 2019a).

Reverse osmosis is the most used process to carry out the desalination of marine or brackish waters. It consists of exerting pressure on a solution with high concentration of salts (sea water) to force its passage through a semipermeable membrane, so that on the other side of this membrane a solution with low saline concentration (desalinated water) is obtained.salino, y las membranas de ósmosis inversa son algunos de estos subproductos (AEDyR 2019a).

Thanks to these 'filters' through which seawater is desalated, it is possible to obtain drinking water for supply, but also for industrial uses or for agricultural irrigation (AEDyR 2019c).

Reverse osmosis membranes are usually discarded after use, generating plastic waste. However, more than 70% of the membranes that are thrown away still have a useful life and can be recycled (Senán-Salinas et al. 2021). That is why, in recent years, the focus has been on the sustainable management of reverse osmosis membranes. Thus, numerous research institutes and companies have focused on promoting a circular model where they are given a second life, for example, reusing these regenerated membranes to treat urban and industrial wastewater (Ecomemb, s. f.).

The brine is a saline concentrate generated in desalination plants, which is commonly returned to the sea without being exploited. But this 'waste' constitutes an entire resource in itself, being possible to extract chemical elements (such as sodium hypochlorite), minerals or even energy from it. Obtaining minerals and chemical elements from brine from desalination plants is what is known as brine mining (AEDyR 2022). In Europe, more and more efficient and circular technologies with low environmental impact are being developed that allow the recovery of high-value metals and minerals from brine, with the aim of limiting the dependence of European countries on the import of strategic minerals and metals such as magnesium, gallium, or lithium, among others (Sea4value, s. f.).

In addition to elements and minerals, we can obtain energy from the brine from salinity gradients. Some Spanish desalination plants that do so are the Atabal (Málaga), the Llobregat, or pilot plants such as ACCIONA's LIFE INDESAL project (Retema 2022; Acuamed 2011; ATL, s. f.).

Did you know that? If exploited, the elements extracted from desalination brines in Spain, could reach values of up to 13,400 – €29.8 billion/year (from Villar et al. 2023).

Regeneration. Reclaimed water is purified wastewater that receives additional treatment so that it can be reused. The use of this alternative resource offers a guarantee of supply superior to that of conventional sources since it can be produced continuously over time (AEDyR 2019b).

It is estimated that by 2030, global production of wastewater has increased by more than 50% compared to 2013 (UNEP 2023).

Given that more than 80% of the fresh water extracted is used in agriculture and industry, the transition to reclaimed water in these areas allows the release of higher quality water volumes, previously committed, for other uses such as supplying the population. This potential of reclaimed water to limit freshwater uptake has led to its reuse becoming a growing activity that can help alleviate water stress (Figure 30) (PTEA 2021; Hristov et al. 2021).

Legislation. The central role of wastewater in ensuring a sustainable future is reflected in Sustainable Development Goal 6. Specifically target 6.3 calls for reducing the volume of untreated wastewater discharged, improving the quality of water bodies, and increasing the reuse of reclaimed water (UN Habitat and WHO 2021; UNEP 2023).

In order to facilitate and promote water regeneration

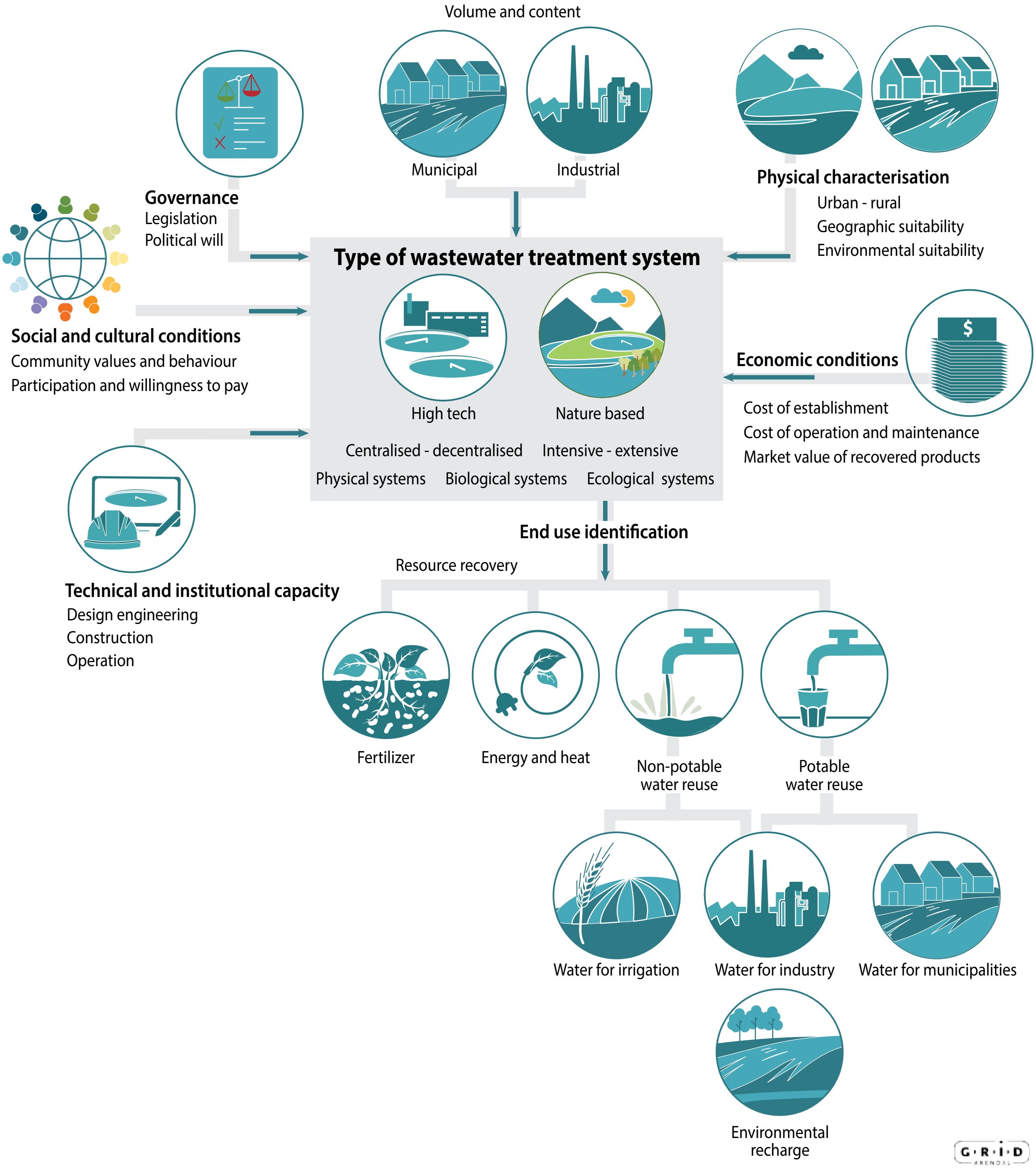


Figure 30: Finding the optimal solution to treat wastewater for resource recovery. Amended UNEP 2023.

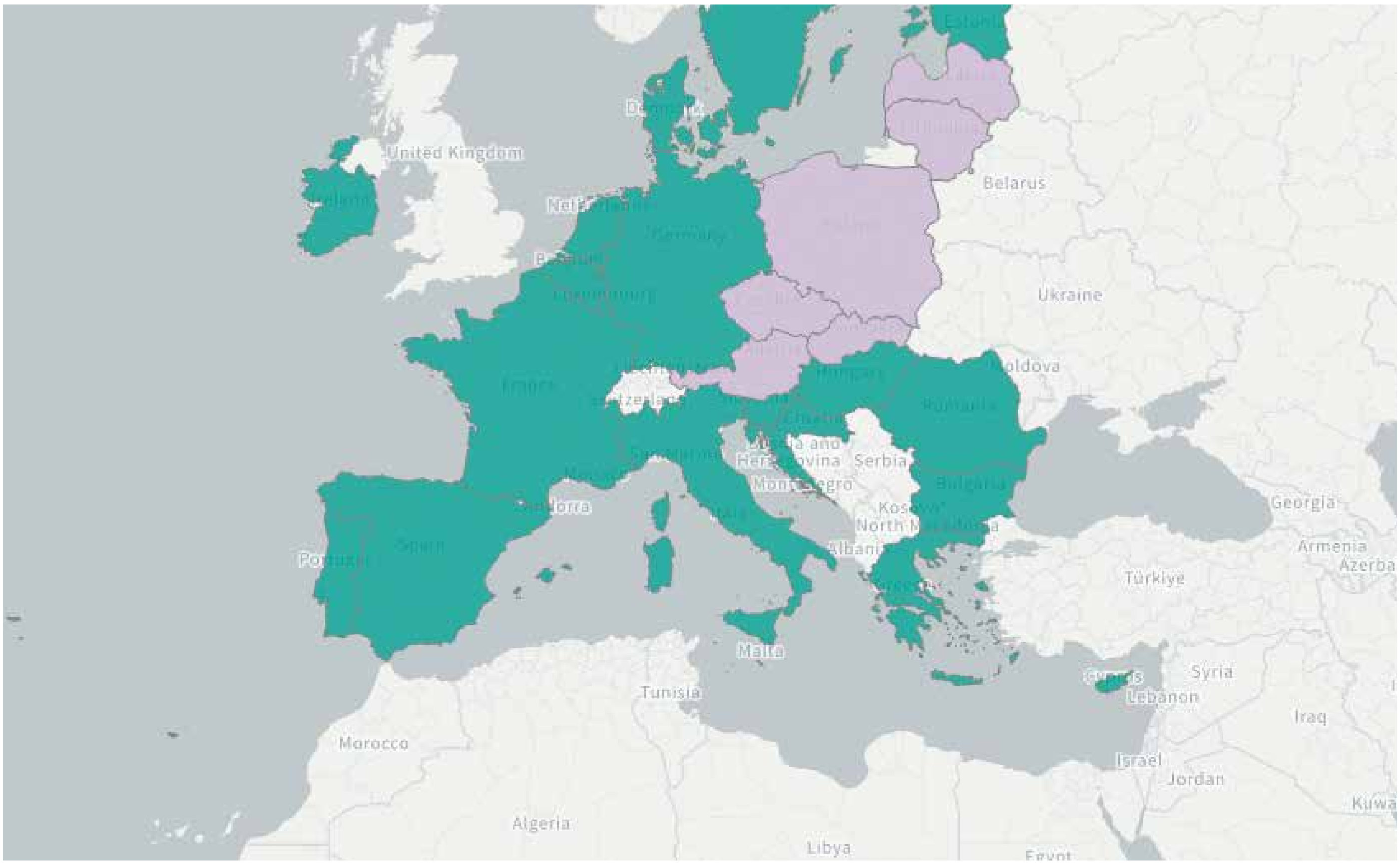


Figure 31: Member States where the regeneration of irrigation water is legal (WISE Freashwater 2024).

in member countries, the European Union published a new regulation in 2020. Regulation (EU) 2020/741 entered into force in 2023, making **mandatory a number of minimum quality and control requirements for the use of reclaimed water.**

Despite the EU's incentives to encourage member states to recycle and reuse wastewater and thus make use of its great potential to alleviate water scarcity, **this practice is not yet legal in all European countries** (Figure 31) (EEA, s. f.-e).

In Spain, Royal Decree 1620/2007 was a milestone for the country **in promoting the reuse of wastewater**, laying down the basic regulations on water regeneration. Following the new Community framework on the matter, last May Royal Decree-Law 4/2023 amended the Water Law, introducing the new requirements set by the EU in water regeneration. This measure was part of component 5, reform 1 (C5.R1) of the PRTR (MITECO, s. f.-i). In addition, the National Plan for Purification, Sanitation, Efficiency, Saving and Reuse (DSEAR Plan) makes the use of reclaimed water an additional element of the integrated management of the country's water resources by including them in the third cycle management plans (2022-2027) (MITECO 2021a).

Uses. **Reclaimed water is mainly used for agriculture**, where its composition can also be used, reducing the consumption of fertilizers through fertigation (PTEA 2021). Other more minority uses include **industrial applications** (such as industrial refrigeration or textile production), irrigation of recreational areas or **municipal parks**, **cleaning streets** and sewage networks, or **fire control.**

However, water regeneration not only makes it possible to reuse this scarce resource, but can also be used to **restore degraded ecosystems,** such as wetlands, limit the impact of discharges into seas and rivers, or for managed recharge of aquifers threatened by overexploitation and saline infiltrations (Abou-Shady, Siddique, and Yu 2023; UNEP 2023).

The fact that the use of reclaimed water has

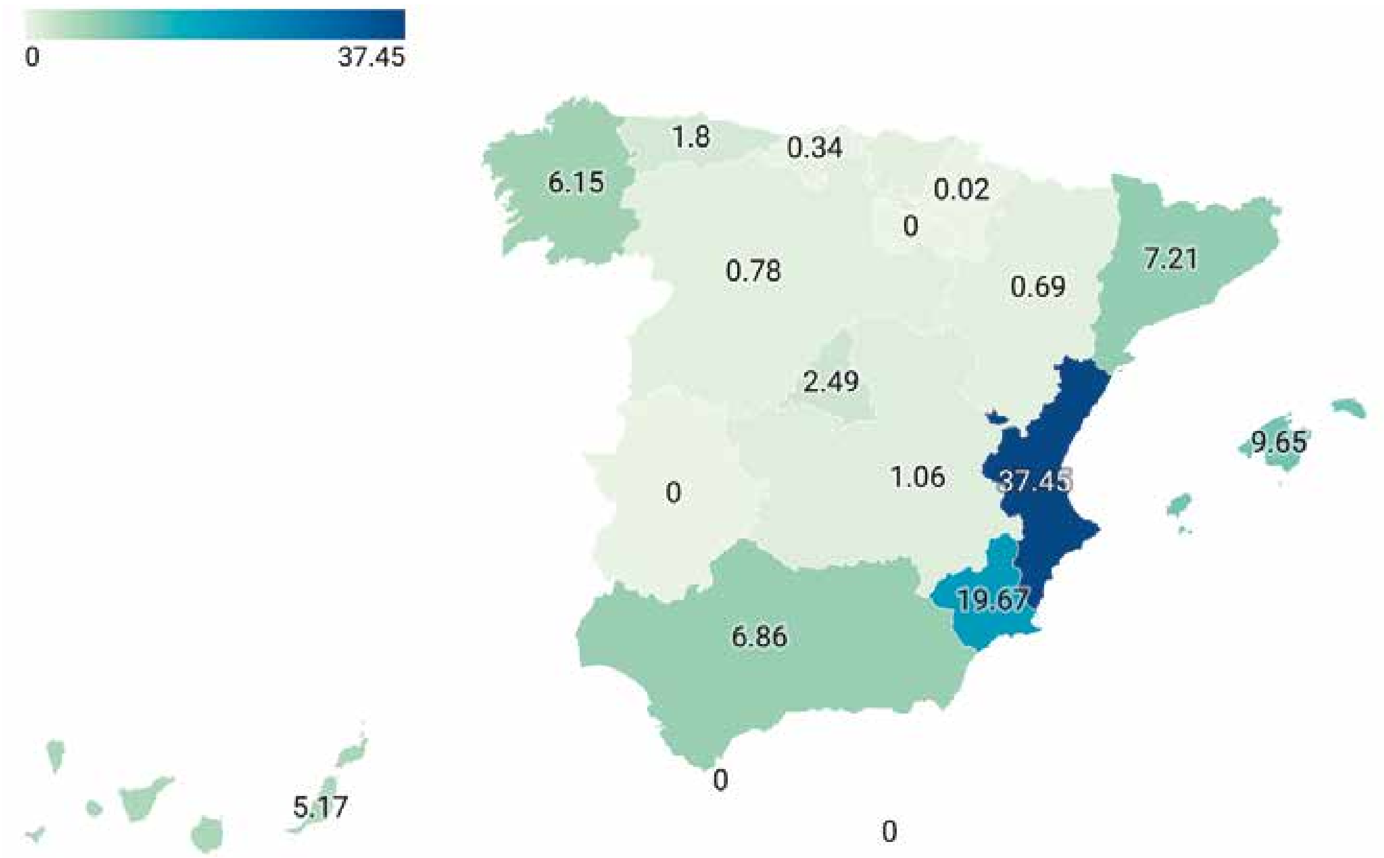


Figura 32: Percentage of reclaimed water by Autonomous Community of the national total (INE 2020).

become an integral element in the management of our country's water resources has made Spain a **European leader** in the matter. Spain is responsible for most of the volume of reclaimed water at European level, **reusing up to 12%** of waste water at national level (compared to 2.4% in the EU) (EEA, s. f.-e; European Commission 2023b).

According to the latest study published by the National Institute of Statistics, in 2020 10.9% of the country's wastewater was regenerated, with the **Region of Murcia being the pioneering Autonomous Community in regeneration, recycling more than 90% of its waters**. Together with Comunidad Valenciana, both Communities are responsible for more than 50% of Spanish reclaimed water (Figure 32) (Hristov et al. 2021; Bluefield research 2023; INE 2022). In the same way, it is the Júcar and Segura River Basin Districts that record the highest volume of reclaimed water supplied each year (MITECO 2022c).

Of this reclaimed water in Spain, 72.4% is used for agricultural irrigation, 17.2% for irrigation of gardens and sports areas, 2.4% for street cleaning and sewerage, and the remaining 5.5% is used in other uses, such as industrial refrigeration or aquifer recharge (INE 2022).

However, there is still a long way to cover the full potential offered by the use of this unconventional water source, since only 1% of the water needed by our fields comes from reclaimed water (in Murcia it reaches 15%, since more than 86% of the reclaimed water is used for agriculture) (Esamur, s. f.; INE 2022).

Benefits. The optimal use of wastewater has the potential **to save up to 57% of the freshwater we use**. This not only has very positive repercussions on the state of our water resources, but also on the economy (Abou-Shady, Siddique, and Yu 2023).

In terms of environmental impact and generation of emissions, that of reclaimed water is considerably lower than that of other alternative methods of water supply, such as water transfer or desalination. And it is also a great solution to address the poor state of conservation of our water bodies, having the ability to **restore coasts, rivers, wetlands or aquifers**. The latter have the added value of functioning as natural filters through which to purify the waters more thoroughly (Abou-Shady, Siddique, and Yu 2023; PTEA 2021).

In addition to recycling wastewater for agricultural, industrial, municipal, or environmental use, the treatment processes of these waters generate a series of **byproducts that are valuable resources in themselves and have to be used.**

In the purification process, **sludge is generated with high organic load**, for which there are many applications such as soil restoration, obtaining biofuels or building materials. But the most common use of these sludges is **the recovery of nutrients**, from domestic wastewater, but also agricultural (from aquaculture, livestock production, slaughterhouses) or industrial (from tanneries or yeast production, for example). High-value nutrients, such as nitrogen, phosphorus or potassium, can be obtained from these waters and sludge.

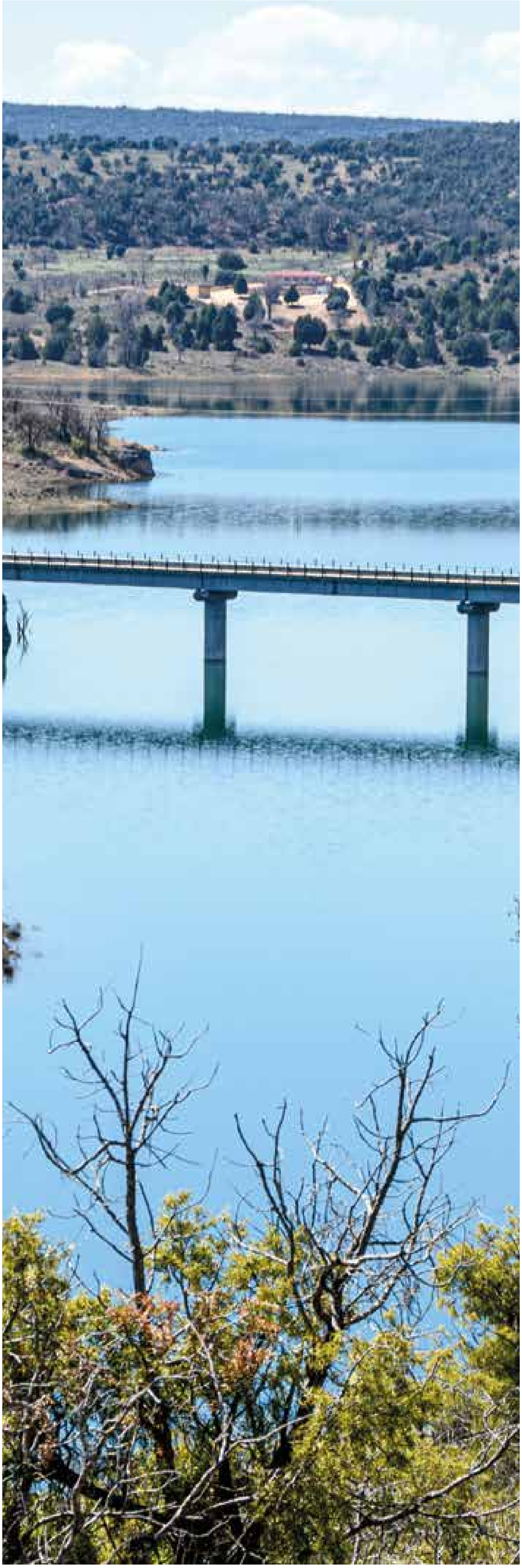
By recovering these nutrients, the discharge of these nutrients to water bodies is controlled, **avoiding eutrophication**. But **the dependence on conventional chemical fertilizers is also limited**, which not only have negative impacts on the environment, but are also very vulnerable to price increases that may arise from crises and / or conflicts. Europe depends on imports for more than 84% of phosphorus used as fertiliser in agriculture (Water Europe 2023).

It is estimated that 13.4% of the global demand for nutrients for agriculture could be supplied through this source. As a result, an economic benefit of between €27 billion and €40 billion could be expected. For example, **in Spain between 25 and 75% of nutrients for agricultural use could be replaced by nutrients recovered from wastewater** (UNEP 2023).

In fact, in our country, 86% of the sludge generated is already destined for agriculture, forestry or gardening, while 9.5% is incinerated or used to produce energy (INE 2022).

In sludge digesters, in which organic matter is degraded, **biogas** is generated by anaerobic digestion, which can be used as fuel. **Biomethane and other renewable gases** (such as hydrogen) can also be generated from wastewater and its sludge. In fact, it is estimated that there is approximately five times more **energy** stored in the wastewater of which is used in its purification, enough to provide electricity to 158 million homes. In other words, **if the energy potential offered by wastewater is harnessed, treatment plants could be climate-neutral**.

But, although it seems a distant reality, these plants already exist. Biofactories are wastewater treatment plants that do not generate waste or impact on the environment, since they opt for a circular model where the waste produced is transformed into resources, such as renewable energy, fertilizers or reclaimed water (UNEP 2023; Van Hove et al. 2019).



Suez has been a pioneer in the implementation of biofactories, with the first of them successfully launched in Santiago de Chile. This circular economy model has also been achieved in Spain, where Suez, through the Agbar Group, has implemented biofactories in Granada and Barcelona. Transforming traditional WWTPs into resource centres. For example, the biofactory South of Granada, is self-sufficient in energy with the biogas it generates, and the surplus electricity is poured into the grid. In addition, 100% of the water is regenerated, which is recycled for irrigation in an area that suffers from water stress. Finally, sludge and solid waste are used as agricultural fertilisers (Topic 2019; Aquae Foundation, s. f.).

30%

Citizen opinion highlights the preference for the reuse of wastewater (31%) and the use of desalinated water (30%) as the most important measures to improve water management. While the least popular are those focused on reducing water consumption.

Source: Citizen's Survey
Citizen`s of Observatory of Drought
2022 (Lafuente et al. 2023).

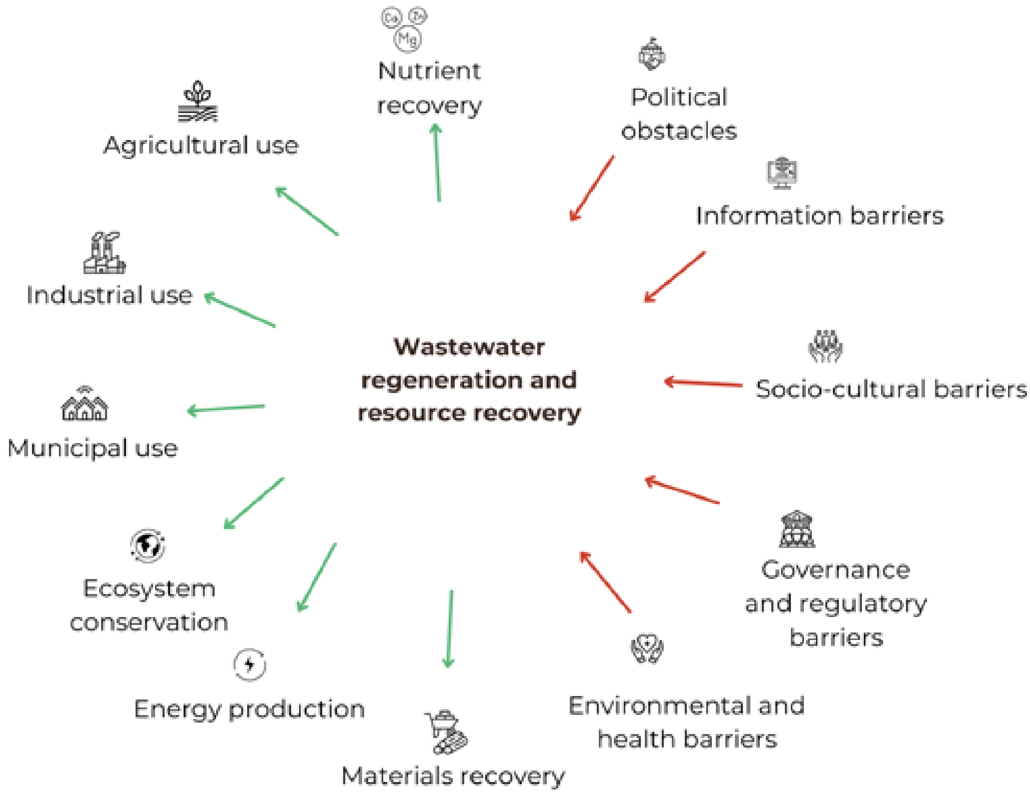


Figure 33: Resources that can be extracted from wastewater. Own production (UNEP 2023).

Apart from recovering water, nutrients and energy from wastewater (Figure 33), there is a wide variety of materials that can be extracted, such as cellulose, fatty acids, polymers or bioplastics, and for which large-scale facilities already exist (UNEP 2023).

Barriers. Although the regeneration and use of resources from wastewater has been successfully implemented in many countries, it is a practice that is not widespread and whose scope is far from its real potential. This is because there are barriers that limit the expansion of this good practice, preventing the progress of circularity in the water sector. Some of these barriers are of a technical nature, since the technologies associated with regeneration and recovery of resources require an investment that is not in all cases possible.

But in addition to technological and financial capacity, the lack of knowledge on the part of institutions, lack of regulations or lack of social acceptance, are other barriers faced by the use of wastewater (UNEP 2023).

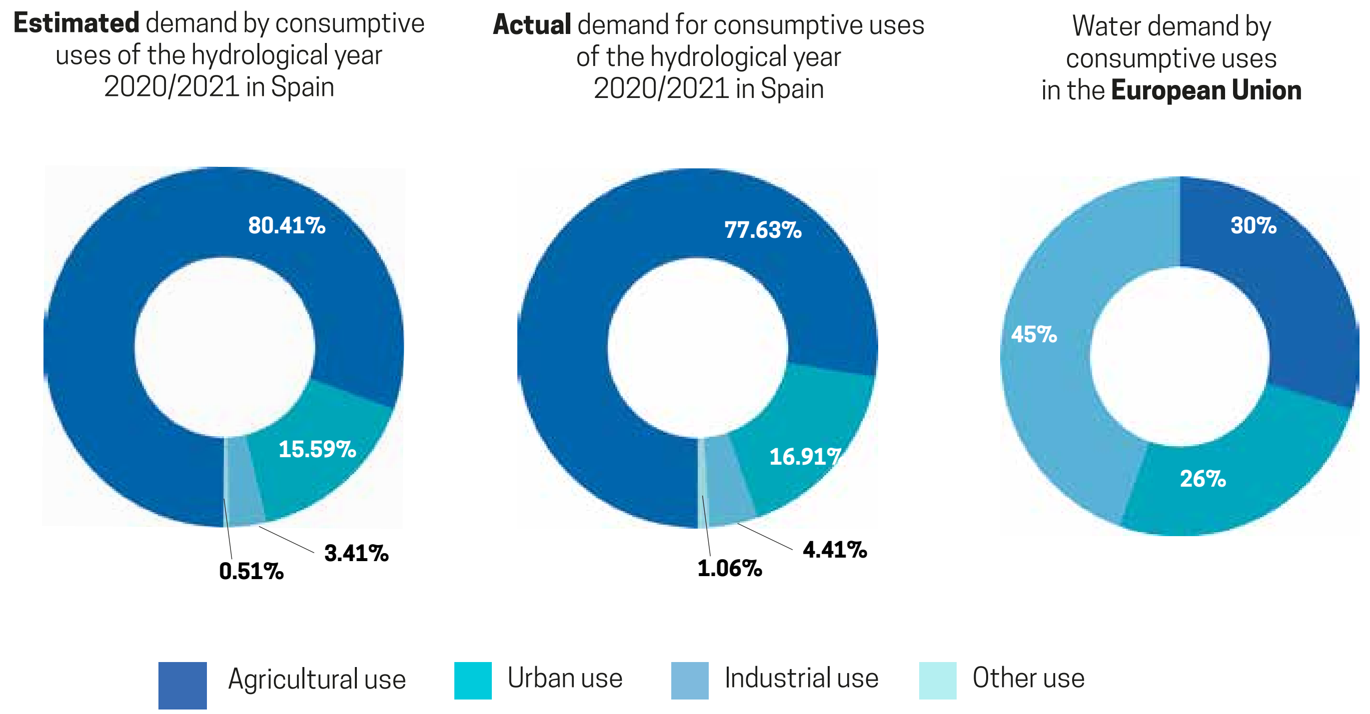
Taking into account the present obstacles, the United Nations Environment Programme has established **6 main pillars** on which **the effective integration of reclaimed water as a valuable resource in the water cycle is based** (UNEP 2023):

- Ensure effective and coherent governance and legislation.
- Mobilizing an adequate investment and sustained over time.
- Promote human, technical and institutional capacity at all levels.
- Boosting technological innovation for a circular water economy.
- Provide access to up-to-date data and information.
- Promote knowledge and environmental awareness.

Water in Spain

Uses of water

Figure 34: Water uses in Spain and Europe (MIRECO 2022; United Nations 2023; FAO 2022).



According to the recast text of the Water Law, water uses are defined as 'the different types of use of the resource, as well as any other activity that has a significant impact on the state of the waters ... Water uses must at least consider the supply of populations, industrial uses and agricultural uses' (BOE 2001).

Currently, the use of water throughout Spain for the main consumptive uses (agricultural use, urban supply and industrial use) is around **30,000 hm3 / year.**

The new hydrological plans advocate a **change in the dynamics of the use of water resources, betting on reversing the growing trend in water use.** In this way, they pose decreases in water use by 15% by 2050. Along these lines, the allocations established for the different water uses (MITECO 2021b) have been reduced by 1,700 hm3/year in all 12 3rd cycle RBMPs of the inter-community RBDs.

For the hydrological year 2020/2021, **the estimated demand** for consumptive uses) was 80.41% for agricultural use, 15.59% for urban use, 3.41% for industrial use, and 0.59% for other uses.

The actual volume used was 77.63% for agricultural use, 16.91% for urban use, 4.41% for industrial use, and 1.06% for other uses (Figure 34) (MITECO 2022c). These volumes contrast with figures at European level, where industrial use consumes 45% of resources, agricultural 30%, and domestic 26% (United Nations 2023c; FAO 2022).

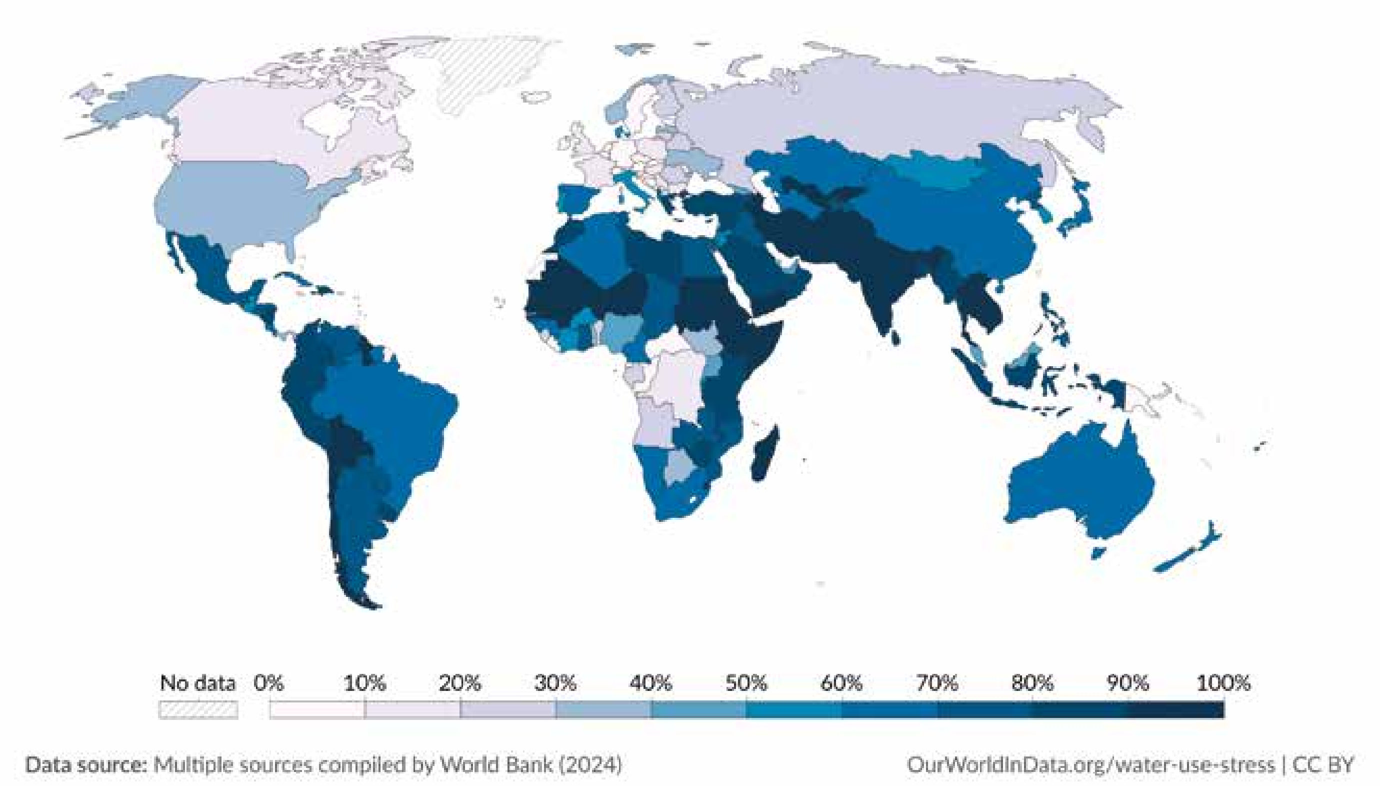


Figure 35: Percentage of water for agricultural use by country (Ritchie and Roser 2018; United Nations 2023c; OECD, s.f.).

Globally, about 70% of water resources are used for agriculture,
However, this proportion varies between regions. being up to 90% in countries with low income and 40% in high-income (Figure 35).

On the other hand, the industrial sector consumes around 17%. This use follows the pattern contrary, dominating in countries with high revenue. Finally, domestic use or supply of populations, is responsible for 12% of water consumption sweet globally, with most countries dedicating less than 30% of its resources water for this use (Ritchie and Roser 2018; United Nations 2023c; OECD, s.f.).

In most river basin districts, **agricultural uses of water clearly predominate, which is conditioned by the hydrological situation and meteorological characteristics**, in addition to the allocations established and the management mechanisms established by the drought plans of each district. However, in some districts, other consumptive uses predominate, either due to the existence of large cities, important industrial activity, large tourist influx, or the scarcity of irrigated area. This is the case of the demarcations of Galicia Costa, the Cantabrian, the Internal Basins of Catalonia, or those of the Balearic and Canary Islands, where water is mainly used for supply and / or industrial use (MITECO 2022c).

Uses of water

Supply to populations

According to the XVII National Study published by AEAS in 2022 (AEAS - AGA 2022), with a reach of 77% of the Spanish population, **water consumption per inhabitant per day is 245 liters.** Of this water supply, 67.4 per cent is for domestic use, 11.9 per cent for industrial and commercial consumption and the remaining 20.7 per cent for other uses, such as municipal or institutional uses.

Domestic consumption among Spaniards is 131 liters per inhabitant per day, being between the lowest in Europe (where the average household consumption is 26% of resources) (FAO 2022). Household consumption is lower in metropolitan areas (reducing to 122 liters), where water destined for other uses increases (reaching 31% of consumption) (AEAS - AGA 2022).

The autonomous communities with the highest water consumption per inhabitants are Cantabria (165 liters per inhabitant per day, Comunidad Valenciana (157) and Murcia (150), while the least consumed are the Basque Country (97), the Balearic Islands (117), the Community of Navarra (120) and Extremadura (120) (AEAS - AGA 2022).

As for the total water distributed for supply (Figure 36), the communities that supplied the most water are Andalusia (18.0% of the total), Catalonia (14.3%) and the Community of Madrid (13.7%). While La Rioja (0.8%), Cantabria (1.6%) and Comunidad Foral de Navarra (1.8%) recorded the least water of the national total (INE 2022).

Figure 36: Water consumption per inhabitant and day by Autonomous Community (INE 2022).

Water in Spain

Uses of water

Agriculture use

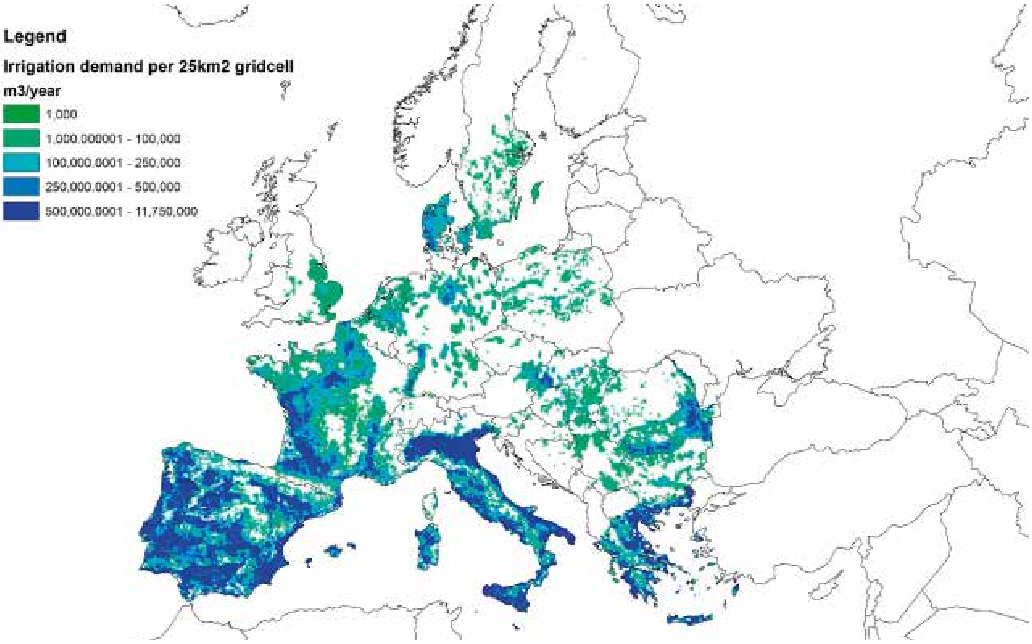


Figure 37: Water use for irrigation in Europe (Pistocchi et al. 2018).

In the area of agriculture, the Autonomous Communities have assumed exclusive competence. And in the case of intra-community basins, regional projects are included in the basin plans, approved by the Government (MMA 2000).

Irrigation areas are generally managed by Irrigation Communities, i.e. **groups of landowners** of a irrigable area that come together in compliance with the Water Act. These entities are attached to the Basin Bodies and are responsible for the management and use of public waters for irrigation (BOE 2001). The National Federation of Irrigation Communities (FENACORE) groups Irrigation Communities from all Spanish provinces, encompassing 80% of the national irrigation (Fenacore, s. f.).

Broadly speaking, agriculture is responsible for the consumption of 80% of water resources in Spain, compared to the 30% European average or 70% globally (FAO 2022; Ritchie and Roser 2018). This is because Spain is the European country that has the most demand for water for irrigation (Figure 37), followed by Italy and other Mediterranean countries (Rossi 2019; Pistocchi et al. 2018). With 12.6% of European agricultural production, Spain is one of the main food producers at European level, being the first power in **fruits and vegetables** (Eurostat 2021; Fruit logistica 2022).

As for the distribution of water for agricultural use, the community that consumes the most is Andalusia (employs 26.9% of the national total of water for agriculture), followed by Castilla y León (14.4%) and Aragón (13.4%). At the other end are the Northwest communities, the Community of Madrid,

and the islands (together they make use of 1.86%) (INE 2020).

74.3% of water for agricultural use is extracted from surface water sources, 23.9% from groundwater bodies, and 1.8% from other sources (INE 2020).

Currently one of the priorities of the agricultural sector in Spain is the modernization of irrigation systems (PTEA 2021). In fact, in the last decade, efficient irrigation systems have grown by 19%, which represents 79% of the irrigated area. Among them, localized or drip irrigation stands out, which is the most used (55.8% of the total area) (MAPA 2023), with Andalusia being the community that uses the most drip irrigation water (INE 2020).

One of the main pillars of the **Common Agricultural Policy** (CAP) is to support rural development by improving the social, environmental and economic sustainability of rural areas. To achieve this objective, the CAP is supported by EAFRD funds, which are implemented by EU countries through Rural Development Programmes (RDPs) (European Commission, s. f.-g).

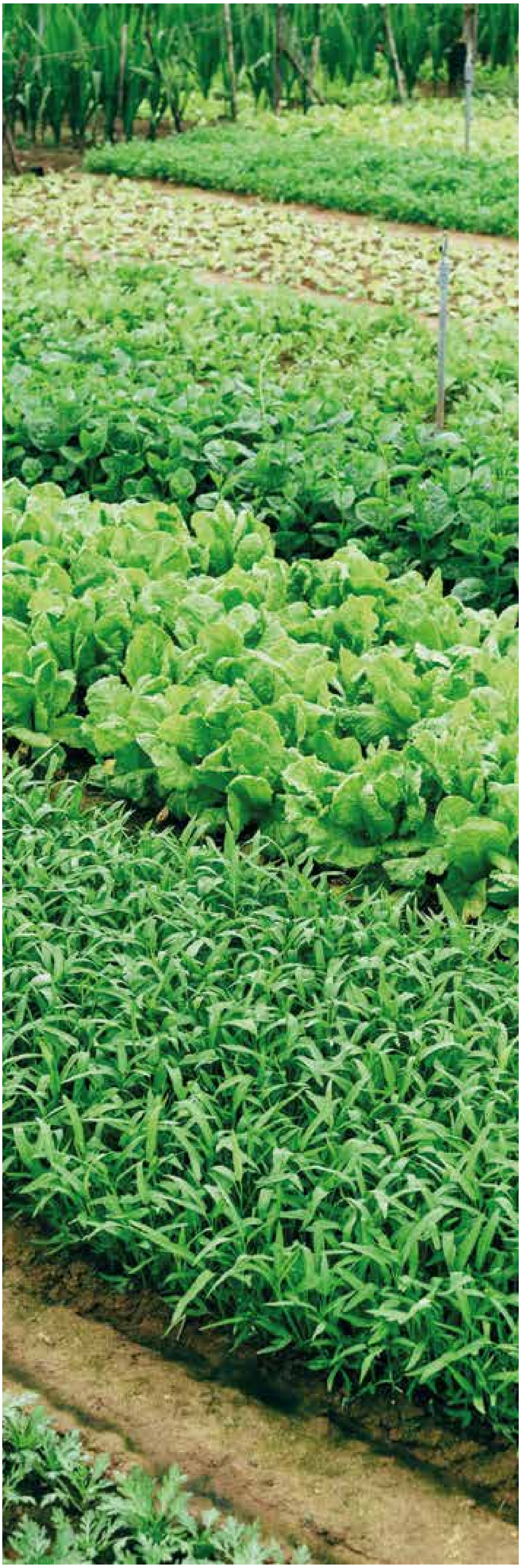
Although these programmes have great potential to positively impact water use in rural areas, CAP funds generally favour higher rather than more efficient water consumption (European Court of Auditors 2021). There are many actions that can be invested in to help reduce the pressure of agriculture on water resources, without harming the sector itself. They are based on increasing efficiency in the use of the resource, exploiting circularity (such as the nutrient recycling) and building biodiversity and resilience in agroecosystems (EEA 2021b)[ref]. Examples of measures where Member States can use rural development funds are (European Court of Auditors 2021):

Natural water retention measures to strengthen or restore the ability to retain water from aquifers, soils and ecosystems, which in turn benefits drought management and flood risk reduction. In agricultural soils, water retention can be improved by:

- Conservation work. Leaving crop residues on the surface slows water displacement and reduces soil erosion.
- Protective strips and hedges. Permanent vegetation on the edges of fields or watercourses improves water infiltration and slows surface flow.
- Restoration of wetlands. They store the water and release it slowly, as 'natural sponges'.
- Renaturalization of banks. Increases soil infiltration and water retention.

Reuse of wastewater for irrigation. The use of reclaimed water is one of the main tools in the saving and circularity of water use.

Modernization of irrigation systems to increase water use efficiency. However, improvements in efficiency do not always translate into water savings, as it is common for saved water to be redirected to other uses. This 'rebound effect' may increase the pressure from basin extraction (Lop 2022).



Uses of water

Industrial use

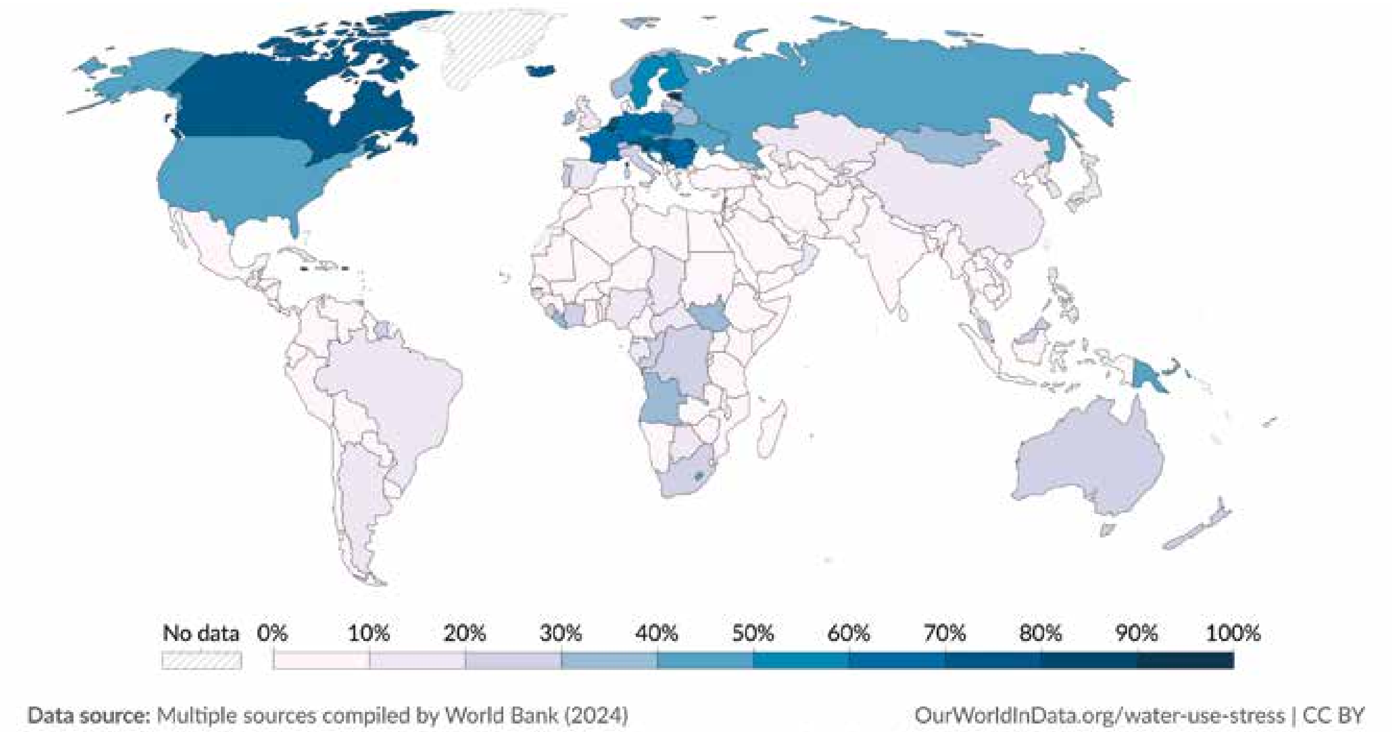


Figure 38: Percentage of water for industrial use by country (Ritchie and Roser 2018).

Water is used in a wide range of industrial processes, such as dilution, steam generation, washing or cooling equipment. Specifically, **industrial refrigeration** is a process in which large amounts of water are usually used and is present in a variety of production chains. We can commonly find industrial refrigeration systems in sectors such as power generation, the chemical industry, the food sector, or even the pharmaceutical industry and data centers.

It is estimated that **around 17% of the water extracted worldwide goes to industry**. However, this figure does not provide a complete picture of reality, as two-thirds of water consumption is involved in supply chains. In this way, we find that the main sectors of industry – food, textiles, energy, manufacturing, chemical, pharmaceutical and mining – are affecting the use and pollution of **more than 70% of fresh water globally** (Ritchie and Roser 2018; United Nations 2023c).

In contrast to the distribution of water use for agriculture around the world, where low-income countries use 90% of their water resources, compared to 41% in those with high incomes, in the case of water for industrial use, the geographical variation is the opposite (Figure 38) (Ritchie and Roser 2018).

According to a survey conducted by the CDP in 2020, two-thirds of companies are reducing or maintaining their water consumption, but only 59% monitor the quality of their wastewater and 4.4% say they have made progress in reducing their pollution. This study also reveals that "**the economic impact of inactivity in the face of water risks in the industrial sector is up to 5 times greater than the cost of acting",** that is, that acting now to deal with the water crisis in the industry has less economic cost than not doing so. Indeed, many companies are already taking measures to mitigate the effects of water scarcity on their industrial processes, which are so dependent on this resource (CPD 2021). Below are a couple of examples of water use in some industry sectors.

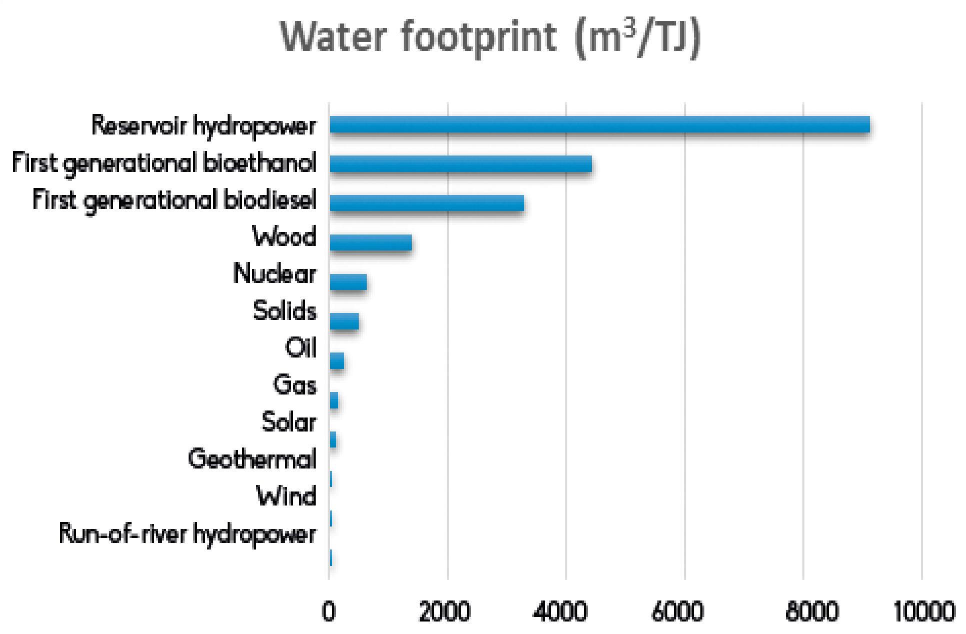


Figure 39: Water footprint by type of energy - Vanham et al. (2019, fig.1, p. 5).

1. Energy system

EThe energy sector is one of the largest consumers of water, using approximately 10% of water resources globally, given that power plants conventional require large amounts of water for cooling, and the extraction and processing of fossil fuels (United Nations 2023c; Ritchie and Roser 2018).

It is estimated that, in the European Union, **the water footprint of energy consumption reaches 1,301 liters per inhabitant per day** (Vanham et al. 2019).

In contrast, renewable energies have a much lower water consumption (Figure 39). In particular, solar and wind energy have negligible water consumption. Once photovoltaic solar panels are manufactured and installed they do not require water to generate electricity throughout their operational life, which can be up to 35 years (IEA 2016; Wilson, Leipzig, and Griffiths-Sattenspiel 2012; Vanham et al. 2019).

In the production of 1 kilo of cotton, an average of 11,000 liters of water are consumed. Buying a second-hand cotton t-shirt can save 2,500 liters of water, while if it is a pair of jeans can save up to 8,000 liters. And if they are domestically produced, the savings can be up to 6,000 liters (Water Footprint Network, s. f.; Sunter Eroglu 2023; Chico, Aldaya, and Garrido 2013).

2. Textile sector

The United Nations Conference on Trade and Development (UNCTAD 2019) declared the textile and fashion industry the second most polluting in the world, responsible for 10% of carbon emissions. **This sector uses 93 billion cubic metres of water per year** (equivalent to consumption for the supply of five million people) and generates 20 per cent of the world's wastewater (United Nations, s. f.-a; Espinoza Pérez, Espinoza Pérez, and Vásquez 2022).

This great dependence on water in the textile industry is due to the modus operandis of 'fast fashion'. In the last decade, this sector has doubled design and production, but less than 1% of these textiles are recycled (European Commission 2020).

3. Data centres

Technology companies are one of the main consumers of water, using it to cool their data centers (Water Europe 2021).

With the aim of achieving climate neutrality, **the European Pact for a Carbon Neutral Data Centre, CNDCP**, was created. This pact seeks to ensure that data centers are part of this transformation towards zero emissions, with a deadline of 2030. This pact encompasses different areas, among which water stands out. As measures for water conservation, it has been proposed that data centers have an indicator to estimate the water used annually, water usage effectiveness, which should not exceed a certain limit (400ml / kWh by 2040). In addition, the aim is to promote the circular economy and water reuse (Water Europe 2021; European Commission, s. f.-c).

In Spain, the Spanish Association of Data Centers, SPAIN DC, has joined the European Pact, thus committing to sustainability and compliance with the 2030 Agenda and SDG6 (Spain DC, s. f.). According to Manuel Giménez, director of Spain DC, "the vast majority of data centers in Spain do not have water consumption: almost all use air-cooling system. And in those who do use water, he prefers to opt for closed circuits of reclaimed or non-potable water (Pascual 2023).

This reality contrasts with that of the large international data centers that are being built in the country, such as the **Meta data hypercenter in Talavera de la Reina**, whose consumption of water for cooling is conditioned by the Tagus Hydrographic Confederation (Lázaro 2023). Because of its strategic geographical position, Spain is one of the fastest growing countries in Europe in terms of data centers (Spain DC, s. f.).

Google

consumes **daily**

19,611,800 m^3

Per day, equivalent to the consumption of

373.131 people

Or the population of Florence (Italy)

Apple

consumes **daily**

4,384,643 m^3

Per day, equivalent to the consumption of

83.421 people

Or the population of Toledo (Spain)

Microsoft

consumes **daily**

7,618,089 m^3

Per day, equivalent to the consumption of

144.940 people

Or the population of Grenoble (France)

facebook

consumes **daily**

3,833,000 m^3

Per day, equivalent to the consumption of

75.554 people

Or the population of Cortrique (Belgium)

Source: Water Europe 2021; European Commission, s. f.-c

Water in Spain

Autonomous Communities

Andalucia

Water Law	Law 9/**2010** of 30 July 2010 on Water for Andalusia Last modified: Decree-Law 2/**2022** of 29 March 2022	
Other related laws	Law 8/**2018** of 8 October 2018 on measures against climate change and for the transition to a new energy model in Andalusia Law 3/**2023** of 30 March 2023 on the Circular Economy of Andalusia	
Additional actions	Andalusian Pact for Water, **2019** Andalusian Wetlands Plan Horizon 2030, **2023** Andalusian Climate Action Plan (**2021**-2030) Hydrological Plan (2022-2027) of the Tinto-Odiel-Piedras Guadalete-Barbate Hydrological Plan (2022-2027) Hydrological Plan (2022-2027) for the Andalusian Mediterranean Basins. The PH of 3o cycle to be approved in **2023** Andalusian Circular Bioeconomy Strategy, **2018**	
River basin districts	Inter-community	Intra-Community
	DH Guadalquivir DH Guadiana DH Segura	DH Tinto-Odiel-Piedras DH of Guadalete-Barbate DH Mediterranean Basins Andalucia
Promoter body	CH Guadalquivir CH Guadiana CH Segura	Ministry of Sustainability, Environment and Blue Economy, Junta de Andalucía
Associated public entity	Andalusian Enviroment and Water Agency	
Unrecorded water volume, 2020	27, 85%	
Actual supply network losses, 2020	16,3%	
Volume of reclaimed water	5,22%	

Water in Spain

Autonomous Communities

Aragon

Water Law	Law 10/**2014** of 27 November 2014 on Waters and Rivers of Aragon
Other related laws	Water Pact of Aragon, **1992** Opinion of the Aragon Water Dialogue Bureau, **2023** Aragonese Climate Change Strategy (EACC 2030), **2019**
River basin districts	Inter-community
	DH Ebro DH Tajo DH Júcar
Promoter body	CH Ebro CH Tajo CH Júcar
Associated public entity	Aragonese Water Institute (IAA)
Unrecorded water volume, 2020	32,04%
Actual supply network losses, 2020	21,1%
Volume of reclaimed water	1,88%

Autonomous Communities

Principado de Asturias

Water Law	Law 1/**1994** of 21 February 1994 on Water Supply and Sanitation in the Principality of Asturias – **in process**
Other related laws	Principality of Asturias Water Supply Master Plan **2020**-2030 Asturian Climate Action Strategy **2023**-2030
River basin districts	Inter-community
	Western Cantabrian DH DH Miño-Sil DH Duero
Promoter body	West Cantabrian CH CH Miño-Sil CH Duero
Associated public entity	Consortium of Waters of Asturias, CADASA
Unrecorded water volume, 2020	31,78%
Actual supply network losses, 2020	19,5%
Volume of reclaimed water	5,89%

Autonomous Communities

Islas Baleares

Water Law	No
Other related laws	Law 10/**2019** of 22 February 2019 on climate change and energy transition
Additional actions	Hydrological Plan of the Balearic Islands River Basin District (2022-2027), **2023** Energy Transition Investment Plan
River basin districts	Inter-community
	DH of the Balearic Islands
Promoter body	Directorate-General for Water Resources, Balearic Government
Associated public entity	Balearic Water and Environmental Quality Agency, ABAQUA
Unrecorded water volume, 2020	25,55%
Actual supply network losses, 2020	18%
Volume of reclaimed water	45,43%

Autonomous Communities

Islas Canarias

Water Law	Law 12/**1990** of 26 July 1990 on water Amendment: Law 10/2010 of 27 December 2010
Other related laws	Law 6/2022 of 27 December 2022 on climate change and energy transition in Canarias Biodiversity and Natural Resources Act – **in process** Canary Islands Circular Economy Law – **in process**
Additional actions	Canary Islands Blue Economy Strategy **2021** – 2030 Canary Islands Circular Economy Strategy **2021** - 2030 Canary Islands Climate Action Strategy, **2023** 3rd cycle hydrological plans (2022-2027) for each island, **2023**
River basin districts	Inter-community
	DH of Gran Canaria DH of Fuerteventura DH of Lanzarote DH of Tenerife DH of La Palma DH of La Gomera DH of El Hierro
Promoter body	Island Water Council of Gran Canaria Island Water Council of Fuerteventura Island Water Council of Lanzarote Island Water Council of Tenerife Island Water Council of La Palma Island Water Council of La Gomera Island Water Council of El Hierro
Unrecorded water volume, 2020	33,31%
Actual supply network losses, 2020	24,4%
Volume of reclaimed water	23,66%

Water in Spain

Autonomous Communities

Cantabria

Water Law	Law 2/**2014** of 26 November 2014 on Water Supply and Sanitation in the Autonomous Community of Cantabria
Other related laws	Cantabria General Supply and Sanitation Plan, **2015** Cantabria Climate Change Action Strategy **2018** – 2030
River basin districts	Inter-community
	Western Cantabrian DH DH of Ebro DH of Duero
Promoter body	West Cantabrian CH CH of Ebro CH of Duero
Associated public entity	Environment, Water, Waste and Energy of Cantabria, S,A,, MARE
Unrecorded water volume, 2020	30,08%
Actual supply network losses, 2020	20,4%
Volume of reclaimed water	1,67%

Autonomous Communities

Castilla-La Mancha

Water Law	Law 2/**2022** of 18 February 2022 on Waters in the Autonomous Community of Castile-La Mancha
Other related laws	Law 7/**2019** of 29 November 2019 on the Circular Economy of Castile-La Mancha Law 2/**2020** of 7 February 2020 on the environmental assessment of Castile-La Mancha Law 2/**2021** of 7 May 2021 on Economic, Social and Tax Measures Depopulation and for the Development of the Rural Environment of Castilla-La Mancha
Additional actions	Regional Water Pact, **2020** Strategic Water Purification Plan horizon 2032, **2021** Climate Change Strategy. Horizons 2020 and 2030, **2018** 2030 Agenda Strategy, **2021** Circular Economy Strategy 2030, **2021**
River basin districts	Inter-community
	DH del Duero DH of the Ebro DH del Tajo DH of Guadiana DH Guadalquivir DH del Júcar DH del Segura
Promoter body	Douro CH CH of the Ebro Tagus CH Guadiana CH Guadalquivir CH Júcar CH CH del Segura
Associated public entity	Water Agency of Castilla-La Mancha, Agagua
Unrecorded water volume, 2020	31,46%
Actual supply network losses, 2020	21,4%
Volume of reclaimed water	2,78%

Water in Spain

Autonomous Communities

Castilla y León

Water Law	No
Other related laws	Castilla y León Climate Change Law – **in process**
Additional actions	Programme for the Promotion of Agricultural Infrastructures of General Interest, **2020** Circular Economy Strategy **2021**/2030
River basin districts	Inter-community
	DH del Duero DH of the Ebro DH del Tajo Western Cantabrian DH DH del Miño - Sil
Promoter body	Douro CH CH of the Ebro Tagus CH West Cantabrian CH CH del Miño - Sil
Associated public entity	The Public Society of Infrastructure and Environment of Castilla y León, SOMA- CYL
Unrecorded water volume, 2020	24,96%
Actual supply network losses, 2020	15%
Volume of reclaimed water	1,01%

Autonomous Communities

Cataluña

Water Law	Legislative Decree 3/**2003** of 4 November 2003 approving the recast textof the water legislation of Catalonia	
Other related laws	Law 16/**2017** of 1 August 2017 on climate change	
Additional actions	Management Plan of the River Basin District of Catalonia, **2023** Catalan Strategy on Adaptation to Climate Change 2021-2030, **2023** Catalonia's natural heritage and biodiversity strategy 2023, **2018** Bioeconomy Strategy 2030, **2021**	
River basin districts	Inter-community	Intra-Community
	DH del Júcar DH of the Ebro	DH of the Internal Basins of Catalonia
Promoter body	Júcar CH CH of the Ebro	Government of Catalonia
Associated public entity	The Catalan Water Agency, ACA	
Unrecorded water volume, 2020	24,14%	
Actual supply network losses, 2020	14,3%	
Volume of reclaimed water	5,43%	

Autonomous Communities

Comunidad Valenciana

Water Law	Law 2/**1992** of 26 March 1992 of the Valencian Government on the sanitation ofwas-te water in the Autonomous Community of Valencia
Other related laws	Law 6/**2022** of 5 December 2022 on Climate Change and the Ecological Transition of the Autonomous Community of Valencia
Additional actions	Management Plan of the River Basin District of Catalonia, **2023** Catalan Strategy on Adaptation to Climate Change 2021-2030, **2023** Catalonia's natural heritage and biodiversity strategy 2023, **2018** Bioeconomy Strategy 2030, **2021**
River basin districts	Inter-community
	DH del Júcar DH del Ebro DH del Segura
Promoter body	Júcar CH CH of the Ebro CH del Segura
Associated public entity	Public Entity for Wastewater Sanitation, EPSAR
Unrecorded water volume, 2020	22,65%
Actual supply network losses, 2020	15,2%
Volume of reclaimed water	42,55%

Water in Spain

Autonomous Communities

Extremadura

Water Law	Law 1/**2023** of 2 March 2023 on urban water management and cycle in Extremadura
Other related laws	Law 3/**2022** of 17 March 2022 on measures to address the demographic and territorial challenge in Extremadura
Additional actions	Green and Circular Economy Strategy Extremadura 2030, **2017** Integrated Energy and Climate Plan (PEIEC) **2021**-2030
River basin districts	Inter-community
	DH del Duero DH del Tajo DH of Guadiana DH Guadalquivir
Promoter body	Douro CH Tagus CH Guadiana CH Guadalquivir CH
Associated public entity	No
Unrecorded water volume, 2020	33,14%
Actual supply network losses, 2020	22%
Volume of reclaimed water	0%

Autonomous Communities

Galicia

Water Law	Law 9/**2010** of 4 November 2010 on Galician waters Law 9/**2019** of 11 December 2019 on measures to guarantee supply in drought episodesand in situations of health risk Law 1/2022 of 12 July **2022** on improving the management of the integrated water cycle	
Other related laws	Law 5/**2019** of 2 August 2019 on the natural heritage and biodiversity of Galicia Law 6/**2021** of 17 February 2021 on waste and contaminated soils in Galicia Galician Climate Law – **in process**	
Additional actions	Plan Auga 2010 – 2025 Galicia-Costa Hydrological Plan 2021-2027, **2023** Galician Climate Change and Energy Strategy 2050	
River basin districts	Inter-community	Intra-Community
	Western Cantabrian DH DH del Duero DH del Miño - Sil	DH Galicia Costa
Promoter body	West Cantabrian CH Douro CH CH del Miño - Sil	Xunta de Galicia
Associated public entity	Category: Waters of Galicia	
Unrecorded water volume, 2020	26,76%	
Actual supply network losses, 2020	16,2%	
Volume of reclaimed water	8,56%	

Autonomous Communities

Comunidad de Madrid

Water Law	Law 17/**1984** of 20 December 1984 regulating water supply and sanitation in the Community of Madrid Royal Decree 3/**2023** of 10 January 2023 establishing the technical andhealth criteria for the quality of drinking water, its control and supply
Other related laws	Circular Economy Law of the Community of Madrid – **in process**
Additional actions	Energy, Climate and Air Strategy of the Community of Madrid-Horizon 2030, **2023** Strategic Plan **2018** – 2030 for the Canal de Isabel II
River basin districts	Inter-community
	DH del Tajo DH del Duero
Promoter body	Tagus CH Douro CH
Associated public entity	Isabella II Canal
Unrecorded water volume, 2020	12,92%
Actual supply network losses, 2020	4%
Volume of reclaimed water	2,59%

Water in Spain

Autonomous Communities

Región de Murcia

Water Law	Law 3/**2000** of 12 July 2000 on the Sanitation and Purification of Waste Water in the Region of Murcia and the Implementation of the Sanitation Fee
Other related laws	Decree-Law 2/**2019** of 26 December 2019 on the Comprehensive Protection of the Mar Menor
Additional actions	II Sanitation and Purification Plan of the Region of Murcia - Horizon 2035, **2020** Comprehensive management plan for the protected areas of the Mar Menor and the Mediterranean coastal strip of the Region of Murcia, **2019** Strategy of Mitigation and Adaptation to Climate Change of the Region of Murcia, **2019**
River basin districts	Inter-community
	DH del Segura DH del Júcar DH del Guadalquivir
Promoter body	CH del Segura Júcar CH Guadalquivir CH
Associated public entity	Regional Entity for Sanitation and Wastewater Treatment, Esamur
Unrecorded water volume, 2020	18,56%
Actual supply network losses, 2020	11,4%
Volume of reclaimed water	91,38%

Autonomous Communities

Comunidad Foral de Navarra

Water Law	Regional Law 10/**1988** of 29 December 1988 on the Sanitation of Wastewater in Navarre
Other related laws	Regional Law 4/**2022** of 22 March 2022 on Climate Change and Energy Transition
Additional actions	Master Plan of the Integral Water Cycle for Urban Use of Navarra **2019**-2030 Navarre Climate Change Roadmap, **2018** Agenda for the development of the Circular Economy in Navarra 2030 (ECNA 2030), **2019**
River basin districts	Inter-community
	DH del Cantábrico Oriental DH del Ebro
Promoter body	Cantabrian CH CH of the Ebro
Associated public entity	Navarra de Infraestructuras Locales, NILSA
Unrecorded water volume, 2020	22,26%
Actual supply network losses, 2020	18,5%
Volume of reclaimed water	0,08%

Water in Spain

Autonomous Communities

País Vasco

Water Law	Law 1/**2006** of 23 June 2006 on water	
Other related laws	Energy Transition and Climate Change Act – **in process**	
Additional actions	Hydrological Plan of the Eastern Cantabrian River Basin Internal) 2022 – 2027, **2023** Energy Transition and Climate Change Plan **2021**- 2024 Biodiversity Strategy of the Basque Country 2030, **2016** Climate Change Strategy 2050 of the Basque Country. Klima 2050, **2015**	
River basin districts	Inter-community	Intra-Community
	DH of the Ebro Western Cantabrian DH	Eastern Cantabrian DH, Internal Basins
Promoter body	CH of the Ebro Cantabrian CH	the Basque Government
Associated public entity	Basque Water Agency, URA	
Unrecorded water volume, 2020	21,95%	
Actual supply network losses, 2020	13,2%	
Volume of reclaimed water	0,94%	

Water in Spain

Autonomous Communities

La Rioja

Water Law	Law 5/**2000** of 25 October 2000 on the Sanitation and Purification of Wastewater in La Rioja
Other related laws	Law 2/**2023** of 31 January 2023 on biodiversity and the natural heritage of La Rioja La Rioja Climate Change Law – **in process**
Additional actions	Master plan for water supply to populations 2016-2027, **2018** Sanitation and Purification Master Plan 2016-2027, **2018** Expansion of the Natura Network in La Rioja and its Management and Management Plans Natural Resources, **2022** Rioja Plan for Adaptation to Climate Change (PRACC) 2023-2030 – **in process**
River basin districts	Inter-community
	DH of the Ebro DH del Duero
Promoter body	CH of the Ebro Douro CH
Associated public entity	Water and Waste Consortium
Unrecorded water volume, 2020	40,09%
Actual supply network losses, 2020	21,5%
Volume of reclaimed water	0%

Water in Spain

Autonomous Communities

Ceuta y Melilla

Water Law	No
Other related laws	No
River basin districts	Inter-community
	DH Ceuta DH of Melilla
Promoter body	Guadalquivir CH
Associated public entity	No
Unrecorded water volume, 2020	45,96%
Actual supply network losses, 2020	25%
Volume of reclaimed water	0%

The future of water

Conclusions

The current state of water resources highlights the need for a change in the water management paradigm. It is imperative to recognize the value of water and incorporate it into governance and decision-making.

Until now, water has been valued according to traditional economic accounting, using its registered price. By not integrating other aspects, the current economy tends to limit the real value of water.

Consequently, this generates an inefficient and unsustainable exploitation of water resources, as well as unequal access to this basic resource. In order to achieve sustainable and equitable water management and use, in line with the 2030 Agenda, a balance must be agreed between the different water values and incorporated into water resources planning (United Nations 2021).

Thus, **the environmental value** of water and its fundamental role in the conservation of ecosystems and biodiversity must be taken into account. A healthy ecosystem fosters resilience and reduces risk to floods, droughts, and other extreme events. Water, as a basic need, is necessary to survive and have proper hygiene, so it is essential to recognize the value of water as a human right.

The network of storage and sanitation infrastructures must also be valued, since it is directly related to socio-economic¬development. And is that the water is closely linked to production and socio-economic activity, being essential in agriculture for food production. But also in the energy sector, industry or trade. And even in other aspects, such as culture,

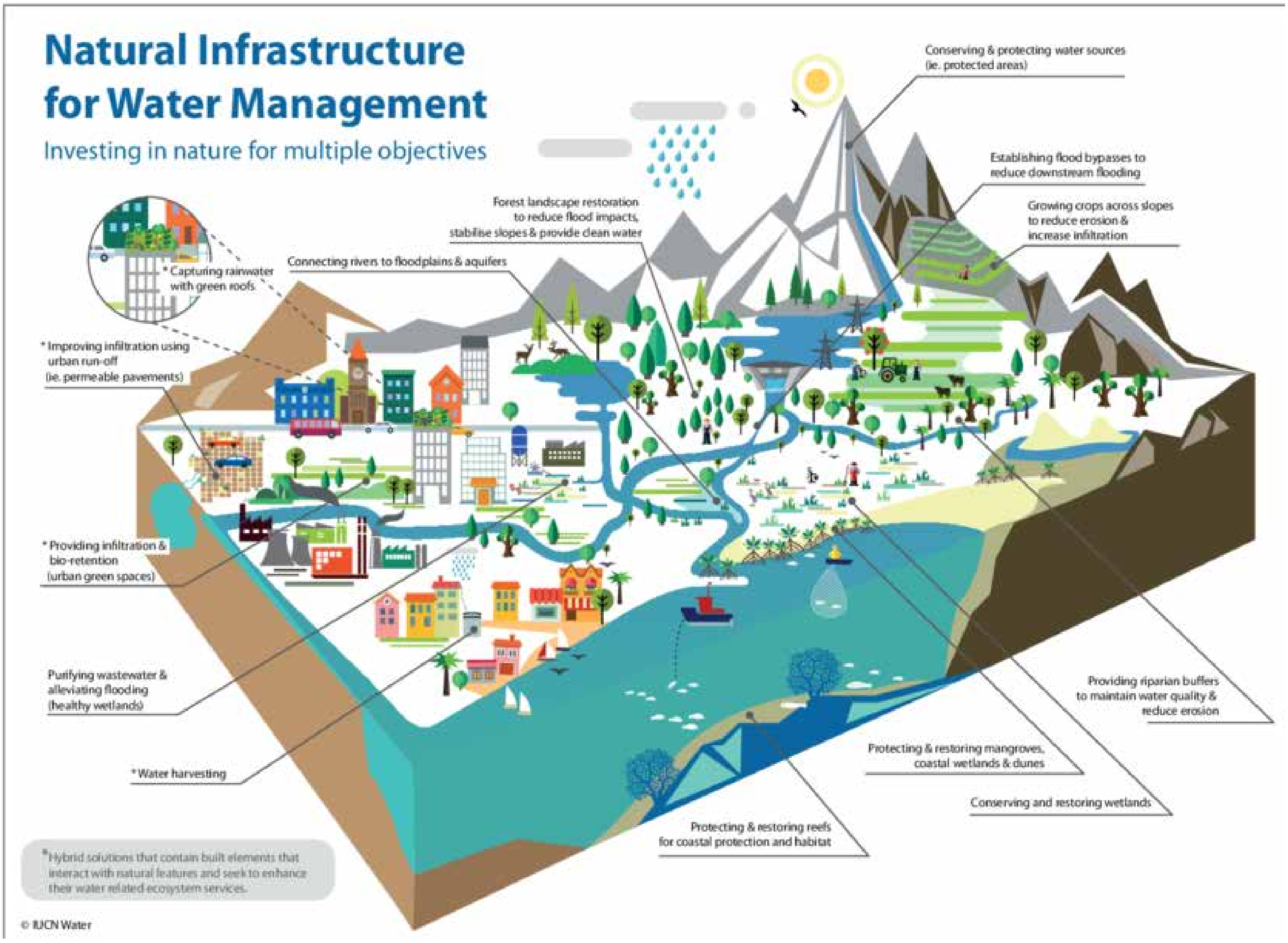


Figure 40: Natural Infrastructure for Water Management (IUCN Water 2017).

water appears again reflected (recreational, spiritual activities ...) (United Nations 2021; Cohen-Shacham et al. 2016).

That is, all aspects of our life, society, development or economy are linked in some way to water (Figure 40). That is why all the multiple values of water must be recognised and must become a priority in decision-making to ensure water security; avoid the scarcity and pollution of the water on which we depend so much; creating closed circles that support a sustainable and efficient economy in the use of this resource; and promote water systems resilient against the impacts of climate change and demographic change (Water Europe 2023).

The change in approach to water resources management also requires **the collaboration and active involvement of a broad set of actors**. From the different administrative levels, to the different sectoral policies, through the key role of the private sector, research or citizenship. But this cooperation must transcend borders, and foster dialogue not only at national but international level (IPCC 2023).

Bibliography

References

Abou-Shady, Ahmed, Muhammad Saboor Siddique, y Wenzheng Yu. 2023. «A Critical Review of Recent Progress in Global Water Reuse during 2019–2021 and Perspectives to Overcome Future Water Crisis». Environments 10 (9): 159. https://doi.org/10.3390/environments10090159.

Acosta, Araceli. 2017. «Gonzalo Delacámara: "No deberíamos esperar a una crisis de agua para tomar decisiones"». ABC Natural. 2017. https://www.abc.es/natural/vivirenverde/abci-gonzalo-delacamarano-deberiamos-esperar-crisis-agua-para-tomar-decisiones-201703171050_noticia.html?ref=https%3A%2F%2Fwww.abc.es%2Fnatural%2Fvivirenverde%2Fabci-gonzalo-delacamarano-deberiamos-esperar-crisis-agua-para-tomar-decisiones-201703171050_noticia.html.

Acuamed. 2011. «Planta desalobradora de El Atabal (Málaga). Principales aportaciones técnicas». https://www.acuamed.es/media/actuaciones/95/elatabal-corta-def.pdf.

Adaptecca. s. f. «Plataforma sobre Adaptación al Cambio Climático en España | Comunidades Autónomas». Accedido 12 de febrero de 2024. https://adaptecca.es/contenido/comunidades-autonomas.

AEAS - AGA. 2022. «Datos sobre los servicios del agua urbana en España. Resultados del XVII Estudio Nacional de Suministro de Agua Potable y Saneamiento en España 2022». https://www.aeas.es/component/content/article/52-estudios/estudios-suministro/301-xvii-estudio-nacional-aeas-aga?Itemid=101.

AEDyR. 2019a. «¿Qué es la desalación de agua?» 2019. https://aedyr.com/que-es-desalacion-agua/.

———. 2019b. «¿Qué es la reutilización de agua?» 2019. https://aedyr.com/que-es-reutilizacion-agua/.

———. 2019c. «¿Qué es y en qué consiste la Ósmosis Inversa?» 5 de febrero de 2019. https://aedyr.com/que-es-osmosis-inversa/.

———. 2022. «Minería de salmuera: la recuperación de minerales en la desalación de agua». 2022. https://aedyr.com/mineria-salmuera-recuperacion-minerales-desalacion-agua/.

———. 2023. «La desalación y reutilización son las principales fuentes de abastecimiento de agua en Barcelona». 10 de julio de 2023. https://aedyr.com/desalacion-reutilizacion-son-principales-fuentes-abastecimiento-agua-barcelona-2023/.

AEMET. 2023. «Informe Anual 2022». https://www.aemet.es/es/conocermas/aeronautica/detalles/informes_anuales.

———. 2024. «Avance Climático Nacional del año 2023». https://www.aemet.es/documentos/es/noticias/2024/01/avance_climatico2023.pdf.

ATL. s. f. «Desalinizadora del Llobregat». Ens d'Abastament d'Aigua Ter-Llobregat. Accedido 13 de febrero de 2024. https://www.atl.cat/es/desalinizadora-del-llobregat_2458.

Autoridad Catalana de la Competencia. 2022. «Análisis de competencia en el suministro de agua en el ámbito urbano». En colaboración con a la Agencia Catalana del Agua. https://acco.gencat.cat/web/.content/80_acco/documents/arxius/actuacions/20220426_estudi_subministrament_aigua_esp.pdf

Avellán, An. s. f. «Sistemas Urbanos de Drenaje Sostenible». SuD Sostenible (blog). Accedido 13 de febrero de 2024. http://sudsostenible.com/sistemas-urbanos-de-drenaje-sostenible/

Beceiro, Paula, Rita Salgado Brito, y Ana Galvão. 2022. «Nature-based solutions for water management: insights to assess the contribution to urban resilience». Blue-Green Systems 4 (2): 108-34. https://doi.org/10.2166/bgs.2022.009

Bisselink, B, J Bernhard, E Gelati, M Adamovic, S Guenther, L Mentaschi, L Feyen, y A Roo. 2020. «Climate Change and Europe's Water Resources». EUR 29951 EN, Publications Office of the European Union, Luxembourg. https://doi.org/10.2760/15553, JRC118586

Bluefield research. 2023. «Europe Municipal Wastewater Reuse: Market Trends and Forecasts, 2023–2030». https://www.bluefieldresearch.com/research/europe-municipal-wastewater-reuse-market-trends-and-forecasts-2023-2030/

BOE. 1978. «Constitución Española». https://www.boe.es/buscar/act.php?id=BOE-A-1978-31229

———. 1985. «Ley 7/1985, de 2 de abril, Reguladora de las Bases del Régimen Local». https://www.boe.es/buscar/act.php?id=BOE-A-1985-5392

———. 1994. «Convención de las Naciones Unidas de lucha contra la desertificación en los países afectados por sequía grave o desertificación, en particular en África, hecha en París el 17 de junio de 1994». https://www.boe.es/eli/es/ai/1994/06/17/(1)

———. 2001. «Real Decreto Legislativo 1/2001, de 20 de julio, por el que se aprueba el texto refundido de la Ley de Aguas». https://www.boe.es/buscar/act.php?id=BOE-A-2001-14276

———. 2016. «Real Decreto 638/2016, de 9 de diciembre, por el que se modifica el Reglamento del Dominio Público Hidráulico aprobado por el Real Decreto 849/1986, de 11 de abril, el Reglamento de Planificación Hidrológica, aprobado por el Real Decreto 907/2007, de 6 de julio, y otros reglamentos en materia de gestión de riesgos de inundación, caudales ecológicos, reservas hidrológicas y vertidos de aguas residuales». 2016. https://www.boe.es/buscar/doc.php?id=BOE-A-2016-12466

———. 2021. «Orden TED/801/2021, de 14 de julio, por la que se aprueba el Plan Nacional de depuración, saneamiento, eficiencia, ahorro y reutilización». https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-12592

———. 2023a. «Boletín Oficial del Estado: jueves 31 de agosto de 2023, Núm. 208». 2023. https://www.boe.es/boe/dias/2023/08/31/

———. 2023b. «Ley de Aguas. Última modificación: 28 de diciembre de 2023». https://www.boe.es/biblioteca_juridica/abrir_pdf.php?id=PUB-PB-2023-202

Brondizio, E. S., J. Settele, S. Díaz, y H. T. Ngo. 2019. «Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services». IPBES secretariat, Bonn, Germany. https://www.ipbes.net/global-assessment

Burkholder, JoAnn M., David A. Tomasko, y Brant W. Touchette. 2007. «Seagrasses and eutrophication». Journal of Experimental Marine Biology and Ecology, The Biology and Ecology of Seagrasses, 350 (1): 46-72. https://doi.org/10.1016/j.jembe.2007.06.024

CBD. 2018. «Solutions to Our Global Water Challenges Can Be Found in Nature». Convention on Biological Diversity. 2018. https://www.cbd.int/article/naturebasedsolutions

CEDEX. 2020. «Informe sobre la Evaluación de Recursos Hídricos en Régimen Natural en España (1940/41-2017/18)». https://www.miteco.gob.es/content/dam/miteco/es/agua/temas/evaluacion-de-los-recursos-hidricos/cedex-informeerh2019_tcm30-518171.pdf.

Chico, Daniel, Maite M. Aldaya, y Alberto Garrido. 2013. «A water footprint assessment of a pair of jeans: the influence of agricultural policies on the sustainability of consumer products». Journal of Cleaner Production 57 (octubre): 238-48. https://doi.org/10.1016/j.jclepro.2013.06.001.

Cohen-Shacham, Emmanuelle, Gretchen Walters, Stewart Maginnis, y Christine Janzen. 2016. «Nature-based Solutions to address global societal challenges». IUCN International Union for Conservation of Nature and Natural Resources. https://doi.org/10.2305/IUCN.CH.2016.13.en.

COP28 UAE. 2023. «COP28 Overview». 2023. https://www.cop28.com/en/about-cop28.

Copernicus. 2023. «European state of the climate - Summary 2022». https://climate.copernicus.eu/esotc/2022/european-state-climate-2022-summary.

———. 2024. «The 2023 Annual Climate Summary: Global Climate Highlights 2023». 10 de enero de 2024. https://climate.copernicus.eu/global-climate-highlights-2023.

———. s. f. «Global temperature trend monitor. Climate Data Store». Accedido 9 de febrero de 2024. https://cds.climate.copernicus.eu/cdsapp#!/software/app-c3s-global-temperature-trend-monitor?tab=app.

CPD. 2021. «Global Water Report 2020. A wave of chance. The role of companies in building a water-secure world». https://cdn.cdp.net/cdp-production/cms/reports/documents/000/005/577/original/CDP_Water_analysis_report_2020.pdf?1617987510.

CUIMC. 2024. «Bottled Water Can Contain Hundreds of Thousands of Nanoplastics. A New Microscopic Technique Zeroes in on the Poorly Explored World of Nanoplastics». Columbia University Mailman School of Public Health. 9 de enero de 2024. https://www.publichealth.columbia.edu/news/bottled-water-can-contain-hundreds-thousands-nanoplastics.

Ecomemb. s. f. «Recycled Membranes». Accedido 13 de febrero de 2024. https://recycledmembranes.com/.

EEA. 2021a. «Natura 2000 Viewer». 2021. https://natura2000.eea.europa.eu/?page=Page-1&views=Blank_View.

———. 2021b. «Water and Agriculture: Towards Sustainable Solutions». Publications Office of the European Union. Luxembourg. https://www.eea.europa.eu/publications/water-and-agriculture-towards-sustainable-solutions.

———. 2021c. «Water Resources across Europe - Confronting Water Stress: An Updated Assessment». Publications Office of the European Union. Luxembourg. https://www.eea.europa.eu/publications/water-resources-across-europe-confronting.

———. 2023a. «Water Use in Europe: Quantity and Quality Face Big Challenges». European Environment Agency. https://www.eea.europa.eu/signals-archived/signals-2018-content-list/articles/water-use-in-europe-2014.

———. 2023b. «What Could the Summer Bring? Is Extreme Weather the New Normal?», junio. https://www.eea.europa.eu/en/newsroom/news/what-could-the-summer-bring.

———. s. f.-a. «Biodiversity Information System for Europe - Spain». Accedido 12 de febrero de 2024. https://biodiversity.europa.eu/countries/spain.

———. s. f.-b. «Country Profiles on Urban Waste Water Treatment - Spain». Freshwater Information System for Europe (WISE Freshwater). Accedido 13 de febrero de 2024. https://water.europa.eu/freshwater/

countries/uwwt/spain.

———. s. f.-c. «Water Framework Directive». Freshwater Information System for Europe (WISE Freshwater). Accedido 9 de febrero de 2024. https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive.

———. s. f.-d. «Water Resources of Europe». Freshwater Information System for Europe (WISE Freshwater). Accedido 8 de febrero de 2024. https://water.europa.eu/freshwater/europe-freshwater/freshwater-themes/water-resources-europe.

———. s. f.-e. «Water Reuse». Freshwater Information System for Europe (WISE Freshwater). Accedido 13 de febrero de 2024. https://water.europa.eu/freshwater/europe-freshwater/water-reuse.

Eke, Joyner, Ahmed Yusuf, Adewale Giwa, y Ahmed Sodiq. 2020. «The global status of desalination: An assessment of current desalination technologies, plants and capacity». Desalination 495 (diciembre): 114633. https://doi.org/10.1016/j.desal.2020.114633.

ENRD. 2021. «LEADER/CLLD». Text. The European Network for Rural Development (ENRD) - European Commission. 2021. https://enrd.ec.europa.eu/leader-clld_en

Esamur. s. f. «Entidad de Saneamiento y Depuración de la Región de Murcia». Accedido 13 de febrero de 2024. https://www.esamur.com/esamur

Espinoza Pérez, Lorena A., Andrea T. Espinoza Pérez, y Óscar C. Vásquez. 2022. «Exploring an alternative to the Chilean textile waste: A carbon footprint assessment of a textile recycling process». Science of The Total Environment 830 (julio): 154542. https://doi.org/10.1016/j.scitotenv.2022.154542

European Commission. 2020. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A New Circular Economy Action Plan. For a Cleaner and More Competitive Europe. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

———. 2021. «European Structural and Investment Funds 2014-2020 2020 Summary Report of the Programme Annual Implementation Reports Covering Implementation in 2014-2019». Brussels: Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52021DC0213

———. 2023a. «Ocean and Waters Mission Portfolio». 2023. https://projects.research-and-innovation.ec.europa.eu/en/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters/eu-mission-project-portfolio.

———. 2023b. «Water Reuse: New EU Rules to Improve Access to Safe Irrigation». Energy, Climate Change, Environment. 2023. https://environment.ec.europa.eu/news/water-reuse-new-eu-rules-improve-access-safe-irrigation-2023-06-26_en

———. 2024a. «Funding & tender opportunities. Single Electronic Data Interchange Area (SEDIA)». 2024. https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-dashboard

———. 2024b. «Horizon 2020 Country Profiles - Spain». 2024. https://research-and-innovation.ec.europa.eu/statistics/framework-programme-facts-and-figures/horizon-2020-country-profiles_en.

———. 2024c. «LIFE Project Portfolio». 2024. https://dashboard.tech.ec.europa.eu/qs_digit_dashboard_mt/public/sense/app/8298c020-48a6-4b84-91f4-f6f2665c0f99/overview.

———. s. f.-a. «Biodiversity and Nature Protection: Natura 2000 Network». EC Library Guides.

Accedido 12 de febrero de 2024. https://ec-europa-eu.libguides.com/biodiversity/natura2000

———. s. f.-b. «EU Missions in Horizon Europe». Accedido 12 de febrero de 2024. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe_en

———. s. f.-c. «Green Cloud and Green Data Centres». Shaping Europe's Digital Future. Accedido 13 de febrero de 2024. https://digital-strategy.ec.europa.eu/en/policies/green-cloud

———. s. f.-d. «Mission, Structure and Objectives». Accedido 12 de febrero de 2024. https://cinea.ec.europa.eu/about-us/mission-structure-and-objectives_en

———. s. f.-e. «NextGenerationEU Green Bond Dashboard». Accedido 12 de febrero de 2024. https://commission.europa.eu/strategy-and-policy/eu-budget/eu-borrower-investor-relations/nextgenerationeu-green-bonds/dashboard_en

———. s. f.-f. «Recovery and Resilience Facility». Accedido 12 de febrero de 2024. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en

———. s. f.-g. «Rural Development». Agriculture and Rural Development - Common Agricultural Policy. Accedido 13 de febrero de 2024. https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en

———. s. f.-h. «Water». Accedido 12 de febrero de 2024. https://environment.ec.europa.eu/topics/water_en

———. s. f.-i. «Water Framework Directive». Accedido 12 de febrero de 2024. https://environment.ec.europa.eu/topics/water/water-framework-directive_en

———. s. f.-j. «Water Scarcity and Droughts». Accedido 12 de febrero de 2024. https://environment.ec.europa.eu/topics/water/water-scarcity-and-droughts_en

European Court of Auditors. 2021. «Special Report. Sustainable water use in agriculture: CAP funds more likely to promote greater rather than more efficient water use». Publications Office of the European Union. Luxembourg. https://www.eca.europa.eu/Lists/ECADocuments/SR21_20/SR_CAP-and-water_EN.pdf

European Parliament. 2021. «Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 Establishing the Framework for Achieving Climate Neutrality and Amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')». Official Journal of the European Union. http://data.europa.eu/eli/reg/2021/1119/oj/eng

Eurostat. 2021. «Agricultural Output of the EU down by 1% in 2020». 2021. https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211115-2

FAO. 2022. «The State of the World's Land and Water Resources for Food and Agriculture – Systems at Breaking Point. Main Report». Rome. https://doi.org/10.4324/9780203142837

Fenacore. s. f. «Federación Nacional de Comunidades de Regantes». FENACORE. Accedido 13 de febrero de 2024. https://fenacore.org/fenacore/

Fruit logistica. 2022. «European Statistics Handbook». In cooperation with Fruitnet. https://www.fruitlogistica.com/fruit-logistica/downloads-alle-sprachen/auf-einen-blick/european_statistics_handbook_2022.pdf

Fundación Aquae. s. f. «Historias del cambio. Biofactorías: un ejemplo en economía circular». Fundación Aquae. Accedido 13 de febrero de 2024. https://www.fundacionaquae.org/biofactorias-economia-circular/

García-Haba, Eduardo, Jorge Rodríguez-Hernández, Ignacio Andrés-Doménech, Carmen Hernández-Crespo, Jose Anta, y Miguel Martín. 2022. «Diseño de pavimentos permeables en España: situación actual y necesidades futuras». Ingeniería del Agua 26 (4): 279-96. https://doi.org/10.4995/ia.2022.18290

Gaya, Joan. 2020. «Informe sobre la regulación del ciclo urbano del agua en España. Libro Verde de la Gobernanza del Agua». https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/libro-verde-gobernanza.html

Generalitat de Catalunya. 2023. «Cataluña sufre una sequía histórica». gencat.cat. 2023. http://web.gencat.cat/es/actualitat/detall/Catalunya-pateix-la-pitjor-sequera-de-la-historia

Gobierno de España. 2021. «Plan de Recuperación, Transformación y Resiliencia». https://planderecuperacion.gob.es/

———. 2023a. «Adenda. Segunda fase del Plan de Recuperación, Transformación y Resiliencia del Reino de España. Impulso a la industrialización estratégica». https://planderecuperacion.gob.es/plan-espanol-de-recuperacion-transformacion-y-resiliencia

———. 2023b. «Componente 5: Preservación del litoral y recursos hídricos». https://planderecuperacion.gob.es/politicas-y-componentes/componente-5-preservacion-del-litoral-y-recursos-hidricos

GOIB. 2023. «Resumen anual de datos de abastecimiento urbano de agua, años 2000 a 2022». Portal del Agua de las Islas Baleares-Abastecimiento urbano. https://www.caib.es/sites/aigua/es/abastecimiento_distribucian_potabilizacian/

Greenpeace. 2022. «SOS acuíferos: la grave situación de nuestras reservas de ag». https://es.greenpeace.org/es/en-profundidad/sos-acuiferos/

Hristov, Jordan, Jesus Barreiro-Hurle, Guna Salputra, Maria Blanco, y Peter Witzke. 2021. «Reuse of treated water in European agriculture: Potential to address water scarcity under climate change». Agricultural Water Management 251 (mayo): 106872. https://doi.org/10.1016/j.agwat.2021.106872

IDAE. 2010. «Estudio de Prospectiva. Consumo Energético en el sector del agua». Fundación OPTI. https://www.idae.es/uploads/documentos/documentos_Estudio_de_prospectiva_Consumo_Energetico_en_el_sector_del_agua_2010_020f8db6.pdf

IEA. 2016. «Water Energy Nexus». International Energy Agency. https://iea.blob.core.windows.net/assets/e4a7e1a5-b6ed-4f36-911f-b0111e49aab9/WorldEnergyOutlook2016ExcerptWaterEnergyNexus.pdf

INE. 2020. «Encuesta sobre el uso del agua en el sector agrario (EUASA). Año 2018». https://www.ine.es/dynt3/inebase/es/index.htm?type=pcaxis&path=/t26/p067/p03/serie&file=pcaxis

———. 2021. «Indicadores de la Agenda 2030 para el Desarrollo Sostenible». Instituto Nacional de Estadística. https://www.ine.es/dyngs/ODS/es/objetivo.htm?id=5003

———. 2022. «Estadística sobre el suministro y saneamiento del agua. Resultados por comunidades autónomas. Serie 2000-2020». https://www.ine.es/dyngs/INEbase/operacion.htm?c=Estadistica_C&cid=1254736176834&menu=resultados&idp=1254735976602#!tabs-1254736194867

Informativos, dir. 2017. Gonzalo Delacamara: La gestión del agua sigue siendo una asignatura pendiente en España. https://www.youtube.com/watch?v=CsgvtJhz7QQ

IPCC. 2023. «Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Changee [Core Writing Team, H. Lee and J. Romero (Eds.)]». Geneva, Switzerland. https://doi.org/10.59327/IPCC/AR6-9789291691647

IUCN. s. f. «Freshwater and Water Security». Accedido 9 de febrero de 2024. https://www.iucn.org/our-work/freshwater-and-water-security

Jaksha, Amanda P. 2013. «One Ocean. Chapter 3: Biodiversity in the Ocean». National Geographic. https://education.nationalgeographic.org/resource/one-ocean-teacher-guide/

Jasechko, Scott, Hansjörg Seybold, Debra Perrone, Ying Fan, Mohammad Shamsudduha, Richard G. Taylor, Othman Fallatah, y James W. Kirchner. 2024. «Rapid Groundwater Decline and Some Cases of Recovery in Aquifers Globally». Nature 625 (7996): 715-21. https://doi.org/10.1038/s41586-023-06879-8

Kingdom, Bill, Roland Liemberger, y Philippe Marin. 2006. «The Challenge of Reducing Non-Revenue Water in Developing Countries - How the Private Sector Can Help: A Look at Performance-Based Service Contracting». Water Supply and Sanitation Sector Board Discussion Paper Series. n. 8, World Bank, Washington, DC, , diciembre. http://hdl.handle.net/10986/17238

Kőrösi, Csaba. 2023. «Summary of Proceedings by the President of the General Asssembly. United Nations Conference on the Midterm Comprehensive Review of the Implementation of the Objectives of the International Decade for Action "Water For Sustainable Development", 2018–2028». In accordance with General Assembly resolution 75/212.

Kuzma, Samantha, Liz Saccoccia, y Marlena Chertock. 2023. «25 Countries, Housing One-Quarter of the Population, Face Extremely High Water Stress». World Resources Institute. 16 de agosto de 2023. https://www.wri.org/insights/highest-water-stressed-countries

La Moncloa. 2020. «Declarada la emergencia climática». 2020. https://www.lamoncloa.gob.es/consejodeministros/Paginas/enlaces/210120-enlace-clima.aspx

Lafuente, Regina, Pilar Paneque, Ernesto Ganuza, y Jesús Vargas Molina. 2023. «Informe de resultados de la encuesta sobre el agua y la sequía». Observatorio Ciudadano de la Sequía. https://doi.org/10.46661/rio.20230720_1

Lázaro, Tomás Villarrubia. 2023. «Medio Ambiente. Resolución de 22/11/2023, de la Dirección General de Calidad Ambiental, por la que se emite el informe ambiental estratégico de la modificación de la ordenación urbanística para la implantación del Proyecto de Singular Interés Meta Data Center Campus (expediente PLA-SC-23-0512), situado en el término municipal de Talavera de la Reina (Toledo), cuya promotora es Zarza Networks, SL. [NID 2023/9812]». Dirección General de Calidad Ambiental de Castilla-La Mancha. https://govclipping.com/es/castillalamancha/boa/2023-12-04/8394-medio-ambiente-resolucion-22-11-2023-direccion-general-calidad-ambiental-se-emite-informe-ambiental-estrategico-modificacion-ordenacion-urbanistica-implantacion-proyecto-singular-interes-meta-data-center-campus-expediente-pla-sc-23-0512-situado-termino-municipal-talavera-reina-toledo-cuya-promotora-zarza-networks-sl-nid-2023-9812

Ligtvoet, Willem, Arno Bouwman, Michel Bakkenes, Arthur Beusen, Bas van Bemmel, Filip de Blois, Sophie de Bruin, et al. 2023. «The Geography of Future Water Challenges; Bending the Trend». , The Hague: PBL Netherlands Environmental Assessment Agency. https://www.pbl.nl/en/publications/geography-of-future-water-challenges#:~:text=Water%20is%20linked%20to%20all,development%2C%20as%20this%20study%20shows

Lop, Alberto Fernández. 2022. «Falsas expectativas de uso sostenible del agua en las cuencas mediante la modernización del regadío». WWF España. https://wwfes.awsassets.panda.org/downloads/informe_wwf_modernizacion_regadios.pdf?62980/La-modernizacion-de-regadios-no-ahorra-agua-y-empeora-la-sequia

Luchena, Julio Barea. 2022. «Los pozos ilegales nos roban el agua». https://es.greenpeace.org/es/noticias/los-pozos-ilegales-nos-roban-el-agua/

MAGRAMA. 2016. «Impactos del cambio climático en los procesos de desertificación en España».

https://cpage.mpr.gob.es/producto/impactos-del-cambio-climatico-en-los-procesos-de-desertificacion-en-espana/

MAPA. 2023. «Encuesta sobre superficies y rendimientos de cultivos (ESYRCE). Análisis de los regadíos en España 2022». https://www.asajasevilla.es/images/An%C3%A1lisis_de_los_Regad%C3%ADos_espa%C3%B1oles._regadios2022_tcm30-655313.pdf

MAPA, y MITECO. s. f. «Geoportal». Accedido 13 de febrero de 2024. https://sig.mapama.gob.es/geoportal/

MARM. 2008. «Programa de Acción Nacional contra la Desertificación». https://www.miteco.gob.es/es/biodiversidad/temas/desertificacion-restauracion/lucha-contra-la-desertificacion/lch_pand.html

Martín, Miguel Ángel Pérez, y Clara Estrela Segrelles. 2022. «Plan de Adaptación al Cambio Climático en la Demarcación del Júcar Universitat Politècnica de València». Instituto de Ingeniería Hidráulica y Medio Ambiente, IIAMA-UPV. Universitat Politècnica de València. Colaboración de la Oficina de Planificación Hidrológica de la Confederación Hidrográfica del Júcar. http://polipapers.upv.es/index.php/IA/article/view/3293

Martínez, Domingo Zarzo. 2020. «La Desalación del Agua en España. Estudios sobre la Economía Española - 2020/22». AEDyR.

Martínez, Manuel Bea, Alberto Fernández Lop, Teresa Gil, Rafael Seiz, y cols. 2022. «El robo del agua. Cuatro ejemplos flagrantes del saqueo hídrico en España». WWF. https://wwfes.awsassets.panda.org/downloads/el_robo_del_agua_wwf_espana.pdf

MDSA. 2021. «Estrategia de Desarrollo Sostenible 2030: un proyecto de país para hacer realidad la Agenda 2030». https://www.mdsocialesa2030.gob.es/agenda2030/documentos/eds-cast-acce.pdf

———. 2023. «Informe de Progreso 2023 de la Estrategia de Desarrollo Sostenible 2030». https://www.mdsocialesa2030.gob.es/agenda2030/documentos/IP23_EDS.pdf

MICIN. s. f. «Horizonte Europa: nuevo Programa Marco de la UE». Accedido 12 de febrero de 2024. https://www.horizonteeuropa.es/que-es.

Ministerio de Hacienda. s. f. «Plan de Recuperación, Transformación y Resiliencia». Accedido 12 de febrero de 2024. https://www.fondoseuropeos.hacienda.gob.es/sitios/dgpmrr/es-es/paginas/plan.aspx

Ministerio de Sanidad. 2022. «Calidad del Agua de Consumo Humano en España. Informe Técnico». https://www.sanidad.gob.es/profesionales/saludPublica/saludAmbLaboral/aguas/aconsumo/Doc/INFORME_AC_2021_OK.pdf

MITECO. 2020a. «Libro Verde de la Gobernanza del Agua en España». 2020. https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/libro-verde-gobernanza.html

———. 2020b. «Plan Nacional de Adaptación al Cambio Climático 2021 - 2030». https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico.html

———. 2021a. «Plan Nacional de Depuración, Saneamiento, Eficiencia, Ahorro y Reutilización». https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-programas-relacionados.html

———. 2021b. «Síntesis de los borradores de los planes hidrológicos de las demarcaciones hidrográficas intercomunitarias. (Revisión para el tercer ciclo: 2022-2027)». Dirección General del Agua. https://www.miteco.gob.es/content/dam/miteco/es/agua/temas/planificacion-hidrologica/sintesisborradoresplanes_tcm30-528453.pdf

———. 2022a. «Espacios Naturales Protegidos». 2022. https://www.miteco.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/enp_descargas.html

———. 2022b. «Estrategia nacional de lucha contra la desertificación». https://www.miteco.gob.es/es/biodiversidad/temas/desertificacion-restauracion/lucha-contra-la-desertificacion/enld.html

———. 2022c. «Informe de seguimiento de Planes Hidrológicos y Recursos Hídricos en España. Año 2021». https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/seguimientoplanes.html

———. 2022d. «Marco actuaciones prioritarias para recuperar el Mar Menor». https://www.miteco.gob.es/es/ministerio/planes-estrategias/mar-menor/marco-actuaciones-prioritarias.html

———. 2022e. «Orientaciones estratégicas de agua y cambio climático». Dirección General del Agua. https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/estrategia.html

———. 2023a. «Marco de Actuaciones Prioritarias para Recuperar el Mar Menor. Informe de avances de septiembre de 2023». https://www.miteco.gob.es/es/ministerio/planes-estrategias/mar-menor/novedades-avances.html

———. 2023b. «Plan de Acción de Aguas Subterráneas 2023 – 2030». Dirección General del Agua. https://www.miteco.gob.es/es/agua/participacion-publica/plan_accion_aguas_subterraneas_2023_2030.html

———. 2024. «Informe mensual de seguimiento de la situación de sequía y escasez - enero de 2024». Dirección General del Agua. https://www.miteco.gob.es/es/agua/temas/observatorio-nacional-de-la-sequia/informes-mapas-seguimiento.html

———. s. f.-a. «Boletín Hidrológico». Accedido 25 de enero de 2024. https://eportal.miteco.gob.es/BoleHWeb/

———. s. f.-b. «Boletín Hidrológico semanal. Dirección General del Agua». Accedido 25 de enero de 2024. https://www.miteco.gob.es/es/agua/temas/evaluacion-de-los-recursos-hidricos/boletin-hidrologico.html

———. s. f.-c. «Categorías y tipos de masas de agua superficiales». Accedido 13 de febrero de 2024. https://www.miteco.gob.es/es/agua/temas/estado-y-calidad-de-las-aguas/aguas-superficiales/categorias-y-tipos-de-masas-de-agua.html

———. s. f.-d. «Cuencas y subcuencas hidrográficas». Accedido 12 de febrero de 2024. https://www.miteco.gob.es/es/cartografia-y-sig/ide/descargas/agua/cuencas-y-subcuencas.html

———. s. f.-e. «Demarcaciones hidrográficas y Organismos de cuenca». Accedido 12 de febrero de 2024. https://www.miteco.gob.es/es/cartografia-y-sig/ide/descargas/agua/ddhh-oocc.html

———. s. f.-f. «Planes de gestión de sequías». Accedido 12 de febrero de 2024. https://www.miteco.gob.es/es/agua/temas/observatorio-nacional-de-la-sequia/planificacion-gestion-sequias.html

———. s. f.-g. «Planes Hidrológicos y Programa de Medidas». Accedido 13 de febrero de 2024. https://servicio.mapa.gob.es/pphh/public/pphh

———. s. f.-h. «Programa LEADER/CLLD». Accedido 12 de febrero de 2024. https://www.miteco.gob.es/es/ceneam/recursos/pag-web/gestion-ambiental/leader-clld.html

———. s. f.-i. «Reutilización de las aguas». Accedido 13 de febrero de 2024. https://www.miteco.gob.es/es/agua/temas/concesiones-y-autorizaciones/reutilizacion-aguas-depuradas.html

———. s. f.-j. «Tipos de usos del Dominio Público Hidráulico». Accedido 12 de febrero de 2024. https://www.miteco.gob.es/es/agua/temas/concesiones-y-autorizaciones/regulacion-usos-aprovechamiento/

tipos-usos.html.

MMA. 2000. «Libro blanco del agua en España». https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/libro-blanco-del-agua.html

———. 2002. «Evaluación Ambiental Estratégica del Plan Hidrológico Nacional». Confederación hidrográfica del Segura. https://www.chsegura.es/es/cuenca/planificacion/plan-hidrologico-nacional/evaluacion-ambiental-estrategica/

Moya, Ana Soledad Acosta, Montserrat Grañeras Pastrana, Darío Lamothe González, Alejandra Piedra Antón, Ma Isabel Rostaing Bellido, y Emiliano Santamaría Cores. 2018. «Evaluación de la Participación Ciudadana en los Planes y Programas Públicos. Plan Hidrológico de la Demarcación Hidrográfica del Guadiana. Informe final».

Murillo, Jose Albiac, Encarna Esteban Gracia, y Safa Baccour. 2023. «La Situación y Perspectivas de los Recursos Hídricos en España». Estudios sobre la Economía Española 2023/29, FEDEA. https://fedea.net/la-situacion-y-perspectivas-de-los-recursos-hidricos-en-espana/

National Geographic España. 2023. «Doñana queda fuera de la Lista Verde de la UICN, ¿qué significa?» 2023. https://www.nationalgeographic.com.es/medio-ambiente/uicn-excluye-a-donana-su-lista-verde_21286

Obermaier, Nathan, y Alberto Pistocchi. 2022. «A Preliminary European-Scale Assessment of Microplastics in Urban Wastewater». Frontiers in Environmental Science 10. https://www.frontiersin.org/articles/10.3389/fenvs.2022.912323

OECD. 2018. «The OECD Principles on Water Governance». Adopted by the OECD Regional Development Policy Committee on 11 May 2015. Welcomed by Ministers at the OECD Ministerial Council Meeting on 4 June 2015 . Centre for Entrepreneurship, SMEs, Regions and Cities. https://www.oecd.org/governance/oecd-principles-on-water-governance.html

———. s. f. «Managing water sustainably is key to the future of food and agriculture». Water and agriculture. Accedido 13 de febrero de 2024. https://www.oecd.org/agriculture/topics/water-and-agriculture/

Our Shared Seas. 2021. «Habitat and Biodiversity Loss». https://oursharedseas.com/threats/threats-habitat-and-biodiversity/

Pascual, Manuel G. 2023. «El hipercentro de datos de Meta en Talavera consumirá más de 600 millones de litros de agua potable en una zona en peligro de sequía». El País. 9 de mayo de 2023. https://elpais.com/tecnologia/2023-05-09/el-hipercentro-de-datos-de-meta-en-talavera-consumira-mas-de-600-millones-de-litros-de-agua-potable-en-una-zona-en-peligro-de-sequia.html

Pistocchi, Alberto, Alberto Aloe, Chiara Dorati, Laura Alcalde Sanz, Faiçal Bouraoui, Bernd Gawlik, Bruna Grizzetti, Marco Pastori, y Olga Vigiak. 2018. «The Potential of Water Reuse for Agricultural Irrigation in the EU: A Hydro Economic Analysis». EUR 28980 EN. Publications Office of the European Union, Luxembourg. https://data.europa.eu/doi/10.2760/263713

PTEA. 2021. «Reutilización y reuso». Revistas IDiAgua. https://ptea.es/revistas-idiagua/

———. 2023. «Digitalización en la gestión del ciclo del agua». Revistas IDiAgua. https://ptea.es/revistas-idiagua/

PwC. 2018. «La gestión del agua en España. Análisis y retos del ciclo urbano del agua». https://www.pwc.es/es/publicaciones/energia/assets/gestion-agua-2018-espana.pdf

Qian, Naixin, Xin Gao, Xiaoqi Lang, Huiping Deng, Teodora Maria Bratu, Qixuan Chen, Phoebe

Stapleton, Beizhan Yan, y Wei Min. 2024. «Rapid single-particle chemical imaging of nanoplastics by SRS microscopy». Proceedings of the National Academy of Sciences 121 (3): e2300582121. https://doi.org/10.1073/pnas.2300582121

Red eléctrica. 2023. «Informe del Sistema Eléctrico. Informe resumen de energías renovables 2022». https://www.sistemaelectrico-ree.es/sites/default/files/2023-03/Informe_Renovables_2022.pdf

Retema. 2019. «Biofactorías, la apuesta de SUEZ para lograr el objetivo residuos cero, se presenta en la COP25». 2019. https://www.retema.es/actualidad/biofactorias-apuesta-suez-lograr-objetivo-residuos-cero-se-presenta-cop25

———. 2022. «Iniciativa pionera para la producción integrada y sostenible de agua, energía y recursos en la desalinización de agua», 2022. https://www.retema.es/articulos-reportajes/iniciativa-pionera-para-la-produccion-integrada-y-sostenible-de-agua-energia-y

Rincón, Víctor, Javier Velázquez, Javier Gutiérrez, Ana Hernando, Alexander Khoroshev, Inmaculada Gómez, Fernando Herráez, et al. 2021. «Proposal of new Natura 2000 network boundaries in Spain based on the value of importance for biodiversity and connectivity analysis for its improvement». Ecological Indicators 129 (octubre): 108024. https://doi.org/10.1016/j.ecolind.2021.108024

Ritchie, Hannah, y Max Roser. 2018. «Water Use and Stress». Published online at OurWorldInData.org. https://ourworldindata.org/water-use-stress

Rodella, Aude-Sophie, Esha Zaveri, y François Bertone. 2023. «The Hidden Wealth of Nations: The Economics of Groundwater in Times of Climate Change». World Bank. Washington, DC. https://documents1.worldbank.org/curated/en/099257006142358468/pdf/IDU0fb2550de013100434708d920a3e3bec6afb1.pdf

Rossi, Rachele. 2019. «Irrigation in EU Agriculture». European Parliamentary Research Service (EPRS). https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/644216/EPRS_BRI(2019)644216_EN.pdf

Rubio, Miguel Á. García, y Francisco González Gómez. 2020. «Informe sobre el ciclo integral del agua en pequeños y medianos municipios. Libro Verde de la Gobernanza del Agua». Departamento de Economía Aplicada, Universidad de Granada. https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/libro-verde-gobernanza.html

S. Jayaraman, K. 2021. «Frequent Earthquakes around Delhi Linked to Groundwater Pumping». Nature India, mayo. https://doi.org/10.1038/nindia.2021.72

Sachs, Jeffrey D., Guillaume Lafortune, Grayson Fuller, y Eamon Drumm. 2023. «Sustainable Development Report 2023. Implementing the SDG Stimulus». Paris: Sustainable Development Solutions Network, Dublin: Dublin University Press. https://sdgtransformationcenter.org/reports/sustainable-development-report-2023

Sachs, Jeffrey D., Guillaume Lafortune, Christian Krol, Grayson Fuller, y Finn Woelm. 2022. «Sustainable Development Report 2022. From Crisis to Sustainable Development: The SDGs as Roadmap to 2030 and Beyond». Cambridge University Press. https://doi.org/10.1017/9781009210058

Salas, Erick Burgueño. 2023. «Number of Natura 2000 Sites in the European Union (EU-27) in 2021, by Country». Statista. 2023. https://www.statista.com/statistics/1392715/number-of-natura-2000-sites-by-country-european-union/

Sánchez, Victor Juan Cifuentes. 2023. «Informe preliminar de estado de los acuíferos en el entorno de Doñana. Año hidrológico 2022-2023». Confederación Hidrográfica del Guadalquivir. MITECO.

Sea4value. s. f. «Mining Value from Brines. Novel Technologies in Seawater Desalination Plants to Extract Minerals and Metals from Seawater Brines». Accedido 13 de febrero de 2024. https://sea4value.eu/

Senán-Salinas, Jorge, Alberto Blanco, Raquel García-Pacheco, Junkal Landaburu-Aguirre, y Eloy García-Calvo. 2021. «Prospective Life Cycle Assessment and economic analysis of direct recycling of end-of-life reverse osmosis membranes based on Geographic Information Systems». Journal of Cleaner Production 282 (febrero): 124400. https://doi.org/10.1016/j.jclepro.2020.124400

Serraller, Mercedes. 2023. «Las 765 desaladoras en España sólo funcionan al 16% de su capacidad en plena sequía». Vozpópuli. 15 de mayo de 2023. https://www.vozpopuli.com/economia_y_finanzas/765-desaladoras-espana-solo-funcionan-16-capacidad-plena-sequia.html

Seung-soo, Han. 2018. «Addressing Water, Sanitation and Disasters in the Context of the Sustainable Development Goals». United Nations | UN Chronicle. United Nations. 2018. https://www.un.org/en/chronicle/article/addressing-water-sanitation-and-disasters-context-sustainable-development-goals

Spain DC. s. f. «La asociación de data Center en España». Accedido 13 de febrero de 2024. https://spaindc.com/

Stein, Ulf, Benedict Bueb, Andreas Englund, Richard Elelman, Natacha Amorsi, Francesca Lombardo, Aitor Corchero, Anna Brékine, Fernando Lopez Aquillar, y Michele Ferri. 2022. «Digitalisation in the Water Sector. Recommendations for Policy Developments at EU Level». LU: Publications Office of the European Union. https://data.europa.eu/doi/10.2848/915867

Sunter Eroglu, Nilsen. 2023. «Water Footprints in Denim Production». 11th Global Conference on Global Warming (GCGW-2023). Istanbul, Turkey, diciembre. https://doi.org/10.2139/ssrn.4663487

TNC, y MITECO. 2019. «Informe de la jornada. Soluciones Basadas en la Naturaleza para la gestión del agua en España. Retos y oportunidades». https://www.miteco.gob.es/content/dam/miteco/es/agua/formacion/soluciones-basadas-en-la-naturaleza_tcm30-496389.pdf

UN Habitat, y WHO. 2021. «Progress on Wastewater Treatment - Global status and acceleration needs for SDG indicator 6.3.1». United Nations Human Settlements Programme (UN-Habitat) and World Health Organization (WHO), Geneva. https://unhabitat.org/progress-on-wastewater-treatment-%E2%80%93-2021-update

UN Water. s. f.-a. «Country (or area) | SDG 6 Data - Spain». Accedido 12 de febrero de 2024. https://www.sdg6data.org/en/country-or-area/Spain

———. s. f.-b. «Snapshots | SDG 6 Data - Global Status». Accedido 12 de febrero de 2024. https://sdg6data.org/en/snapshots#indicator_global_home

UNEP. 2023. «Wastewater – Turning Problem to Solution.» A United Nations Environment Programme Rapid Response Assessment. Nairobi. https://wedocs.unep.org/xmlui/handle/20.500.11822/43142

UNFCCC. 2023. «Outcome of the first global stocktake». United Arab Emirates: Draft decision -/CMA.5. Proposal by the President. https://unfccc.int/documents/636608

———. s. f.-a. «The Paris Agreement». Accedido 9 de febrero de 2024. https://unfccc.int/process-and-meetings/the-paris-agreement

———. s. f.-b. «What is the Kyoto Protocol?» Accedido 9 de febrero de 2024. https://unfccc.int/kyoto_protocol

———. s. f.-c. «What is the United Nations Framework Convention on Climate Change?» Accedido 9 de febrero de 2024. https://unfccc.int/es/process-and-meetings/que-es-la-convencion-marco-de-las-naciones-unidas-sobre-el-cambio-climatico

United Nations. 2010. «The human right to water and sanitation». Resolution adopted by the General Assembly in A/RES/64/292. https://www.un.org/spanish/waterforlifedecade/human_right_to_water.html

———. 2015. «Transforming our world: the 2030 Agenda for Sustainable Development». Resolution adopted by the General Assembly in A/RES/70/1. https://sdgs.un.org/2030agenda

———. 2017. «Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development». Resolution adopted by the General Assembly in A/RES/71/313 (Annex). https://unstats.un.org/sdgs/indicators/indicators-list/

———. 2018. «United Nations Secretary-General's Plan: Water Action Decade 2018-2028». https://www.un.org/sustainabledevelopment/water-action-decade/

———. 2020. «The United Nations world water development report 2020: water and climate change». UNESCO. Paris. https://unesdoc.unesco.org/ark:/48223/pf0000372985.locale=en

———. 2021. «The United Nations World Water Development Report 2021: Valuing Water». UNESCO. Paris. https://www.unwater.org/publications/un-world-water-development-report-2021

———. 2022. «The United Nations World Water Development Report 2022: groundwater: making the invisible visible». UNESCO. Paris. https://unesdoc.unesco.org/ark:/48223/pf0000380721

———. 2023a. «Blueprint for Acceleration: Sustainable Development Goal 6 Synthesis Report on Water and Sanitation 2023». https://www.unwater.org/publications/sdg-6-synthesis-report-2023

———. 2023b. «Global Sustainable Development Report 2023: Times of Crisis, Times of Change: Science for Accelerating Transformations to Sustainable Development». New York. https://sdgs.un.org/sites/default/files/2023-09/FINAL%20GSDR%202023-Digital%20-110923_1.pdf

———. 2023c. «The United Nations World Water Development Report 2023: partnerships and cooperation for water». UNESCO. Paris. https://unesdoc.unesco.org/ark:/48223/pf0000384655

———. 2023d. «The Sustainable Development Goals Report 2023: Special Edition». https://doi.org/10.18356/9789210024914

———. s. f.-a. «ReFashion Week de NY celebra la sostenibilidad y la moda de segunda mano». United Nations. United Nations. Accedido 13 de febrero de 2024. https://www.un.org/es/impacto-acad%C3%A9mico/refashion-week-de-ny-celebra-la-sostenibilidad-y-la-moda-de-segunda-mano

———. s. f.-b. «Water: At the Center of the Climate Crisis». United Nations. Accedido 8 de febrero de 2024. https://www.un.org/en/climatechange/science/climate-issues/water

Van Hove, Eduardo Perero, David Escobar Gutiérrez, Gari Villa-Landa Sokolova, Jokin Larrauri Abasolo, Juan Carlos García Carrasco, Lydia Saéz García, María Pilar García de Rentería, y Samir Rramzi. 2019. «Informe. Agua y economía circular». Fundación Conama. https://www.fundacionconama.org/que-hacemos/proyectos/agua-y-economia-circular/

Vanham, Davy, Hrvoje Medarac, Joep F. Schyns, Rick J. Hogeboom, y Davide Magagna. 2019. «The Consumptive Water Footprint of the European Union Energy Sector». Environmental Research Letters 14 (10): 104016. https://doi.org/10.1088/1748-9326/ab374a

Velázquez-Gaztelu, J. P. 2019. «Sin gestionar bien el agua no podemos afrontar el cambio climático». elDiario.es. 8 de febrero de 2019. https://www.eldiario.es/alternativaseconomicas/agua-podemos-afrontar-cambio-climatico_132_1708860.html

Villar, Alberto del, Joaquín Melgarejo, Marcos García-López, Patricia Fernández-Aracil, y Borja Montano. 2023. «The economic value of the extracted elements from brine concentrates of Spanish desalination plants». Desalination 560 (agosto): 116678. https://doi.org/10.1016/j.desal.2023.116678

Water Europe. 2021. «Digitalization and Water. Start with digital water and end with a water-smart digital sector». https://watereurope.eu/new-position-paper-digitalization-and-water/

———. 2023. «The value of water: towards a water-smart society». https://watereurope.eu/wp-content/uploads/WE-Water-Vision-2023_online.pdf

Water Footprint Network. s. f. «Product Gallery». Accedido 13 de febrero de 2024. https://www.waterfootprint.org/resources/interactive-tools/product-gallery/

WHO. s. f. «Drinking-Water». Accedido 9 de febrero de 2024. https://www.who.int/news-room/fact-sheets/detail/drinking-water

Wilson, Wendy, Travis Leipzig, y Bevan Griffiths-Sattenspiel. 2012. «Burning Our Rivers: The Water Footprint of Electricity». A River Network Report. Rivers, Energy & Climate Program. Portland, Oregon. https://jbo.pdh.mybluehost.me/wp-content/uploads/2020/12/BurningOurRivers_0.pdf

WMO. s. f. «Water». World Meteorological Organization. Accedido 8 de febrero de 2024. https://wmo.int/topics/water

World Bank. 2022. «Water Resources Management». World Bank. 2022. https://www.worldbank.org/en/topic/waterresourcesmanagement

———. s. f. «Water». World Bank. Accedido 9 de febrero de 2024. https://www.worldbank.org/en/topic/water/overview

WRI. 2023. «Aqueduct | Water Risk Atlas». 17 de octubre de 2023. https://www.wri.org/aqueduct

WWAP/UN-Water. 2018. «The United Nations World Water Development Report 2018: Nature-Based Solutions for Water». Paris, UNESCO. https://www.unesco.org/en/wwap/wwdr/2018

WWF/Adena. 2006. «Uso ilegal del agua en España. Causas, efectos y soluciones». http://awsassets.wwf.es/downloads/uso_ilegal_del_agua_mayo06.pdf

WWF. 2022. Living Planet Report 2022 – Building a nature positive society. Almond, R.E.A., Grooten, M., Juffe Bignoli, D. & Petersen, T. (Eds). WWF, Gland, Switzerland. https://livingplanet.panda.org/en-US/

About REDR | redr.es

The Spanish Network for Rural Development (REDR) is a non-profit association, established in 1995, with the aim of promoting an integrated and sustainable rural development model. The Local Action Groups (LAGs), members of REDR, manage Rural Development Programmes and Initiatives, through the LEADER methodology framed in the European Fund for Agriculture and Rural Development (EAFRD), throughout Spain.

Currently, REDR is associated with more than 180 Local Action Groups and regional networks at national level, whose action extends to more than 6,000 municipalities throughout Spain. REDR acts as an interlocutor for its members, the LAGs, vis-à-vis the different administrations: European, State and Autonomous Community. At the international level, it develops capacities for dialogue and coordination and generates and promotes alliances within a community-led local development approach in territorial policies at the international level.

RedR
Red Española de Desarrollo Rural

Spanish Network for Rural Development

Website | redr.es
E-mai | redr@redr.es
Twitter | @redespanola
Instagram | @redespanola
LinkedIn| RedEspanoladeDesarrolloRural
Facebook | RedEspanolaDesarrolloRural