OBSERVATOIRE Défense & Climat

Note

SECURITY CHALLENGES OF WATER STRESS IN SOUTHERN EUROPE

November 2024

DGRIS

IRIS INSTITUT DE RELATIONS INTERNATIONALES ET STRATÉGIQUES

The Defence and Climate Observatory, launched in December 2016, aims to study climate-related security and defence issues.

It is coordinated by IRIS as part of the contract carried out on behalf of the French Ministry of Armed Forces's Directorate General for International Relations and Strategy (DGRIS). The Observatory's multi-disciplinary team includes researchers specializing in international relations, security, defence, migration, energy, economics, climatology and health. It is directed by Julia Tasse and François Gemenne.

The Observatory has initiated numerous collaborations with European partners (Netherlands, Luxembourg) and international partners (Australia, United States, India), international NGOs and national and international public bodies. These initiatives have strengthened cooperation on climate issues and their security implications.

The Climate and Defence Observatory produces reports and notes, organises restricted seminars and conferences open to the public, and hosts the podcast "On the climate front".

www.defenseclimat.fr/en

The Ministry of Armed Forces regularly calls upon private research institutes for outsourced studies, using a geographical or sectoral approach to complement its external expertise. These contractual relationships are part of the development of the defence foresight approach, which, as emphasised in the latest White Paper on Defence and National Security, *"must be able to draw on independent, multidisciplinary and original strategic thinking, integrating university research as well as specialised institutes*".

Many of these studies are made public and available on the Ministry of Armed Forces website. In the case of a study published in part, the Directorate General for International Relations and Strategy may be contacted for further information.

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The latest report from the World Meteorological Organisation (2024) **highlights the alarming deterioration of the world's water resources and the worsening of water stress,** due to changes in water cycles brought about by human activities and climate change. Water stress is a phenomenon of **severe pressure on a territory's water resources**, occurring when demand for water exceeds the quantity available, or when its poor-quality limits its use. A country is considered to be under "water stress" when its annual water resources drop below 1,700 m³ per person per year (United Nations, n.d.). This concept considers several physical aspects of water resources, including scarcity, but also quality, environmental flows and accessibility.

Imperfect public policies for distributing water resources (wastage, intensive irrigation, pollution of surface and groundwater, artificialisation of land, etc.) combined with the consequences of climate change on the water cycle (rising temperatures, intensifying droughts, changing rainfall patterns, etc.) have led to an **overall reduction of 24% in renewable water resources per capita across the European continent over the last 50 years** (European Environment Agency, 2018)**.** Southern Europe has experienced a particularly sharp decline, further intensified by decreasing rainfall levels. Each year, **water stress affects around 20% of Europe** - particularly the countries of the Mediterranean basin such as Greece, Spain, Portugal, Italy, Cyprus and Malta - and **30% of the European population** (WWF, 2023).

As a user of the resource, and to anticipate upheavals in the water cycle, the Ministry of Armed Forces recently became aware of the importance of a holistic approach to water resources and developed a Ministerial Water Strategy for 2030, which is part of the French government's Water Plan (Ministry of Armed Forces, 2024). Unveiled in June 2023, **this strategy sets forth guidelines and objectives aimed at fostering resilience and promoting water efficiency within the defence sector.**

To complement this strategy, this report from the **Defence and Climate Observatory aims to explore the security challenges associated with water stress in France and its Mediterranean neighbours** in the European Union (France, Portugal, Spain, Italy, Greece, Slovenia, Croatia, Cyprus and Malta). The report first analyses the societal consequences of water stress in southern Europe, including the potential water-related conflicts that may arise (I). It then looks at the operational implications for the armed forces, particularly in France, and compares them with the practices of other European armies (II). Based on these analyses, the report offers three scenarios for 2050, and strategic recommendations for the Ministry of Armed Forces (III).

PART 1

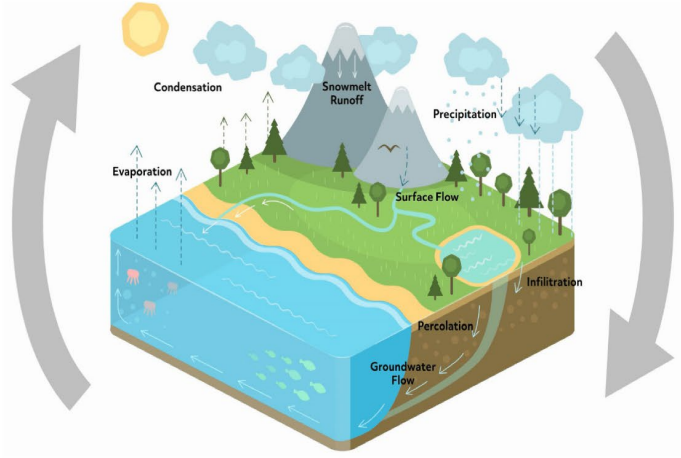
WATER STRESS AND HUMAN SOCIETIES IN SOUTHERN EUROPE

A - Climate change and water stress in southern Europe

1. Impacts of climate change on the quantity and quality of freshwater

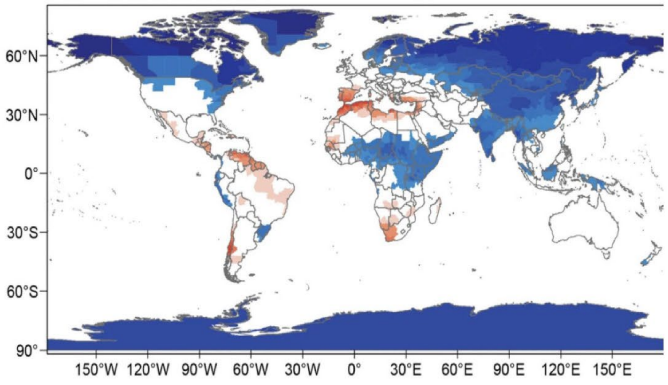
Freshwater accounts for only 3% of earth's water. It is divided between glaciers and ice caps (which account for 70% of the volume) and groundwater, surface water and, to a lesser extent, the atmosphere. The various natural processes involved in the circulation and transformation of water collectively make up the water cycle. Solar energy is the driving force. Water leaves the oceans, lakes, rivers and plants - a phenomenon known as **evapotranspiration** - and rises into the air as water vapour. When it encounters lower temperatures, water vapour condenses, forming droplets that create clouds. These droplets grow and eventually fall as rain or snow: **precipitation**. Some of the water from precipitation infiltrates the soil, while some runs off into rivers and oceans.

Figure 1 - Water cycle diagram



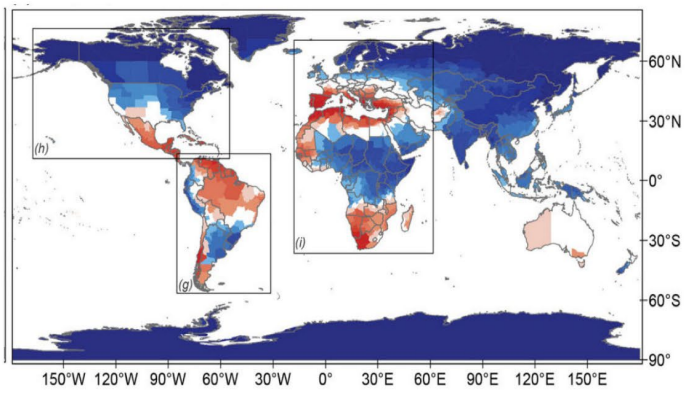
Source : Mometrix.com

Figure 2 - Change in rainfall distribution by 2100 according to an intermediate emissions scenario (RCP4.5)



Source : Trancoso et al., 2024

Figure 3 - Change in rainfall distribution by 2100 according to a high emissions scenario (RCP8.5)

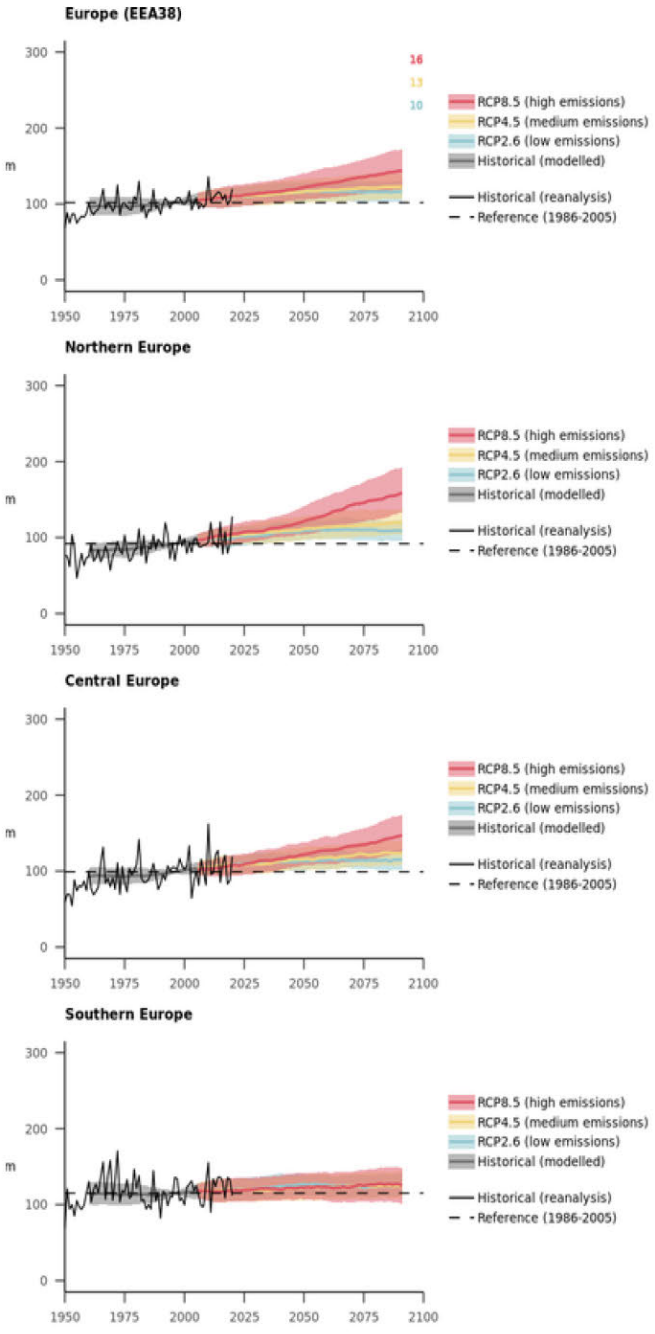


Source : Trancoso et al., 2024

Red zones indicate increasingly dry areas, while blue zones indicate increasingly wet areas.

The latest IPCC report highlights the fact that several concomitant phenomena, due to climate change (see definition in the glossary), are transforming the hydrological cycle in all its components. Firstly, climate change is causing **changes to the general circulation and distribution of rainfall across the planet**. As a result, the Mediterranean region is likely to become drier by 2100, due to an increase of North Africa's dry climate. The region will therefore become a dry 'hotspot', reinforced by rising temperatures. Greece, Spain and Portugal are expected to experience a marked decrease in precipitation: up to 21% in a scenario of intermediate greenhouse gas emissions (IPCC RCP4.5) and 55% for very high emissions (RCP8.5) (Trancoso et al., 2024). Cyprus, Malta and Italy would also experience strong aridification under these scenarios (Trancoso et al., 2024). Conversely, a gradual humidification of northern Europe is forecasted, but projections for northern France remain uncertain (Habets, 2024).

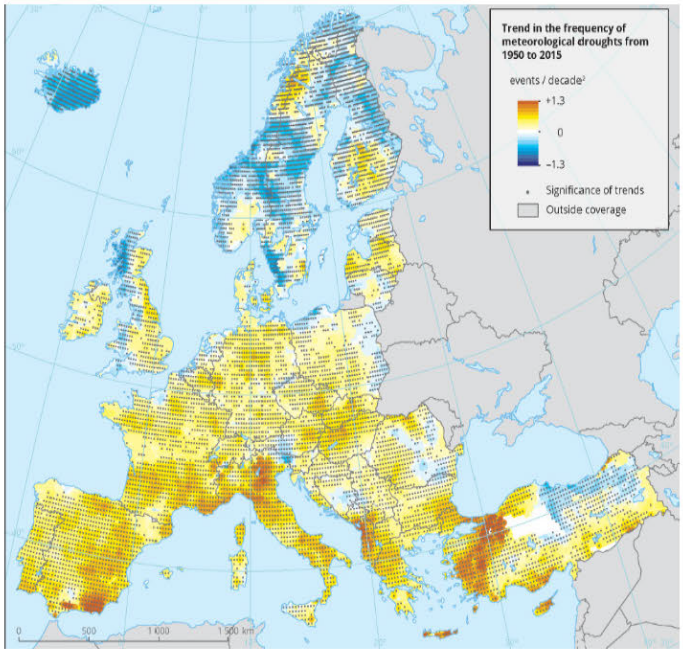
Figure 4 - Extreme total rainfall in Europe



Source : European Environment Agency, January 2022

A second effect of climate change is the **intensification of extreme precipitation**, due to the increase in the concentration of water vapour in the atmosphere, coupled with warmer air. In Europe, a concentration of precipitation is expected in winter and autumn, with a significant increase in precipitation in the north and center, and a slight increase in the south. These Europe-wide projections apply to France, although they are more uncertain (Trancoso et al., 2024). For example, researchers have observed a 22% increase in the average intensity of extreme precipitation over 50 years in the Cévennes region of France (Habets, 2024). The intensity of this rainfall complicates the management of water recovery and treatment systems. This water will potentially be unavailable for human use due to the current inability to retain it. In addition, the soils, which have become steep because of rising temperatures and artificialised by human activities, will no longer be able to absorb this extreme precipitation, which will run off and lead to an **intensification of the flooding associated with these precipitations.**

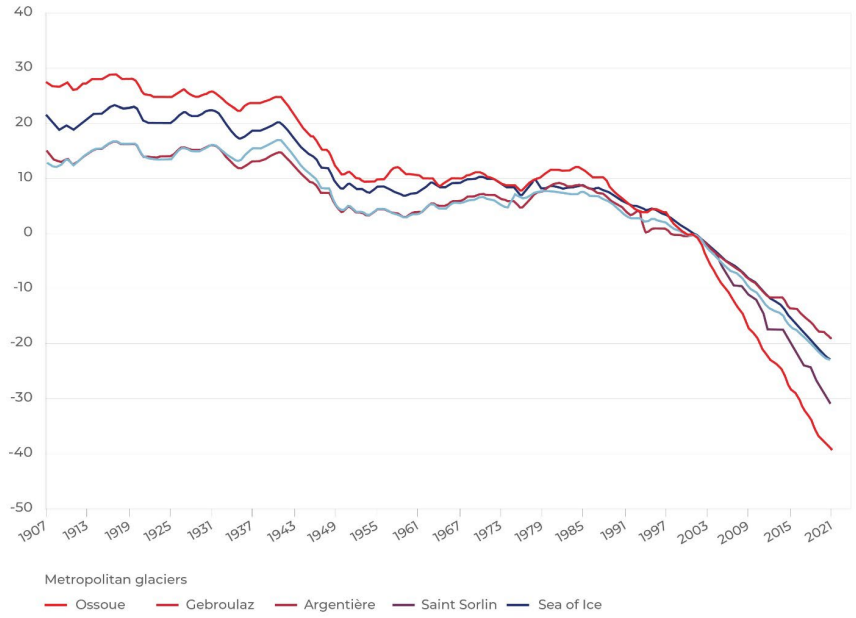
Figure 5 - Trends in meteorological drought frequency in Europe for the 1950-2015 period



Source : European Environment Agency, 18 March 2020

We are also witnessing **an increase in the recurrence of droughts,** caused by higher temperatures, more rapid **evaporation of water** and lower groundwater flows and levels. A drought is an unusual and temporary shortage of available water due to a lack of rainfall and increased evaporation (because of high temperatures). It differs from water scarcity, which is the structural lack of fresh water throughout the year due to over-consumption of water. In Europe, climate projections estimate that 30% of land areas will be drought-stricken by 2100 (Habets, 2024). The models agree on an increase in the recurrence and duration of droughts in Europe, particularly meteorological droughts. These droughts correspond to prolonged shortfalls in rainfall measured against seasonal norms. With an increase in global average temperature of 3°C, corresponding to RCP4.5, these droughts would be twice as frequent. The most severe droughts will be in the Mediterranean and Atlantic regions of Europe. In addition, this increase in frequency and intensity would lead to an **increase in the length and severity of the fire season, particularly in southern Europe**. Fighting forest fires involves intensive use of water resources, which illustrates the complexity of resource availability.

Figure 6 - Changes in thickness of glaciers in mainland France (in meters equivalent water)



Source : Ministry for Ecological Transition and Territorial Cohesion, 22 juiy 2024

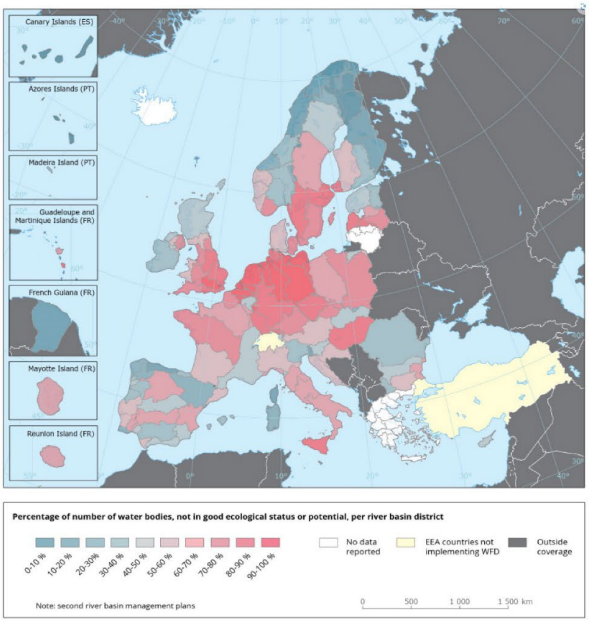
The increase in average global temperature leads to **widespread melting of several elements of the cryosphere** (see definition in the glossary), in particular continental glaciers and ice caps (Eau France, n.d.). These are melting increasingly earlier in the season, three times faster than before, and finding it harder to reform in winter (The IMBIE Team, 2018). As a result, the entire redistribution function of glaciers is in jeopardy, and consequently the downstream located rivers.

Since 1994, more than 28,000 tonnes of ice have disappeared worldwide, at a melting rate that has increased by 65% in 30 years (McKie, 2020). Risks of a breach of continuity, and therefore of the ice supply, in certain areas could further accelerate the melting. These are the risks for the two largest glaciers in the Alps: Argentière and Mer de Glace. These have already lost respectively 25% and 32% of their average thickness since the beginning of the 20th century, and their total disappearance could occur by 2100 in the IPCC's RCP8.5 trend scenario (Vincent et al., 2019). For example, in the Rhône basin, the flow is expected to fall by more than 20% in August in 2055, and by up to 40% in some stretches, due to the reduction in snow cover and the retreat of glaciers (Agence de l'eau Rhône-Méditerranée-Corse, 2023). In addition, the accelerated thawing of glaciers increases the formation of water pockets within them, increasing the risk of flooding in the event of a break-up. The case of the Tête-Rousse glacier, which dominates the commune of Saint Gervais Mont-Blanc, is particularly convincing, and has led to the implementation of a regular monitoring and pumping system, as well as a regularly tested warning protocol (Sirop et al., 2022). In addition, melting ice causes sea levels to rise. Salt water then gradually penetrates the coastal aquifers, which are the underground freshwater reservoirs located near the coast, reducing freshwater reserves.

Figure 7 - Surface water bodies with ecological status or ecological potential below 'good' by river basin district (%)

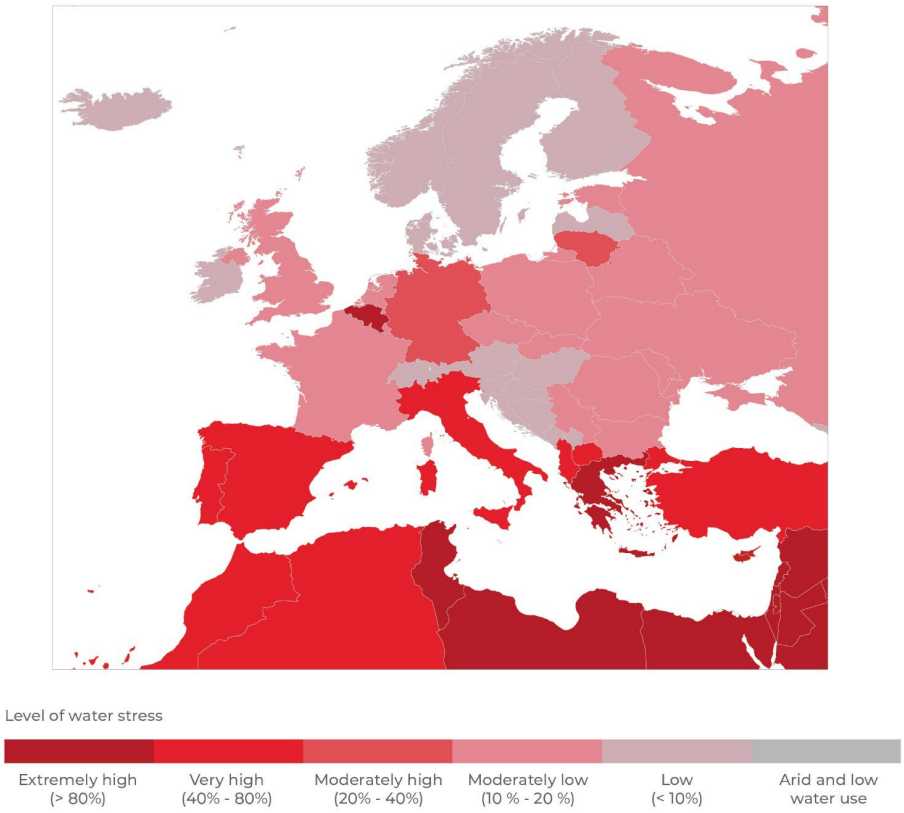
Finally, climate change is having an impact on **water quality**. The rise in the temperature of lake and river water, induced by the rise in atmospheric temperature, but also by the reduction in flow rates and therefore the increasing stagnation of water, leads to a change in the chemical and biological balance of water. This leads to **eutrophication** (see definition in the glossary) and therefore an increase in the presence of nutrients in watercourses, altering water quality and therefore aquatic biodiversity. Northern European countries in particular are affected by the decline in water quality, but certain regions in southern Europe, such as Italy, Croatia and Spain, are also victims of this proliferation of nutrients and pollutants resulting from human activity (Freshwater Information System in Europe, 2024).

The data on the map opposite includes chemical inputs from human activity.



Source : Freshwater Information System in Europe, 2024

Figure 8 - Countries affected by water stress in Europe



The 25 countries facing extremely high water stress each year are (in order of vulnerability): Bahrain, Republic of Cyprus, Kuwait, Lebanon, Oman, Qatar, United Arab Emirates, Saudi Arabia, Israel, Egypt, Libya, Yemen, Botswana, Iran, Kingdom of Jordan, Chile, San Marino, Belgium, Greece, Tunisia, Namibia, South Africa, Iraq, India and Syria. Three European countries are on this list, and two are Mediterranean.

Source : World Resources Institute, 2023

These mutually reinforcing phenomena are leading to a **reduction in available freshwater resources, a decline in aquatic biodiversity and are fuelling water stress**. As a result, 25 countries, most of which are located around the Mediterranean and in the Middle East, and which are home to a quarter of the world's population (WRI, 2023), face extremely high water stress each year, as they regularly use more than 80% of their available water reserves, mainly for activities such as irrigation, livestock farming, industry and domestic needs. Consequently, even a short-term drought exposes these regions to serious threats to human health and safety (WRI, 2023). For the Middle East and North Africa, this means that 100% of the population will be living in conditions of severe water stress by 2050. The European Mediterranean area is also largely affected by this phenomenon, particularly Malta, Cyprus, Portugal, Spain, Italy and Greece.

2. Anthropogenic pressures on water resources in southern Europe

Water distribution

The rise of water stress in the European Union (EU) is caused by climate change[1] and by the growing need for water in European countries, due to demographic growth and economic models that are leading to the depletion of resources. However, national strategies for managing water resources appear to be ill-suited to the increasing scarcity of the resource, even if efforts are being made to reduce water withdrawals, as in France, which aims to reduce its water withdrawals by 10% by 2030. On the one hand, governments are trying to find solutions to increase the quantity of fresh water available, without attempting to reduce society's dependence on water resources (Taithe, 2024) or investing sufficiently in policies to reduce wastage. Because of the **poor state of European water networks, a quarter of the drinking water available in the EU is lost on average, through pipes leaks**, which are often more than sixty years old (the maximum age for a pipe) (Tsigoraki, 2024; Institut Rousseau, 2024)[2]. On the other hand, the issue of water does not seem to be taken into consideration to the extent that it is at stake in adjacent policies: increasing urbanisation is increasing soil sealing and pressure on water resources, exacerbating the vulnerability of populations to water stress and extreme climate events.

Water supply networks in the countries of southern Europe

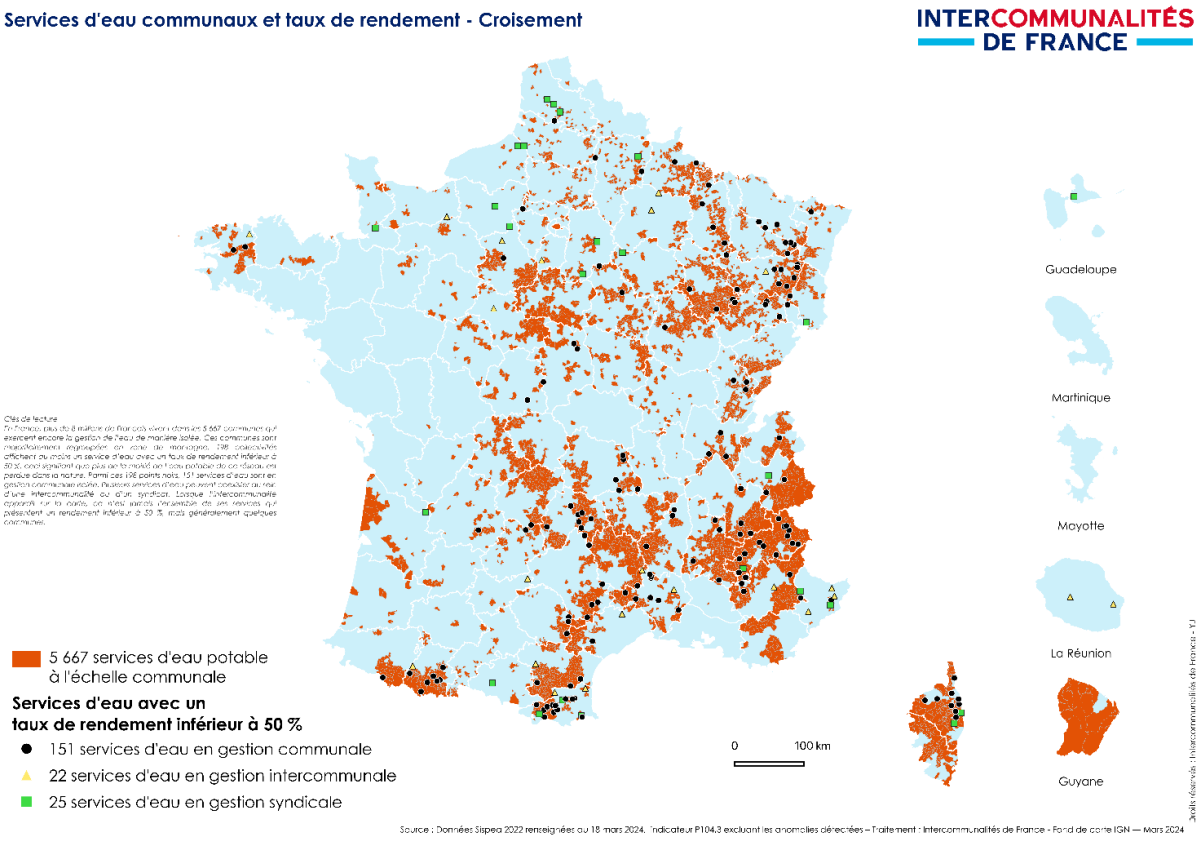
- **IN ITALY**, the pipe network is poorly maintained and old, resulting in the loss of 42% of drinking water. In some regions of the south, these losses reach 60% due to the age of the pipes, the lack of communication and information on services, the poor allocation of European funds, the heterogeneity of the networks between the north and the south and the multiplicity of private operators of the resource (La Rocca, 2024).
- **IN SLOVENIA**, actual water losses due to outdated networks are estimated at 24% (Rižanski vodovod Koper, n.d.). In 2015, 12 Slovenian municipalities received aid from the Ministry of Economy and Technological Development amounting to €9 million for the construction and renovation of the water supply network, which corresponds to the replacement of around fifty kilometers of network.

[1] From one year to the next, a river's flow may decrease for so-called natural reasons. It is therefore important to look at variations in river flow over time. Indeed, the variation in annual flows observed in rivers must be read in the light of multi-decadal variability, which is due to variations in the temperature of the Atlantic Ocean. These variabilities limit predictions linked to the water cycle over the short term and allow us to take a step back from the sometimes extremely alarming ten-year predictions. Variations in the temperature of the Atlantic Ocean have several impacts on the water cycle: when the ocean is warmer, water flows in France are lower. It is therefore crucial to take account of this 'natural' variability, which plays a major role in the water cycle. However, this cause of water stress is less important than the main cause, which is the increase in global temperature due to climate change (Habets, 2024).

[2] The renovation of water networks in the Mediterranean region, although very costly, could make it possible to reduce these losses and safeguard 35% of water resources (Fader et al, 2015), provided that societies pursue sobriety and do not increase their consumption (Le Strat, 2023).

- **IN GREECE**, it is estimated that 20% of drinking water is lost through leaks in distribution systems. Some experts estimate that actual losses could be as high as 60% in certain regions, particularly in urban areas (Logaras, 2024). In 2024, following the renationalisation of the resource, the government mapped out water-related problems in Greece and announced that it would take on urgent water supply projects totalling 80 million euros (Peponi, 2024).
- **MALTA**, one of the countries with the highest water stress in the world, has invested heavily since the 1990s in its public water service to limit leakage (European Environment Agency, 2018). As a result, losses have been reduced, efforts have been made to reuse water and residents have developed thrifty practices, influenced by prices, which rise when there is a shortage.
- **In CYPRUS**, citizens have recently had to pay higher water prices to finance urgent repairs to the water network, particularly in the Nicosia region (Charalambous, 2022).
- **CROATIA** suffers water losses of up to 40% due to the obsolescence of its network. The Treasury Directorate General (2018) estimates that 'only 3% of wastewater is purified to the maximum, compared with an EU average of 85%'. Croatia nevertheless has an ambitious legislative framework: the 2009 Water Act and the 2010 Water Management Financing Act aim to halve water losses during supply.
- **PORTUGAL** is also suffering from outdated water networks: 30% of water for domestic use seeps into the ground without being used, due to the lack of modernisation of supply networks (Faget, 2023).
- **SPAIN** loses an average of 25% of its distributed water per year due to leaks or unauthorised water use (Zarza, 2024). To remedy this situation, the government has published a decree requiring Spanish municipalities, from 2025, to record all leaks detected in their distribution networks (Ministerio de la Presidencia, Justicia, y Relaciones con las Cortes, 2023).
- **FRANCE** estimates its water losses at around 20% in 2024. The Water Plan 2023 aims to reduce these losses by 10% by 2030 (Ministry for Ecological Transition and Territorial Cohesion, 2023). To achieve this, the French water agencies have committed to provide €181 million in 2023 to help local authorities reduce leakage from drinking water networks. According to the French official documentation, 93 of the 171 leakage points identified have received financial support from the water agencies, without specifying their location (French State & France Nation Verte, 2024).

In 2024, the Intercommunalités de France association published a map of the 198 water utilities with an efficiency rate of less than 50%, meaning that more than half the drinking water is lost. Most of these networks are in the east of France, as well as in the south-east and Corsica, regions that have been particularly hit by growing water scarcity (Association Intercommunalités de France, 2024). **The areas most affected by drought, notably Occitanie and Provence-Alpes-Côte d'Azur, are also the areas with the least efficient supply networks**.



Source : Association Intercommunalités de France, 2024

Water Uses

Some European public water management policies are akin to **climate change maladaptation policies**, since they increase the vulnerability of territories, economic sectors and populations to water stress, rather than reducing it (Taithe, 2024). For example, on average, **40% of the total amount of water withdrawn in Europe is allocated to the agricultural sector**, ahead of industry and domestic needs, a figure that reaches 70% in Spain and Portugal (European Environment Agency, 2018). The **agricultural sector is also the one that consumes the most water** (25% of the freshwater withdrawn in Europe is consumed[3] by agriculture), mainly for land irrigation[4] (INRAE, 2019).

Despite the increase in irrigation efficiency since the 1990s[5], the sector is maintaining this rate of consumption, particularly in southern Europe, due to the development of agriculture and the

[3] According to the OECD (2024), water withdrawals refers to 'volumes of freshwater extracted permanently or temporarily from an underground or surface source and transported to its place of use'. Water consumed refers to the quantity of freshwater withdrawn that is used and not reintroduced directly into the natural environment after use (surface water and groundwater). This corresponds to water incorporated into products and water evapo-transpired (France Stratégie, 2024, April).

[4] Only 6% of the EU's agricultural land was irrigated in 2016, despite accounting for 24% of final European consumption (European Court of Auditors, 2021).

[5] In France, this would have enabled a reduction of more than a third in water consumption in the agricultural sector (Ministry of Agriculture and Food Sovereignty, 2023, April; WWF, 2023).

dependence of crops on irrigation (European Environment Agency, 2018). Through the CAP[6], the EU supports this intensive irrigation[7] to meet yield, economic income and food security objectives. However, it **increases farmers' vulnerability to declining water resources**[8] (European Court of Auditors, 2021), and bears witness to a **policy of maladaptation**. For example, the Portuguese and Spanish agricultural sectors take around 70% of the freshwater available nationally, and continue to use intensive, water-hungry practices such as avocado growing in Portugal, despite extreme droughts[9] (Fundação Calouste Gulbenkian, 2020; Caballero, 2024). Insofar as the use of water in agriculture can be suspended or postponed, unlike domestic use, farmers are regularly subject to **restrictions on the use of water in the event of drought**, which they sometimes contest through demonstrations. To cope with these restrictions in southern Europe, some farmers are **drilling illegally**, as in Spain, Portugal and Italy, which makes access to the resource even more precarious for other users[10].

The **lucrative tourism sector accounts for 10% of Europe's gross domestic product (GDP)** and is highly developed on the Mediterranean coast (L'Echo touristique, 2020). However, the urbanisation and demographic growth induced by these activities represent a threat to water and the coastal environment. For example, on the island of Malta, which has no river at all, the population quadruples during the high season, **exacerbating the already precarious decline in groundwater levels**. Portugal's tourism sector also makes a significant contribution to the economy (15% of GDP in 2023) (The Portugal News, 2023), but it puts **pressure on water resources and accentuates inequalities**[11] (Faget, 2023).

Thus, in Europe, climate change is increasing the pressure on water, exacerbated by human activities, through the increase in demand for water *via* demographic growth and the development of sectors requiring large quantities of water. **Despite data demonstrating the worsening of water stress in southern Europe over the coming decades, a large proportion of public policies, in terms of distribution and use, are ill-adapted considering they increase the vulnerability of societies to the increasing scarcity of water resources.**

[6] The Common Agricultural Policy (CAP) was introduced in 1962 in response to the crisis in the agricultural sector. Initially designed to structure and develop the agricultural market, the CAP has undergone several reforms. The aim is to find a balanced approach between economic objectives (farmers' incomes, competitiveness, etc.) and social and environmental issues.
[7] See definition in the glossary.
[8] According to the Court, authorisations for new water catchments are issued too easily, checks on irrigators are too weak and not systematic enough, and water tariffs are favourable to farmers, which does not discourage over-consumption.
[9] In July 2023, 97% of Portuguese territory was affected by drought, including 15.3% in a state of extreme drought (Portuguese Institute of the Sea and Atmosphere, 2023, July).
[10] The Spanish region of Murcia, which has more than a million illegal wells, is suffering from the contamination of its water tables by the infiltration of phytosanitary products (Piquer, 2022). In addition, in January 2023, the Andalusian regional government proposed a law to legalise hectares of illegally planted farmland and put pressure on Madrid to obtain more water resources. If this law were adopted, it could encourage other users to settle illegally on this land.
[11] In February 2024, the Portuguese government passed the 'Simplex Ambiental' law, which simplifies the administrative procedures for obtaining environmental licences for companies. The law aims to speed up the development of mass tourism and economic activities, but some associations fear that it will weaken the environmental laws governing the tourism sector (Sul Informação, 2023).

B - Societal consequences of water stress

1. Human health

Lack of water is a vital risk to human health (Klobucista & Robinson, 2023), particularly for the most vulnerable and isolated people. Children are particularly vulnerable, with serious consequences for their health, nutrition, cognitive development and future livelihoods. **Water shortage can lead people to drink poor-quality or contaminated water**[12], and to contract **gastrointestinal diseases** such as cholera, typhoid fever and hepatitis A. It also leads to a reduction in personal hygiene, increasing the risk of contracting and transmitting **infectious or parasitic diseases**. Shortages can also affect the operation of wastewater treatment plants, sanitation and hygiene services, contributing to undernutrition and the transmission of pathogens. Changes to the water cycle also contribute to **an increase in the number of insects that carry infectious diseases,** such as the tiger mosquito, which thrives in warm, stagnant water. Droughts encourage people to store water as close as possible to their homes, further encouraging the nesting of this insect, the carrier of chikungunya, dengue fever and zika[13], whose growing presence in Europe is increasing people's exposure to these previously rare diseases (European Environment Agency, 2022).

2. Agricultural sector and food security[14]

The **growing scarcity of water, an essential resource for agriculture, also threatens crops and can put additional pressure on food resources** and even threaten food security. Water resources are scarce during the summer season, when the agricultural sector needs them most. One study has shown that **crop losses due to heatwaves and droughts have tripled in the EU over the last fifty years** (Brás et al., 2021). The impact of droughts and heatwaves was greater over the period 1991-2015 than over the period 1964-1990 for the different types of crops studied[15]. In 2022, northern Italy was hit by the worst drought for 70 years, threatening more than 30% of the country's agricultural production and half the livestock in the Po plain, causing damage of more than two billion euros (Gautheret, 2022). According to NASA, global maize yields could fall by 24% by 2100 because of climate change (Jägermeyr et al., 2020). **With the increase in extreme weather events due to climate change, agricultural losses are likely to rise, threatening European food security**. In the EU, 8.3% of the population was unable to afford a balanced meal on a regular basis in 2022, an increase of one percentage point compared to

[12] The reduction in the quantity of water available concentrates pollutants, which leads to a reduction in water quality and can render a source unfit for use. This unavailability can increase pressure on the remaining usable resources, and lead humans to use water of lower quality, which can represent a risk to human health.
[13] These three viral diseases can be transmitted by mosquitoes. Chikungunya and Zika cause muscle and joint pain, headaches and fever, and skin rashes. Dengue fever causes similar symptoms, accompanied by nausea and vomiting. Severe' dengue fever is characterised by more serious forms.
[14] See definition in the glossary.
[15] The crops most affected are cereals, which need much more water than vegetables or fruit, and which occupy almost 65% of the cultivated agricultural area in Europe, mainly for animal feed (Brás et al., 2021).

2021 (Struna, 2023). This increase can be explained by a drop in income caused by the pandemic, food price inflation (accentuated by the war in Ukraine) and disruptions to supply chains in certain countries. To deal with this major security challenge for European countries, environmentalists, researchers and farmers are calling for a **more resilient agricultural system and reduced water consumption**. Among the solutions proposed are more economical irrigation techniques, the adoption of crops that consume less water and are more resistant to high temperatures (avoiding the cultivation of non-European products such as avocados, or water-intensive products such as beef) (Mekonnen & Hoekstra, 2010), a reduction in the use of pesticides and fertilisers, and a shift in the eating habits of Europeans towards less carbon-intensive and more local products.

3. Energy and industry sector

The **pressure on water resources is becoming a growing concern for the industrial sector,** particularly the textile, chemical, metallurgy, food and drink sectors, which are heavily dependent on water and risk interruptions or increased costs in the event of a shortage. The energy sector, which **accounts for 47% of water withdrawal in France**, is also heavily dependent on water resources, particularly for **cooling nuclear reactors and diluting waste from power stations**[16]. The energy transition, which is necessary to achieve the objectives of the Paris Agreement, is also a factor in increasing dependence on water resources. This is illustrated by the **climate vulnerability of hydroelectric production**[17] - in France, it fell by 12 TWh during the historic drought of 2022, reaching its lowest level since 1976 (Connaissance des énergies, 2024), or the boom in biofuels, one litre of which can require up to 4,000 litres of water (Centre d'Information de l'Eau, 2020, 14 February).

4. European economic consequences

Climate change, and drought in particular, is causing economic losses for the sectors mentioned above, as well as for services and infrastructure. For example, between 2021 and 2022, the SNCF reported a 600% increase in operating incidents due to climate hazards, with extreme heat accounting for 20% of train cancellations (Carbone4, 2023). In addition, the **shrinking and swelling of clays caused by drought** (also known as geotechnical drought) can lead to serious damage to homes, roads and supply networks (Bergé, 2023). Between 1995 and 2019, French insurance companies paid out more than €12 billion following damage caused to buildings by these phenomena, representing an annual average of around €480 million (Ministry for Ecological Transition and Territorial Cohesion, 2024, January). The accumulation of all these losses could lead to a **contraction in the economies of European countries**. According to a 'conservative estimate' by the European Commission, **the**

[16] The energy sector is the largest user of water in France, but accounts for only 12% of the water consumed in France each year, while agriculture accounts for 58% of the water consumed, albeit at a lower level.
[17] In 2023, hydroelectricity accounted for 11.8% of the EU's electricity production, making it the fifth largest electricity producer and the second largest renewable energy producer, after nuclear (22.9%), wind (17.3%), natural gas (16.8%) and coal (12.3%) (Connaissance des énergies, 2024).

worsening effects of climate change could reduce the EU's economic output by 7% by 2100 (Weise, 2024, March 6). Similarly, in the absence of climate action (RCP8.5), annual losses due to drought in the EU and the UK are expected to reach more than €65 billion a year, compared with €9 billion a year currently (Naumann et al., 2021). **Tensions surrounding a resource on which all economic sectors depend are therefore set to increase, against a backdrop of increasing water scarcity**. These water tensions will be a major factor in destabilisation and mobility, multiplying the risk of conflict between users and even between states.

C - Water stress-related security issues: water management conflicts

1. Water and interstate conflicts

The potential of water-related conflits is a growing issue in geostrategic analyses, given climate change and the increasing scarcity of this resource. Indeed, the neologism 'geostrategy', first used in the 19th century by the Piedmontese officer Giacomo Durando, introduces the idea that political and military implications can be analysed in terms of geographical space (Boulanger, 2023). In the wake of the Malthusian observation[18], Thomas Homer-Dixon established a direct link between armed conflict and the scarcity of resources, arguing that 'environmental stress' increases the frequency and intensity of conflicts (Malthus, 1966; Homer-Dixon, 1999). Philippe Boulanger reinforces this idea by defining water as a priority resource, and therefore water stress as a major risk (Boulanger, 2015; Estève, 2024).

The interplay between water and conflict, according to Franck Galland

To describe the types of interaction between water and conflict, Franck Galland (2021) develops four concepts, **the 'war without water' and the 'war with water', and the 'war against water' versus the 'war for water'.**
The first two concepts establish the importance of water, and above all its availability and potability, as a determining factor in military maneuvers. He thus proposes a reading of the First World War as a '**war without water**'. For Galland, the victorious outcome of Verdun in 1916 for the French army was partly due to the development of a formula for sterilising water by Philippe Bunau-Varilla, known as 'javellisation', which protected French soldiers against the deadly epidemics caused by water that was often contaminated on the battlefield. These lessons enabled the French to better anticipate the water issue in the Second World War, which Galland defines as a '**war with water**' (Galland, 2021). He goes on to associate '**war against water**' with conflicts using unconventional techniques, employing water as a 'weapon of destruction'. These can take many forms, such as poisoning wells, occupying or destroying dams. Finally, he refers to a '**war for water**', as a competition for the resource, which he sees as a potential in the years to come, given the increasing security of the resource.

[18] In his *Essay on the Principle of Population* (1798), Robert Thomas Malthus noted an asymmetry between demographic dynamics and the production of resources, since 'population progresses faster than subsistence', generating a 'growing imbalance'. He argued that population develops geometrically, i.e. exponentially, while resources increase arithmetically, i.e. linearly.

Many discourses refer to water wars as a growing possibility in the context of climate change and increasing global water stress (World Economic Forum, 2018)[19]. These mainly concern transboundary waters whose shared nature creates challenges, as water that belongs to one upstream state becomes the property of another state as it crosses the border (Csefalvayova, 2014). This mobility of water calls into question notions of state sovereignty, and facilitates sometimes bellicose rhetoric (Lasserre, 2007)[20]. While water wars seem to be particularly predominant in the analysis of the intersection between conflict and water, **many researchers offer a less alarmist narrative**. In the 1990s, **Aaron Wolf was already denouncing the lack of empirical evidence** for the growing trend towards water wars (Wolf, 2001)[21]. Others stress that **the determining variable in water conflicts is the social perception of scarcity**, rather than the objective scarcity of the resource. Experienced scarcity' is said to determine a society's 'social capacity to adapt', i.e. its ability to cope with a change in the availability of the resource (Lasserre, 2007, p.113). Discourses on the water war sometimes underestimate **the key role of cooperation processes**, such as the EU's Water Framework Directive (WFD), in de-escalating or mediating conflicts[22]. The dispute between Hungary and Slovakia over the Gabčíkovo-Nagymaros dam on the Danube was resolved through mediation by the International Court of Justice (1993), and the countries' accession to the EU (Jansky et al., 2004). Finally, more holistic analyses suggest that water is generally not the trigger, but rather an aggravating factor in an already deteriorating security context. By taking other social, cultural and economic factors into account, we can understand that **water is a multiplier of tensions rather than a cause of conflict** (Taithe, 2024)[23].

On the other hand, water seems to be **instrumentalised in warfare, used as a weapon, as 'an object to attack', or as a target, as 'an object to be attacked'** (Larché, 2024, p.172). The notion of 'war against water' developed by Franck Galland (2021) underlines this tactical and particularly belligerent value of water. In the context of climate change, the militarisation of water is even more threatening because the water situation in certain regions is already sensitive. Furthermore, in a context where the use of unconventional warfare techniques is increasingly common, it is important to stress that military strategies that include water could become more common in military tactics. Water can be used for defensive as well as offensive purposes, such as targeting

[19] A study by the EU's Joint Research Centre (JRC) identified potential global 'hot spots' using a tool to help detect areas at high risk of hydropolitical conflict (Farinosi et al. 2018).
[20] The Tagus, for example, has been a source of tension between Spain and Portugal, since its diversion in 1933 in favour of certain Spanish regions for their agricultural development, such as the Huerta, affected Portuguese river flow (La Croix, 2018).
[21] Aaron Wolf's study on water wars analyses more than 1,800 interactions around international river basins between 1948 and 1999, and reveals that countries cooperate far more often than they confront each other. According to his data, 67% of these interactions are cooperative in nature and only 28% are conflictual, with less than 1% leading to violent tensions. Wolf concludes that water resources, rather than leading to war, encourage diplomacy and collaboration even between countries in conflict (Wolf, 2001).
[22] In response to the security risks associated with Europe's many cross-border river basins (the Rhine, the Meuse, the Sambre, the Scheldt, the Rhône, etc.), the EU has developed a common approach to water management, the Water Framework Directive. The 2000 Water Framework Directive is the EU's main legal tool for protecting water and demonstrates the crucial role of political agreements in preventing cross-border tensions.
[23] In Kenya, clashes between pastoral communities around Lake Turkana, some of them fatal, are often attributed to a desire to monopolise water resources (Akari, 2017). However, other researchers have pointed out that the clashes may be caused more by cattle raiding between communities, often located near water points (Wymeersh, 1993). Thus, despite the presence of victims near water points, a more holistic analysis suggests that water is not the trigger, but rather an indirect cause of the conflict (Taithe, 2024).

dams, deliberate sabotage, poisoning water sources, flooding or threatening restricted access to the resource. **The contemporary military use of water and water stress seems to prioritise the targeting of hydraulic infrastructures**, such as hydroelectric dams, desalination plants and storage reservoirs (Lamballe, 2020). The direct and indirect consequences of destroying such infrastructure are numerous. An attack on a dam and the associated destruction can be deeply traumatic for the local population (Larché, 2024). There are also significant health risks, including the spread of certain diseases, and risks of food insecurity. There is also a considerable risk of soil or river pollution caused by flooding. **Many legal developments took place after the Second World War to deal with such risks.** Marion Larché (2024) highlights the emergence of several international humanitarian law treaties that consider water as a source of inter-state conflict as well as a weapon or target of war. The aim of these treaties is to ensure access to water for all populations and to recognise access to this resource as a fundamental right (Larché, 2024). In particular, the Geneva Conventions of 1949 prohibit the use of water as a weapon (Lamballe, 2020). In 1977, protocols also prohibited 'attacking, destroying, removing or rendering useless' objects essential to the survival of the civilian population (Larché, 2024). In theory, therefore, water infrastructures benefit from protection in the context of armed conflict. However, although this right has been violated on several occasions during contemporary conflicts, such as in Ukraine and the Middle East, **the absence of inter-state wars between the countries of southern Europe seems to prevent the use of water as a weapon or target of war for the time being.**

The destruction of the Ukrainian Kakhovka hydroelectric dam on 6 June 2023

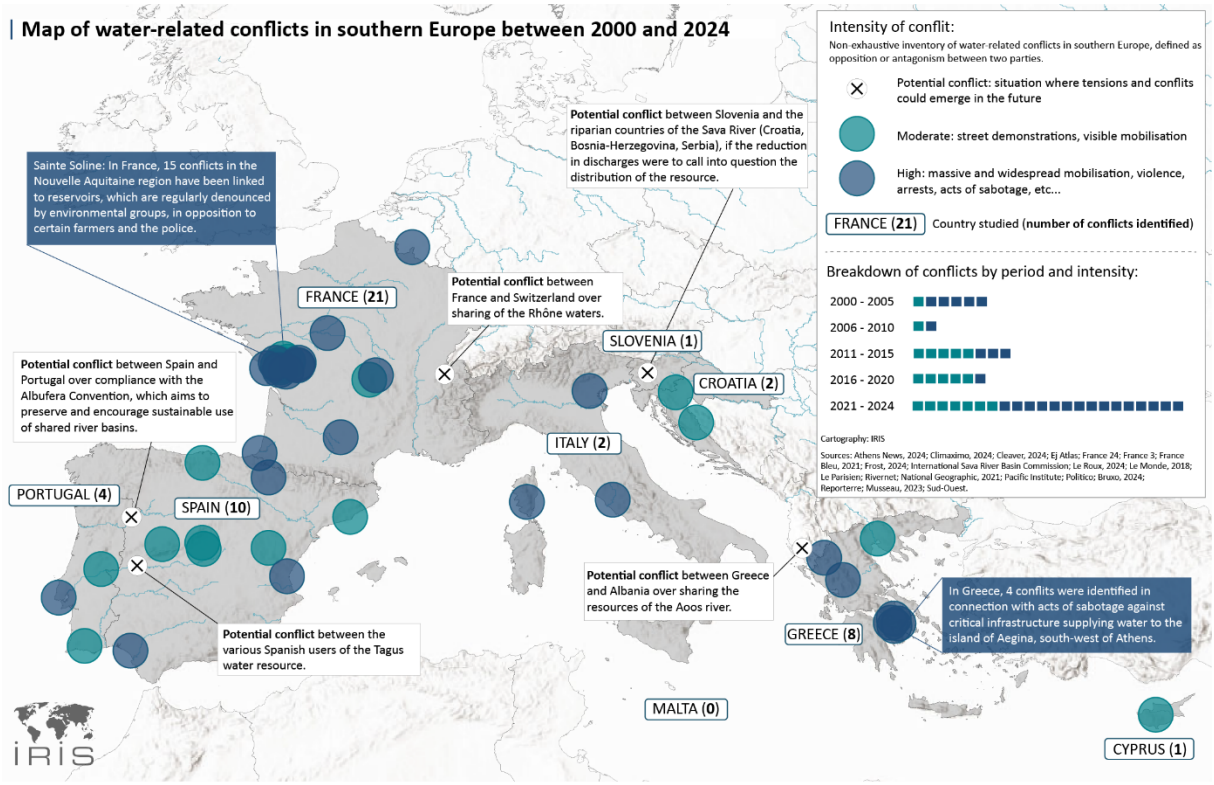
Russia's invasion of Ukraine, which began on 24 February 2022, illustrates how water can be used as an instrument of conflict. On 6 June 2023, the destruction of the Kakhovka hydroelectric dam caused catastrophic flooding, as the 18 km^3 of water contained in the reservoir spilled over dozens of villages in the Kherson region. 620km^2 of land was covered and 17,000 people forced to evacuate the area. Shortly after the dam was destroyed, Ukrainian President Volodymyr Zelensky accused Russia of being responsible and called a meeting of his security council, where he described the destruction of the dam as a 'war crime' (Bourdillon, 2023).

The destruction of the dam had many consequences. **Militarily**, it would appear that the dam exploded a few hours after the start of a Ukrainian counter-offensive in the Donbass (Bourdillon, 2023). **Economically**, UNESCO has estimated the cost of the impact on culture, education and the environment at over 485 million dollars (UNESCO, 2024). **From a health point of view**, the impact of the explosion on the region's drinking water supply has generated a risk of water shortages and contamination (WHO, 2023). Finally, **in ecological terms**, the destruction of the dam has been described as an 'environmental disaster', or 'ecocide', because of its disastrous consequences for the local flora and fauna. The deterioration in water quality, due in particular to pollution from agrochemical waste, was also denounced by the associations (Chauvin, 2023). This event highlights the 'water military strategy' and the destructive capacities of water, used as a weapon of war (Larché, 2024, p. 172).

Therefore, after having analysed the inter-state risks linked to water, it would be appropriate to adopt a less State-centred perception to highlight other players, such as communities and local authorities, and other potential conflicts, more local in nature, which are dealt with in the following section.

2. Analysis of the map of water-related conflicts in southern Europe

Despite the absence of inter-state conflicts over water in southern Europe, the Defence and Climate Observatory has noted an increase in the number of conflicts over water use at local level. The Observatory has identified **45 water-related conflicts in the nine countries studied in this report over the period 2000-2024** (see map). This open-source data is not exhaustive, but it does enable us to identify trends, in particular **the increase in the number and intensity of these conflicts since 2021**. These are mainly conflicts between users concerning the appropriation, management or use of water. These conflicts of use are frequent in France and, to a lesser extent, in Spain, Portugal and Greece. They are localised and often of moderate or high intensity[24]. There have also been acts of sabotage of water-related infrastructure or direct contamination of water in Italy and Greece, the causes of which are difficult to analyse, but which can aggravate certain conflicts.



Peaceful agricultural protests for better access to water and against rationing policies are regularly organised in countries where agriculture is an important part of the national economy and where droughts are particularly intense. In early 2023, Spanish farmers demonstrated against the lowering of the extraction threshold for the river Tagus, which would have reduced the amount of water available

[24] The criteria for the level of conflict intensity (medium or high) are based on the World Atlas for Environmental Justice. The medium level of conflict intensity involves boycotting official procedures or non-participation in official processes, community-based participatory research, the creation of alternative reports, the development of a collective network, the drafting of alternative proposals, and even referendums and other local consultations. The level of intensity is high when there are land occupation actions, sabotage, property damage or arson.

for irrigation (Fernández & Wilson, 2023, 11 January). In early 2024, Portuguese farmers demonstrated to demand that more water be allocated to farmland in the face of intensifying droughts (Bruxo, 2024, 8 March). In July 2024, Cypriot farmers demonstrated against water restrictions linked to the water shortage affecting the island, demanding that more water be allocated to farmland (Cleaver, 2024, 16 July).

The second trend observed is the opposition of environmentalists to water-related infrastructure construction projects such as dams, water transfers and reservoirs, which are considered unsustainable and associated with resource grabbing policies. They also denounce policies that favour projects that do not guarantee responsible water management. These environmentalist opposition movements have a wide range of collective actions at their disposal, including so-called conventional actions such as the mobilisations organised in Croatia in August 2024 against the construction of a hydroelectric power station near the source of the Una River, which led to the project being halted (Frost, 2024). Activists are also adopting more radical forms of mobilisation, such as occupying land or sabotaging illegal wells, like the actions of the *Climate Rebellion Hueva* group in Spain in 2023 (Zimmermann & Weise, 2023).

In **Portugal** and **Spain**, dams and attempts to transfer water seem to be at the heart of conflicts over water resources. The management of water resources and rivers shared by the two countries is also governed by the Albufeira Convention, signed in 1998, which aims to preserve and encourage the sustainable use of several shared river basins (Miño, Limia, Duero, Tagus and Guadiana). Spain is upstream of most of these rivers, leaving Portugal largely dependent on its neighbour (Bukowski, 2011). Political tensions arise when Spain fails to supply the agreed amount of water to Portugal, as in 2019 due to a leak in a Spanish dam (Matias & Gusmão, 2019), or in 2022 due to the extreme drought that affected Spanish reservoirs (Matias & Gusmão, 2022). These events have been reported at European level, illustrating the trust placed in European institutions to address water governance issues, as mentioned above.

Spain has the highest concentration of dams in Europe, which are used to power Spanish agriculture. However, they are often criticised for their negative impact on the environment and aquatic ecosystems[25]. These protests can be met with heavy police repression, as in October 2012 in Aragon, during a gathering of environmentalists and residents of the town of Artieda, who were facing the expropriation of their land because of an increase in the size of a water reservoir (Asociación Río Aragón, 2012).

Conflicts with a high level of violence are mainly recorded in France (20 violent conflicts, i.e. 45% of conflicts recorded) **and Greece.** There are two types of violence: **violence generated during**

[25] Obstacles to the flow of water, such as weirs and dams, modify flow conditions, leading to the partial blocking of the sediment load in transit in watercourses. The increase in stagnant zones also encourages the establishment of invasive exotic species, which threaten ecosystems. Structures also restrict the fish migration necessary for the life cycle of many species, leading to a reduction in the diversity of aquatic flora and fauna (Michelet, 2017).

environmental protests, which accounts for most violent conflicts[26], and violence targeting water infrastructure. Despite the increase in forms of mobilisation associated with civil disobedience[27] among French and European environmental activists (UNECE, 2024), most environmental demonstrations in Europe are peaceful and non-violent (Mijatović[28], 2023, 2 June). However, almost every rally opposing water-related construction between 2000 and 2024 resulted in arrests and injuries on the part of the demonstrators and injuries on the part of the forces of law and order. Thus, the violence identified in water-related conflicts in France stems mainly from **confrontations between demonstrators, sometimes from radical groups, and the police.** The police response to these demonstrations can be described as violent, in terms of both numbers and resources (mobilisation of the mobile gendarmerie, use of tear gas, dismantling grenades, truncheons, defensive bullet launchers (LBD) and surveillance helicopters). The climax of these water-related conflicts occurred in March 2014, when Rémi Fraisse, a 21-year-old environmental activist, was killed by the explosion of a grenade during a demonstration against the Sivens dam project (Le Monde, 2021, 25 November). The conflicts attracting the most attention and violence are those linked to **water reservoirs** in the Nouvelle-Aquitaine region between 2000 and 2024. Of the 20 conflicts identified in France, 15 were linked to these reservoirs. In March 2023, 3,200 law enforcement personnel were sent to oversee demonstrations against the Sainte-Soline megabasin project, which brought together around 6,000 demonstrators according to the police and 30,000 according to the organisers. The clashes resulted in 200 injured demonstrators and 46 injured police (Barroux, 2023). More research is needed to understand this level of violence at national level, in comparison with other European countries.

[26] This note does not provide an in-depth analysis of the causes of this violence. For more information on this subject, see Porchon, D. (2023, 16 November). A quoi sert la violence des mouvements écologistes ? Le rituel de l'écodésordre, entre spectacle et espoir d'un nouveau monde. *The Conversation*. https://theconversation.com/a-quoi-sert-la-violence-des-mouvements-ecologistes-le-rituel-de-lecodesordre-entre-spectacle-et-espoir-dun-nouveau-monde-217934

[27] According to the encyclopaedia Universalis, 'civil disobedience occurs when citizens, motivated by ethical motives, deliberately transgress a law in force in a public, concerted and non-violent manner, in order to exert pressure to have the legislator repeal or amend the law (direct civil disobedience) or to change a political decision taken by the executive (indirect civil disobedience)' (Mellon, n.d.).

[28] Dunja Mijatović was Council of Europe Commissioner for Human Rights between 2018 and 2023.

Irrigation basins in France: conflict of use and monopolisation of the resource

Conflicts over reservoirs in France, particularly in the Nouvelle Aquitaine region, are linked to the construction and use of water reserves for the agricultural sector. Their purpose is to store large quantities of water during periods of abundance (the rainy seasons) so that it can be reused later for agricultural irrigation during periods of summer drought. They can store up to 650,000 cubic metres of water, the equivalent of 260 Olympic swimming pools (Sauvage, 2022). The average surface area of a reservoir is 8 hectares and can reach 18 hectares for certain megabasins (Poirier, 2024). The significant volume of water therefore means that the basins need to be filled with rainwater, and by pumping groundwater or diverting surface water from catchment areas (Poirier, 2024).

Although they are discussed at local, regional and national level, decisions concerning their construction and management are often politically sensitive. Indeed, the construction of megabasins can have harmful effects on the environment, including the modification of local ecosystems, the impoverishment of soils, and the disruption of watercourses, which would exacerbate drought episodes. Water evaporation is also an issue, as it is higher in open expanses than in underground aquifers. However, estimates vary widely (from 4% to 60% according to estimates made by the Fédération nationale des syndicats exploitants agricoles (FNSEA) or by researchers (Romain & Jullien, 2022). Some argue in favour of more sustainable alternatives, such as more rational water management, the reuse of wastewater or the optimisation of farming practices, particularly with a view to reducing consumption. Others point out that this irrigation model, linked to an intensive agricultural model, would favour agribusiness, to the detriment of smaller farmers who are trying to make the transition to more sustainable agriculture.

Local disagreements over these reservoirs have been going on for some twenty years, but have intensified in recent years, with demonstrations pitting protesters against the forces of law and order. The reservoirs have become a symbol of the wider protest by environmental activists, scientists and some farmers against a liberal agricultural system.

For instance, in February 2024, Michel Frost, the United Nations Special Rapporteur on Environmental Defenders, expressed **concern about the increasing repression and criminalisation of peaceful civil disobedience in Europe** (UNECE, 2024). These actions (occupation of construction sites, slow marches, road blockades, etc.), although likely to disrupt the public space, are often described as anti-democratic or violent by the authorities and certain media, leading to increased repression, particularly in France, where Forst denounces police violence, harassment, criminalisation and abusive sentences against environmental activists.

After France, **Greece** is the second country in which water-related conflicts show a high level of violence: 6 out of the 7 conflicts recorded by the Observatory in the country. Environmental protests took place in Greece in 2010 and 2012, with various forms of action including eco-campsites, festivals and concerts. However, the Observatory has identified four highly violent conflicts involving **acts of sabotage**. Between 2020 and 2024, four acts of sabotage were carried out on an underwater *pipeline* that supplies water to the island of Aegina, around twenty kilometres from Athens. According to some official statements, these acts, which deprived the inhabitants of access to drinking water, could be linked to competition between private interests for the supply of water to the islands neighbouring

Athens (Tillman, 2022). Similarly, in **Italy**, the two conflicts recorded in the early 2000s resemble acts of sabotage or even terrorism. For example, in Padua in 2003, poisoned bottles were distributed in the area, potentially by anarchist groups calling for opposition to the 'water racket' (Le Monde, 2003). Finally, in **Malta and Slovenia**, the Observatory did not record any water-related conflicts over the period 2000-2024. However, in **Malta**, the actions of farmers and environmentalists highlight a lack of policies for adapting to climate change, although these initiatives are not specifically focused on water management.

Finally, **five potential conflicts have been identified by the Observatory**. The first is a potential conflict between Spain and Portugal over compliance with the Albufeira Convention (Salinas Palacios, 2024), followed by an internal conflict within Spain over competing uses of water from the Tagus (Cabot, 2023). The third potential dispute is between France and Switzerland over the sharing of the waters of the Rhône, most of which is in Swiss territory (Weise, 2024, 10 May). The fourth is between Greece and Albania over the sharing of the Aoos resource, and a final conflict could arise between Slovenia and the countries bordering the Sava basin, if the drastic reduction in water resources were to call into question the cooperation agreements in place. However, the common European governance agreements mentioned above prevent the escalation of these conflicts, which could therefore take the form of political tensions or local conflicts between users, rather than armed conflicts between states.

While most conflicts **in southern Europe can be described as violent, no conflict has required the involvement of European or French armed forces**[29]. Nevertheless, there are nuances and contexts specific to each country that influence the dynamics of water-related conflicts, which can be observed on a local scale.

[29] Gendarmes mobilised to maintain law and order come under the heading of internal security and are therefore not included in our analysis of armed forces.

PART 2

WATER STRESS CHALLENGES FOR MILITARY FORCES IN SOUTHERN EUROPE

A - The French armed forces' response to water stress

The integration of water-related issues by the French armed forces can be considered from two angles: on the one hand, **organisational adaptations on national territory or in its projection capabilities**, and, on the other hand, actions to share and preserve the resource, often through cooperation. **Resource management already appears to be highly structured in the conduct of overseas operations** and incorporates the principles of sobriety and autonomy inherent in the projection zones in which the French armed forces are used to operating (Lanic, 2024)**. On the national territory, the subject is in a structuring phase**, and if convincing examples already exist, a generalization of the good practices as well as their deepening must be carried out. It will also be necessary to examine the coherence of water-related actions, and in particular the appropriateness of projects in which the armed forces are involved, in the light of the objectives set by the Ministerial Water Strategy for 2030.

1. Organisational adaptations to water stress

A - National territory

The drafting of the Ministerial Strategy for Water to 2030 demonstrates a holistic vision of the water challenges. **It provides a solid basis on which to work, and the multi-dimensional approach adopted confirms a desire for transformation** that goes beyond the common pitfall of essentially securing the water supply, without questioning the possibilities of reducing or modifying uses[30]. This is borne out by the Ministry's objective of participating in the national effort to reduce water withdrawals by 10%[31], the implementation of desilting initiatives[32] and the systematic sharing of best practice and feedback from local projects (Ministry of Armed Forces, 2023, June). However, **the integration of a quantitative and qualitative analysis of water use and consumption** must be the first key step to map precisely the efforts that need to be made to reduce the vulnerability of the French armed forces to water scarcity. This analysis should not simply take the form of a current situation but should **incorporate climate scenarios** to build a long-term vision of changes in the state of the resource (Houalet & Charrier, 2024). Such an analysis could lead to a more precise determination of the Ministry's objectives in terms of reducing consumption, as well as the financial resources required to achieve these objectives.

Furthermore, **as climate change is already having an impact on the occurrence and scale of fires in France**, the armed forces **have chosen to transform their operational capabilities as part of an**

[30] The Ministerial Strategy for Water to 2030 is based on five objectives: knowledge and assessment of current consumption, securing needs and sober use, limiting the ecological footprint and exposure to extreme events, structuring ministerial governance, and strengthening cooperation with water stakeholders.
[31] The departmental strategy is in line with the government's Water Plan, but it does not present quantified reduction targets specific to the Ministry of Armed Forces.
[32] The Mont-de-Marsan air base, for example, has installed two rainwater retention and infiltration basins. Rainwater is collected, treated and then channelled into the basin to improve groundwater recharge. Other buildings on the base should be equipped with similar infrastructure in the future (Coraux, 2024).

adaptation process. The creation in 2024 of the 4th *Unité d'instruction et d'intervention de la sécurité civile* (UIISC) is evidence of this desire to integrate the transformation of the armed forces' missions in the face of the impact of climate change on the environment and water stress in particular (préfet de la zone de défense et de sécurité sud-ouest, 2024; De Guglielmo Weber et al., 2024).

B - Water in overseas operations[33]

Water management is essential to the success of military operations abroad. In particular, it must take into account the importance of sharing the resource with users in the vicinity of the deployment zone, as well as the supply of troops. For example, **the French army has been criticised for taking too much water from the groundwater during support operations in Chad.** French boreholes installed to supply troops were accused of depleting shallower local wells (Taithe, 2024)**. This risk was consequently incorporated into the strategy of the *Centre interarmées de concepts, de doctrines et d'expérimentations*** (CICDE), which stated that 'water management can have an impact on the conduct of the operation (...), particularly when the exploitation of the local resource is to the detriment of the needs of the population.' (Salva, 2020, p.13). This strategy proposes a complete water management protocol, including a preliminary analysis of the availability and quality of the resource, methods of withdrawal and treatment, and an assessment of the quantities and types of water allocated to the various uses[34].

Furthermore, **the exposure of water supply logistics is a crucial point of vigilance for armies** seeking to reduce their vulnerability and strengthen their strategic autonomy[35]. This vulnerability has been demonstrated on overseas operations, when the host government took the supply of an isolated outpost hostage (Lanic, 2024). Against a backdrop of increasing pressure on resources, armies are prioritising **a more reactive approach, adapted to the local characteristics of resources**, to reduce dependence on logistics flows (Galland, 2017)[36]. This desire for autonomy involves the acquisition by armies of equipment for treating, producing and conditioning drinking water, as well as the **development of systems for extracting atmospheric water** (Peeters et al., 2021). The United States is

[33] Although initially outside the initial geographical scope of the analysis, the wealth of lessons that can be learned from water management in EO to improve organisation on national territory led the authors to devote the following sub-section to it.

[34] In EO water management, the CICDE categorises the resource as follows:

- Resource water: taken from the natural environment and not treated in any way.
- Water intended for human consumption: used for food, personal hygiene and washing of premises used for housing, offices, care or catering.
- Swimming pool water: Artificial pools or swimming pools, depending on the infrastructure in place.
- Water reserved for technical uses: very large quantities, including the construction and maintenance of infrastructures; excreta disposal; washing of military equipment, etc.

These categories are then quantified, giving a total of 70l/h/d in the deployment phase and 110l/h/d in the stationing phase (Salva, 2020, p.13).

[35] See definition in the glossary.

[36] Mobile water treatment units (MWTUs) enable engineers to produce water during the deployment phase. However, their operating limits in the event of extreme temperatures and their limited mobility have led to them being replaced by Mobile Water Treatment Stations (MWTS). During the stationing phase, the SID takes charge of supplies thanks to its Treatment Units (UTE 400) capable of meeting the daily needs of 2,500 men.

particularly advanced in setting up such a process[37] (DARPA, 2020). Another example of the French armed forces taking account of water-related issues in theatres of operation is **the 'Eco-Camp 2025' project**, **which aims to reduce the environmental footprint of projected bases** by installing infrastructure that uses less water and energy. An initial accommodation building has been deployed by the planned Niamey air base (Niger) in 2022, with a capacity of 336 beds (SGA, 2022). Other modules have already been deployed, such as the *EcoSan* sanitary facilities used in Romania during Operation Eagle (EMA & SID, 2024). Although water management in overseas operations already incorporates the challenges of reducing consumption, it seems that **these good practices are not being shared with facilities on national territory**.

2. The French armed forces: a proactive partner for water sharing and preservation

The French armed forces provide significant support to water stakeholders throughout the country and are **working to share and preserve water resources**. In the first case, the installation of a borehole by the *Escadre Aérienne d'Appui aux Opérations* (EAAO) at the Mérignac air base to meet the needs of an agroecological[38] market gardening project is an interesting example, enabling the EAAO to train and develop its skills in a type of technical manoeuvre (Lanic, 2024). At the same time, the project benefits an agricultural project that integrates the logic of sobriety in the use of water (Galiacy, 2024). On the other hand, examples such as these **cannot be generalised without threatening to increase pressure on the resource**, particularly if the aim is to support less water-efficient practices.

In addition to this example of joint use of an aquifer, the cooperative preservation of the resource by the French armed forces takes various forms: **investment in infrastructure, efficient management of land holdings, or collaboration with environmental protection bodies**. The connection of the Cazaux air base to the wastewater treatment plant of the neighbouring communes and the investments made as a result are part of a rationalisation of infrastructures (Syndicat intercommunal du Bassin d'Arcachon, n.d.). Some initiatives, which predate the implementation of the Ministry's Water Strategy, have also led to significant savings, as demonstrated by **the refurbishment of the water network at the 118 air base in Mont-de-Marsan.** Initiated in 2016 and completed in 2023, **this renovation has reduced the base's consumption by 50%** (Coraux, 2024).

The protection of biodiversity undertaken by the Ministry of Armed Forces indirectly benefits water resources. For example, the LIFE NaturArmy programme, **which provides for an increase in the Ministry of Armed Forces' action in favour of biodiversity** on several pilot sites, is an extension of the

[37] The Defence Advances Research Project Agency *(*DARPA) has launched the *Atmospheric Water Extraction* programme to develop technologies for capturing drinking water from the air, even in dry climates. Five research contracts aim to create portable, lightweight, low-energy systems using *Metal Organic Frameworks*. These systems should be suitable for mobility, provide water for an individual soldier in a combat situation and be able to meet the needs of 150 people for wider missions.
[38] See definition in the glossary.

experiment conducted by the *LIFE Défense nature 2Mil* programme. The Ministry regularly carries out development work for the operational preparation of the armed forces. As such, it must avoid, reduce and sometimes compensate for its own developments on military land, an obligation imposed by Natura 2000 environmental regulations. **One example of this is the partnership set up with the *Conservatoire d'Espaces Naturels de Nouvelle-Aquitaine* in 2011**. The Conservatoire provides technical assistance for the restoration of the riparian forest[39] and for the implementation of the hydraulic management plan for Cazaux air base 120 (Ministry of Armed Forces, n.d.).

Finally, the Canjuers training camp is a convincing case study, demonstrating a **dual logic of conservation and resource sharing**. Its geographical location and the already tangible consequences of climate change on the region's water resources partly explain why it has been so proactive in terms of water management[40] (Bonnin, 2024). The drought of 2022 caused critical water shortages in many French municipalities, necessitating emergency measures to ensure water supplies (Mittelberger et al., 2024). The Var department was placed under drought alert on[1] April 2022 (Préfet du Var, 2022), and local authorities such as those of the *Dracénie Provence Verdon agglomération* (DPVa) had to be supplied by military tankers. To overcome these difficulties, a more sustainable supply system has been put in place thanks to the proximity of the Canjuers military camp, enabling six communes in the Haut-Var to be connected to the camp's borehole. **The creation of a new borehole** to supply the networks of the DPVa conurbation has also been approved (Ministry of Armed Forces, 2024). **However, such decisions are not without consequences, since they lead to restrictions on activities around the extraction zone located on the training camp** (Butrulle & Desenclos, 2024). The camp is also committed to participating in discussions on preserving water resources, as an active member of the local water commission of the Verdon Regional Nature Park (PNR). **The representation of the armed forces on the local water commissions,** as well as the monitoring of hydrogeological studies conducted by the local water agency in coordination with the PNR, attest to the fact that the issues at stake for the long-term future of the camp have been considered (Butrulle & Desenclos, 2024).

In conclusion, **the integration of water-related issues in the French armed forces shows significant disparities between the national territory and overseas operations**. The Ministerial Water Strategy shows that the challenges of preserving this resource are increasingly being considered at national level and address the various aspects of more effective management. Nevertheless, its implementation remains a considerable challenge, and the fact that it was adopted so recently makes it impossible to assess the results. However, **the dynamics that predate its adoption do exist**, creating disparities in the degree of progress made towards good resource management and awareness of the challenges ahead. Furthermore, **in crisis situations, the armed forces can play a key role in sharing**

[39] See definition in the glossary
[40] The Var department already suffers from very high temperatures, fires and extreme rainfall, and is vulnerable to the retreat of the coastline. In addition, the Canjuers camp lies at the heart of a major karstic groundwater network, giving it a key role for the region (Butrulle & Desenclos, 2024).

the resource with other users. However, the impact of climate change on water availability raises **questions about the sustainability of certain initiatives.** The exploitation of new aquifers through the creation of boreholes could, if these practices become widespread, worsen the situation in the long term. Moreover, this capacity remains fragile, as it depends on specific and complex skills (Lanic, 2024). The main areas for improvement therefore lie in **strategic autonomy and increasing sharing of feedback** on water management with national infrastructures.

B - Operational challenges for military forces

Operational issues for the armed forces represent **all the challenges, priorities and objectives linked to the execution of their military missions**. These concern their ability to plan, organise and conduct operations in the field, in times of peace, crisis or war. The operational consequences of water stress include an analysis of the vulnerability of facilities, the impact on training and operational conditions, and the need for more effective governance and crisis management to maintain the operational capabilities of armed forces.

1. Impacts of water stress on military infrastructures

Firstly, the issue of **base supplies** needs to be analysed. The conclusions of the various studies carried out in France highlight **the dilapidated state of the water supply networks, which is a major point of vulnerability for the armed forces** (Haury & Descoeur, 2024). Upgrading the infrastructure is an important first step towards saving resources (Haury & Descoeur, 2024). In addition, changes in rainfall patterns **risk exposing right-of-way networks to the phenomenon of clay shrinkage and swelling**, thereby worsening their condition (Ministère de l'Écologie, du Développement et de l'Aménagement durable, 2008). **By reducing their water consumption on their bases, the armed forces are limiting their exposure to the risk of water shortages**.

A **detailed quantitative and qualitative study of water consumption on military facilities would provide an overview of the scope for optimising** and adapting the different types of water to the associated uses. This study should also make it possible to define back-up options in the event of a crisis. CICDE's overseas operations water management strategy could serve as an example to be replicated in the various military establishments. A detailed analysis of needs and the use of water of different qualities (technical water, swimming pool water, grey water, water intended for human consumption[41], etc.) could make it possible to reduce the use of drinking water in a facility to what is strictly necessary (Salva, 2020). **The ability to assess the level of resilience** of different types of infrastructure, and the existence of emergency action strategies to deal with increasingly frequent and

[41] See definition in the glossary.

intense situations of water stress, are crucial issues (Ministry of Armed Forces, 2023, June; Smith et al., 2022).

It is also worth emphasising the need to **limit the vulnerability of military facilities regarding the water cycle**, particularly from the point of view of run-off and infiltration into the soil. With climate change leading to an increasing risk of extreme rainfall events, strategies to reduce soil sealing are a way of increasing the efficiency of rainfall[42] (Mittelberger et al., 2024), but above all reducing the risk of flooding. **Some sites are already reporting damage, minor, admittedly, but recurrent in the event of heavy rain**, to buildings that are paradoxically recent. The construction of certain military buildings requires special skills, and in some cases, subcontracting such projects exposes them more to the vagaries of the weather (Coraux, 2024). **The development of solutions based on ecosystem services[43] seems particularly relevant** (Haury & Descoeur, 2024), as does the pursuit of numerous initiatives undertaken by the Ministry of Armed Forces which, as manager of the State's largest property portfolio, is a key player in these issues (*see above*: EX Life, restoration of wetlands, etc.).

There are also cross-cutting issues throughout the region, the most important of which is the risk of fire, which has been greatly accentuated by climate change (Fargeon et al., 2020). **Between now and 2060, the risk of fire reaching its maximum level could affect the whole of France on between 10 and 20 days a year**, and this figure could rise to **100 days in the Mediterranean region** (Haury & Descoeur, 2024). The consequences of such episodes on the ability of armies to maintain an identical volume of training are undeniable, and the impact of forest fires is already affecting the preparatory activities of armies. Indeed, this risk already has operational implications, as in the case of Operation Hephaestus. In Nouméa, for example, mortar fires are banned during certain periods because of the risk of fires breaking out (Taithe, 2024). The case of the fire that consumed more than 450 hectares following firing exercises at the Captieux range in the summer of 2020 is also a convincing example of the risks that water stress is likely to accentuate (Ouest France, 2020). **Changes in operational conditions linked to water stress can also pose a threat to the proper functioning of military equipment**. In the years to come, **vehicles, aircraft and weapon systems will have to cope with harsher climates**: extreme temperatures, increased rainfall, high humidity, more intense sandstorms, all of which are likely to affect their operation. The intensification of water evaporation is also likely to increase the risk of icing for drones and certain aircraft (Ministry of Armed Forces, 2023). It is therefore essential for armed forces to be able to **assess the impact of climate phenomena (drought, flooding, salinisation, etc.) on the operation and wear and tear of military equipment**.

[42] See the definition in the glossary
[43] See the definition in the glossary

Risk and governance mapping: assessing the physical and normative vulnerabilities of armed forces

Water availability in mainland France varies greatly from region to region. Climate models predict an increase in winter rainfall of up to 45% in the North Ministry for Ecological Transition and Territorial Cohesion, 2024). Conversely, the Mediterranean region appears to be highly vulnerable to water stress and extreme drought (Tramblay et al., 2020). However, **these models are subject to considerable uncertainty when scaled down** (Dumas et al., 2013). This makes it more difficult to adapt military sites to a variety of potential scenarios. Despite this, tools are emerging to assess the physical and economic impacts of water-related risks. The ***Caisse Centrale de Réassurance*** **has developed a flood risk map based on a cross-reference between historical data and a probabilistic projection model** (Onfroy & Orlhac, 2020). Similar approaches should be encouraged for the Ministry's property holdings, whether in terms of flood or drought risks (Ministry of Armed Forces, 2024).

It **is also crucial to ensure that the Ministry is systematically represented on the decision-making bodies of the regions in which it is based**. These bodies are organised by catchment area and sub-catchment area, under the supervision of the regional and departmental prefects, with the support of the 'Water Resources' committees. The catchment areas correspond to the catchment areas around the main French rivers and are governed by *Schémas directeurs d'aménagement et de gestion des eaux* (SDAGE). These are then divided into sub-catchment areas, and each SDAGE is then broken down into a *Schéma d'aménagement et de gestion des eaux* (SAGE). Bringing together local stakeholders, these committees provide a framework for local consultation, particularly during periods of low water (see definition in the glossary). The regional prefects set minimum measures for each basin in the event of water pressure, which the departmental prefects adapt to the sub-basins via a multi-year framework decree to anticipate droughts.

In the event of drought, restriction orders are issued in accordance with these measures (Ministry for Ecological Transition and Territorial Cohesion, 2023). In addition to the ministry being represented in these discussion plans, it would also be important to ensure that the armed forces are included in departmental civil security arrangements relating to the supply of drinking water in crisis situations (Witkowski & Vallet, 2017). The same applies to the potential legal liability of military facilities in the event of an incident on water network infrastructures placed under the responsibility of the Ministry (Ministerial Order of 5 August 2024).

2. Water stress and the use of forces: ensuring the health and missions of the armed forces

A - The consequences of water stress on the health and capabilities of soldiers

The health of military personnel may be affected by water stress. The risk of bacteriological development and/or eutrophication in the infrastructures used to extract, treat and store drinkable water is increasing in the context of increasing scarcity of resources (Houalet & Charrier, 2024). **A quality supply is just as crucial as an adequate available volume**, and failure to meet either of these two imperatives would expose the armed forces to health risks and reduced performance[44]. **A rate of**

[44] In French Guiana, the French military face significant water stress. The volume of water required is secured through large volumes of bottled water, which compensate for the small quantities available locally. On the other hand, the quality of the

dehydration of 4 to 5% of individual weight can lead to a reduction in physical and cognitive capacity of up to 50% (Savytskyi & Kazmirchuk, 2021). Here again, the structuring of protocols for analysing resource availability and infrastructure sizing, as well as the qualitative and quantitative reassessment integrated into the overseas operations water management strategy, serve as examples to be followed for military bases (Salva, 2020). **Water consumption in military hospitals is also a major issue in France, because it is used for so many purposes** (food, standard care, haemodialysis, hygiene, cleaning, etc.). As these are connected to the public water supply network, it seems crucial to be able to quantify the volumes of water consumed by these facilities (Rozborski et al., 2024). In terms of risk management, **specific measures are put in place within military hospitals** to prevent any accidental pollution of the establishment's network. The procedures for maintenance, water treatment and disinfection of the facilities are known and controlled. In addition, rainwater and wastewater networks are separated and regularly inspected (Rozborski et al., 2024).

B - Training and deployment of military forces in the face of water stress

Water stress also raises operational issues relating to the use of forces, and the complexity of resolving them sometimes lies in the contradiction between some of them. The **training of military personnel is a major dilemma in this respect**. The necessary coherence between exercise conditions and troop deployment implies, in the context of climate change, **exposure to an environment which will be physiologically increasingly hostile** (Rozborski et al., 2024). But such exposure to extreme weather conditions requires a redefinition of water requirements (Salamanca, 2018). In a 'very hot' environment, **these can increase by 10 to 30 litres per person per day for water intended for human consumption alone** (Savytskyi & Kazmirchuk, 2021; Salva, 2020). The consequences of climate change on temperatures and water availability therefore lead to a complex situation: in some cases, it will be necessary to rethink supply strategies, **reconciling a potential increase in needs with sometimes more difficult access to water of satisfactory quality**. This contradiction is even more important to resolve as water supply in overseas operations can sometimes represent a significant economic cost (Taithe, 2024). In 2019, the US army was devoting more than 30% of the funds dedicated to overseas operations to this purpose (Berthier & Mazzucchi, 2019). The equipment required is also substantial, as shown by the 40,000 litres of water transported daily to supply Operation Serval in Mali, the equivalent of 10 containers (Galland, 2017).

The question of **training military personnel in water resource issues** is also a point of attention. This would enable the armed forces to acquire greater strategic autonomy regarding this resource and to limit its impact. The information aspect can, in the same way as a better estimate of needs, involve,

water once it has been treated, in this case its very low mineral content, raises health issues, even more so in a context of very hot weather that can cause other health problems (Rozborski et al., 2024).

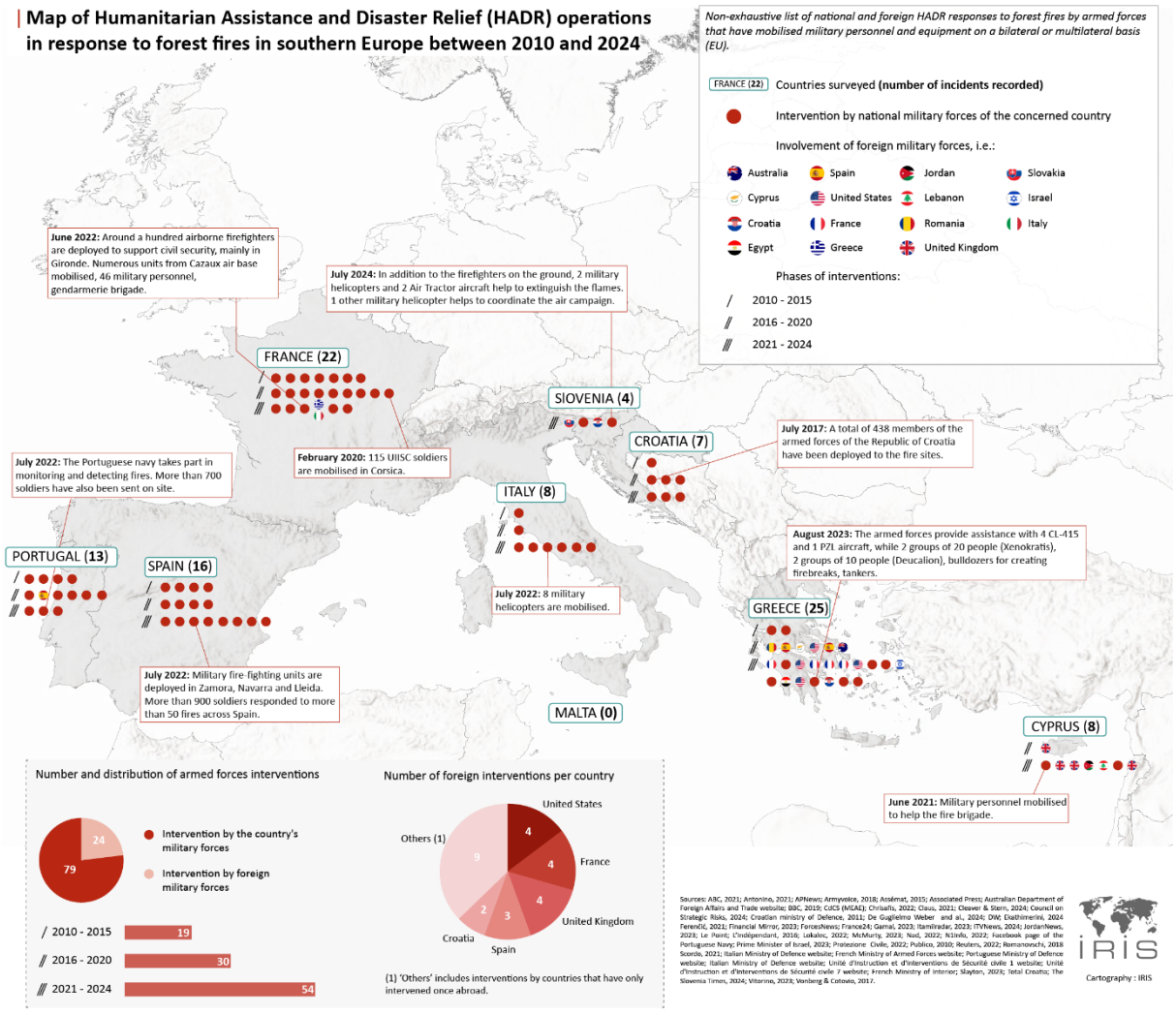
for example, the development of technological tools designed by and for military personnel[45] (Charkoudian et al., 2016).

C - The impact of water stress on humanitarian assistance and disaster relief operations (HADR) by the armed forces

The **missions of armies could also be affected by the disruption of the water cycle,** insofar as **the lack of water can intensify certain climate disasters that sometimes require an HADR operation from armies**. Extreme weather events are increasing in frequency and intensity (Rodell & Li, 2023), leading to greater demands on the armed forces (De Guglielmo Weber et al., 2024). Between 2007 and 2023, flooding was the type of climate disaster that most frequently required the mobilisation of the armed forces for HADR operations on French territory (37% of cases) and forest fires accounted for 15% of HADR operations by the French armed forces (De Guglielmo Weber et al., 2024). In Europe, **this increase can be illustrated by the rise in the number of armed forces interventions in response to forest fires**, as shown on the map.

Through open-source documentation, the Observatory identified 19 interventions from 9 European countries between 2010 and 2015, then 30 between 2016 and 2020 and finally 54 between 2021 and 2024 (count stopped in August 2024). This increase can be partly explained by the aridification of soils and vegetation, which facilitates the spread of forest fires and therefore requires more support from the armed forces to the civil security forces responsible for fighting fires. **These changes in the armed forces' missions have been anticipated, but there are still many areas for improvement**, as demonstrated by the May 2024 report from the Climate and Defence Observatory on the impact of climate change on the armed forces' emergency response to climate disasters.

[45] The US Army, for example, has conducted research into the development of an application enabling corps commanders and soldiers to quantify their individual and collective drinking water requirements according to variables that include weather conditions, the type of activity planned, and the clothing worn.



Cooperation on forest fire management in southern Europe (see map)

Cooperation between European armies is mainly illustrated by the involvement of certain States in HADR operations to support civil security and military forces. At European level, these HADR operations are most often carried out within the framework of the **European Union's Civil Protection Mechanism**, created in 2001. The aim of this instrument is to strengthen civil protection cooperation between EU countries and 10 other Member States participating in the Mechanism, with a view to improving disaster prevention, preparedness and response.

The map presented in this note illustrates these forms of military cooperation, and **the projection and support capabilities of armies specifically in the fight against forest fires**. France and Spain have intervened 3 and 4 times respectively abroad: in Portugal only for Spain, and in Greece for both countries. This demonstrates the high projection capability of the armed forces. **The capacity of individual countries to manage disasters varies** according to the number of foreign interventions on their territory. Some countries, such as Croatia, Italy and Spain, **appear to be more independent than others**, in that no external intervention has been recorded on their territory since 2010 to fight forest fires. Portugal and France are also very independent, having rarely needed help. Yet these countries are among those most affected by forest fires in Europe, particularly Spain, Portugal and Italy, which are the three countries that have suffered the most destruction on average in the EU between 2006 and 2022 (Statista, 2023, June).

Our hypothesis is that these countries are used to responding to this type of disaster and have developed the skills of their civil security forces and created specific military support units (as in France and Spain), enabling them to support their allies. Conversely, the forest fires in Slovenia, but above all in Cyprus and Greece, required emergency assistance from several countries, some of them outside the EU. Of the 25 military interventions recorded by the Observatory in Greece between 2010 and 2024, only 8 were carried out by the Greek army. Countries such as the United States, the United Kingdom, France and Spain regularly provide support to Greece, whose emergency response capabilities are potentially undersized given the scale of the forest fires ravaging the country. Cyprus, which is home to one of the largest British military sites outside the UK, regularly calls on the British army to help deal with forest fires. Countries on the eastern and southern shores of the Mediterranean, such as Egypt, Lebanon, Jordan and Israel, have also come to their aid. **States that are both vulnerable in terms of climate and limited in their disaster response resources may be forced to accept the presence of foreign military resources, a vulnerability that is likely to increase with climate change** (De Guglielmo Weber et al., 2024).

In conclusion, the difficulty of implementing efficient water management in a context of water stress is twofold. Firstly, **the scarcity of the resource is increasing independently of water management policies**, as the effects of climate change become more tangible. Secondly, the cyclical nature of water resources means that **implementing a strategy in a given area will have consequences beyond the areas and players involved**. While it is clear from the Ministerial Water Strategy that water is now considered a national issue, the diversity of players involved in water resources and climate projections across the country pose major challenges for the Ministry of Armed Forces. To understand how European Mediterranean countries facing similar climate pressures are coping with the challenges of water stress, it is now necessary to assess how the increasing scarcity of water is being considered within the armies of these countries.

C - Managing water stress in European armies

1. Different approaches to water management within European armies

To put water management by French armies into perspective, this section offers an **analysis of how armies in southern European countries take these issues into account**. This analysis is based on open-source documents and must be treated with caution: certain initiatives may exist but have not been identified during our research, thereby altering certain conclusions. Two major trends seem to be emerging within European armies regarding water management. On the one hand, an in-depth analysis of the role of armies in the water cycle leads to **a desire to improve infrastructures and reduce consumption**. This is particularly the case in Italy, Spain and Portugal. On the other hand, **a less transformative dynamic based on a reactive policy** seems to characterise the approach adopted by Slovenia. Greece is a special case, as there is little information on water management within the army. Paradoxically, the Hellenic Republic 1) is in a critical situation regarding the availability of water

resources, and 2) has initiated promising and relatively avant-garde military cooperation on water management (*see below*).

A - Sobriety and cooperation for a better management

Water management is an integral part of Italian military strategy. The Defence Staff's Office for Prevention and Protection of the Environment reports 'numerous feasible interventions that allow significant water savings. The Office also states that such savings lead to energy gains, given 'the energy [required] to (...) heat [the water]' (Vecciarelli, 2019. p.16). **The Italian army is implementing a system to measure and monitor water consumption on its facilities**, and to make rational use of available water resources (Vecciarelli, 2019). One example of this is **the *Caserme Verdi* project,** which involves renovating around twenty dilapidated infrastructures to reduce their environmental footprint and water consumption (Stato Magiorre Esercito, 2019). This project is part of the transformation of the Italian army structured around the Defence Energy Strategy (Camera Dei Deputati, n.d.). Lastly, the Ministries of Defence and the Environment have been working together since 2015 to **ensure that there is no water contamination around firing ranges operated by the army** (Ministero della Difesa, 2023).

In 2023, Spain unveiled a global water strategy, emphasising the challenges for human security and the need for cooperation (Ministerio para la Transición Ecológica y el Reto Demográfico, 2023). As a major player in land management, the Spanish army is at the heart of these issues. For example, the Ministry of Defence, in collaboration with the Ministry of Ecological Transition, has drawn up a **plan for the prevention and remediation of contaminated land on military sites**, which includes issues relating to surface water and groundwater (Ministerio de Defensa & Ministerio para la transicion ecologica, 2021). In addition, the national security strategy mentions the risk posed to Spain by droughts and water shortages linked to climate change (Pérez-Castejon, 2021). **The BLET project**[46], the most advanced Ministry of Defence initiative, proposes the transformation of logistical support for the armed forces through resilient infrastructures based on self-consumption, the use of renewable energy and waste management. Specific proposals for water management on such infrastructures have been put forward concerning **drainage systems that encourage water infiltration into the soil**, as well as the use of rainwater (Lanceta Gutiérrez et al., 2024).

Like Spain, **Portugal is experiencing severe pressure on water resources**. In the field of defence, **water issues are integrated into the National Defence Strategy for Environment, Security and Climate Change (2023)**. Water is described as a factor with growing conflict potential, but also as **a resource on which the armed forces will be increasingly dependent** in extreme environmental conditions (Direção-Geral de Recursos da Defesa Nacional, 2023). **National Defence is committed to improving its water performance** on military platforms (infrastructure, equipment, vehicles and weapon

[46] *Base Logística del Ejército de Tierra*

systems), in particular through the assessment of its facilities by the European Commission's EMAS[47] tool, or the ECO.AP[48] barometer (Almeida et al., 2022; Eco.AP, n.d.). Ambitious objectives attest to the transformation of important practices such as pollution control or the reuse of treated wastewater, reaching up to 50% for certain bases. It should be stressed, however, that reusing wastewater is not a panacea for the contraction in the amount of water available (Ambiente em Portugal, 2024); **sobriety measures must go hand in hand with efficiency-based approaches** (Le Strat, 2023).

B - Techno-solutionism and reactive approaches to water disruptions

Slovenia's approach to dealing with water disruption differs from previous cases. Firstly, there does not appear to be a ministerial strategy specifically dedicated to climate change or water. However, the Minister of Defence has admitted in several interviews **that the armed forces will be increasingly affected by the consequences of changes in rainfall patterns** through the proliferation of natural disasters such as floods and fires (Ministry of Defence, 2022). It also mentions the importance of improving protection measures against droughts, floods and fires, through a logic of prevention-preparedness-response in the event of extreme phenomena (Republic of Slovenia, 2024a). However, for the time being, this approach seems to be limited to **an increase in capabilities** such as C-25J Spartan aircraft or night-time thermal drones (Republic of Slovenia, 2024b). Such a technocentric, capability-based approach was also applied in response to the severe flooding that hit the country in 2023, favouring artificial solutions over natural ones (Schüler, 2024).

The issue of water in Greece is crucial to the country's security, as demonstrated by the intensification of the droughts and fires ravaging the country. Even though the country has one of the highest levels of water availability per capita in the Mediterranean region, **there are major disparities between the West, which has plenty, and the East, which is very dry**, contributing to the country's vulnerability (Heggie, 2020). Structured around the integration of the WFD into national legislation, public water management policies in Greece are frequently updated, the most recent in September 2024. The Minister of Environment and Energy mentioned that 'regardless of the availability of water, [Greek] consumption must be autonomous' (GTP Headlines, 2024), mainly thanks to **the upgrading of networks and desalination plants**. The testing of a solar-powered version at the Strongili military base has also attracted the attention of the Greek authorities (Heggie, 2020). Paradoxically, **no document dealing strictly with the military seems to address this issue**. This is even more surprising given that Greece initiated the Smart Blue Water Camps military cooperation project back in 2016. Nevertheless, the Greek approach to water management seems to focus on securing the

[47] EMAS is an important tool in the European *Green Deal*. Its aim is to lead organisations towards circularity and reduce their impact on the environment. EMAS makes it possible to improve and regularly check an organisation's overall environmental performance. It makes it possible to assess the direct and indirect environmental impact of an infrastructure or activity, and to devise ways of improving it.

[48] The AP ECO Barometer is an IT tool to support the implementation and monitoring of the 'ECO. AP 2030', in accordance with Council of Ministers Resolution No. 104/2020 of 24 November, and aims to characterise, compare and disclose the consumption (energy and other resources) and direct and indirect greenhouse gas emissions of the public administration.

resource through the deployment of technological resources, including numerous desalination plants and many dams (Ekathimerini, 2024).

2. Water stress and military cooperation at the European level

In 2023, the United Nations World Water Partnership and Cooperation Report highlighted the **growing wave of water cooperation projects**, stating that 'almost all water-related interventions involve some form of cooperation' (United Nations Educational, Scientific and Cultural Organization, 2023). Cooperation between armies, through the sharing of knowledge, would enable better assessment of threats, faster responses and optimisation of logistical resources. However, despite the many benefits of military cooperation on cross-border and global issues, there are few specific agreements between the armies of southern European countries to combat water stress, although some cooperation on water management indirectly addresses this problem (Lanic, 2024).

The **Smart Blue Water Camps**, a **European military cooperation programme**, is a good example of how to anticipate the security risks associated with water stress by sharing knowledge about the resilience of military sites. In 2014, the European Defence Agency (EDA) set up an Energy and Environment Working Group to define a common approach to energy and environmental challenges between EU armed forces (European Defence Agency, 2014). This working group, renamed Captech Energy and Environment in 2021, launched the Smart Blue Water Camps initiative in 2016, enabling Greece, the lead country, Cyprus, Spain, Portugal and Ireland to work together on a water management project. The aim was to analyse the water infrastructure on a military site in each Member State to define its blueprint, or water footprint[49] (European Defence Agency, 2016). Phase 2 should involve implementing the interventions identified. Thanks to the technical assessments and data collection carried out by the National Technical University of Athens on water supply, distribution and consumption, recommendations were formulated for each military site (European Defence Agency, 2019). The results of the project included detailed modelling of the water and wastewater cycle for each camp using a simulation tool (Urban Water Cycle Optioneering Tool, UWOT). The teams have also developed a SmartBlue Camp profiling tool, comprising 31 performance indicators assessing the sustainability of water management in a camp, and 15 context factors assessing the basic characteristics of the surrounding area (Makropoulos et al., 2018). The Smart Blue Water Camps thus demonstrate the **ability of armies to coordinate to improve their resilience and adaptability to water stress** by proposing concrete solutions that are ready to be implemented, even though phase 2 does not yet appear to have been officially inaugurated. This cooperation is even more relevant given the similarity of military installations and the challenges they face, making it possible to implement practices on a broader scale (European Defence Agency, 2016).

[49] The water footprint is a term used to quantify the total quantity of water required to produce goods and services, or to run organisations. It considers both direct and indirect water use.

There are other cooperative approaches to combating water stress, although some of them have limitations, such as reactive cooperative approaches, **which run the risk of favouring solutions that are neither sustainable nor effective in the long term**. They even run the risk of deploying unsuitable alternatives that reinforce vulnerabilities leading to maladaptation, as in the case of the Rhône-Barcelona transfer project (Taithe, 2024). The aim of this project is to enable Catalonia to benefit from the waters of the Rhône, while the river itself is in a vulnerable situation due to the reduced flow of its tributaries (Guilpart, 2024). Furthermore, **cooperation can increase the vulnerability of states by creating interdependencies**, especially in the case of cross-border waters (Lasserre et al., 2011). By linking certain regions to sources or drilling points in other countries, this cooperation creates dependencies that can then be used as levers for negotiation, pressure or blackmail between states. **These interdependencies explain the reluctance of military personnel to engage in bilateral or multilateral cooperation on operational issues**. Although such cooperation could lighten the logistical burden on armies by sharing water resources in theatres of external operations, the desire to preserve national sovereignty over the supply chain and water quality puts the brakes on these initiatives (Lanic, 2024). Lastly, **the implementation of these joint initiatives is proving complex, since the logistical support of troops in overseas operations depends on national chains** (Lanic, 2024). Standards also vary from country to country, and water quality and potability standards are generally not equivalent.

Despite these limitations, studies suggest that military cooperation initiatives outnumber the occurrence of international water conflicts (Wolf, 2001). The development of such cooperation is even more necessary given that France will probably have to intervene increasingly in coalition, which will require the creation of agreements to prevent potential disputes over the sharing of the resource between users, including allies (Lanic, 2024). Finally, the key role of cooperation can also be seen at national level. In its Ministerial Strategy on Water, the Ministry of Armed Forces emphasises the importance of local cooperation with civilian stakeholders and the various ministries in its objective 5 ‘Strengthen cooperation with all stakeholders’.

PART 3

FORESIGHT SCENARIOS AND RECOMMANDATIONS

Scenario 1: 2035 - Conflicts over water use in France

This scenario deals with the increase in water-related conflicts in France. The escalation of tensions and the political polarisation of society make it difficult for the armed forces to simultaneously manage the missions of maintaining law and order, protecting infrastructures and helping the population, while at the same time facing accusations of partiality.

In 2035, the Mediterranean basin will experience warming of more than 2.5°C (IPCC RCP8.5), coupled with a 20% drop in rainfall, leading to aridification of the region, an intensification of extreme rainfall and floods that threaten crops and homes. The hydrological drought has led to a **significant increase in water stress**, bringing the average rate of use of available resources to 40% in France, and to more than 65% in Spain, Italy, Portugal and Greece, where the rate is 85%. Despite the pressure exerted by water stress on the agricultural sector, France has **continued to develop its agriculture** to ensure its **food security** and feed the growing production of **biofuels**. This development has been accompanied by large farms and agricultural cooperatives, which are pursuing a policy of securing water. Despite the efforts made by small farms to increase their resilience to water stress through economical irrigation systems and the creation of drought-resistant species, **dozens of water reservoirs continue to be built to supply large farms**, particularly in the Nouvelle-Aquitaine region, despite scientific warnings about pumping groundwater. The fight against these reservoirs has intensified, and in 2027 a *Zone à défendre* (ZAD) was set up against a project covering around ten hectares to the north-west of Poitiers, bringing together local and European activists from farming and community groups. Actions of **civil disobedience, such as blocking motorways or occupying symbolic sites, and ecological demonstrations have increased** in Europe in the face of the climate emergency and government inaction. Symbolic actions against infrastructures associated with unsustainable resource management, such as water reservoirs, illegal wells and golf courses, are on the increase.

In September 2034, **AgroHydra**, **a European agri-food multinational** whose farms cover thousands of hectares in the Nouvelle-Aquitaine region, obtained permission to build a 25-hectare 'gigabasin' in the Lot-et-Garonne region. For the past ten years, the company has been **securing its water resources through a dozen boreholes and 15 water reservoirs for its business activities,** which has infuriated residents, farmers and scientists. Then, faced with drought in the summer of 2035, prefectoral decrees were issued to restrict domestic, industrial and agricultural water use. However, the large farms connected to the basins, such as AgroHydra, were not subject to these restrictions, as the water had already been stored and was therefore considered to be available. **Tensions are mounting between small farmers, who are deprived of irrigation, and the managers of large farms, who continue to irrigate on a massive scale for their own production.** Numerous demonstrations took place in the Nouvelle-Aquitaine and Puy-de-Dôme regions in July 2035, where the megabasins were also a source of conflict. On 25 July 2035, local farmers, joined by environmental activists and far-left groups, blocked access to the megabasin irrigation channels, demanding a fair redistribution of water. To protect their access to water, **the farmers benefiting from the basins, supported by far-right groups such as Action Française, took up arms and entered into direct confrontation with the activists**. On

29 July, a tractor driven by a cereal farmer deliberately rammed into a group of environmental activists in a field on the sidelines of a demonstration, killing two of them. French public opinion was divided. In less than a week, New Aquitaine was plunged into violence, mixing political, social and environmental conflicts, becoming **the most violent confrontation of the 21st century in France**. The situation got out of hand with the local authorities and the police, who were overwhelmed by the rapid spread of the conflict and the scale of the violence.

At the beginning of August, the **prefectures of Agen and Clermont-Ferrand were attacked by farmers deprived of irrigation, who demanded an end to the restrictions on water use**. Far-right groups, determined to fuel chaos and damage the reputation of environmental groups, shut down the computer systems of several wastewater treatment plants around Agen. Drinking water is no longer available in many communes in Lot-et-Garonne, for part of the town of Agen and for the 48th transmission regiment in Agen, which must reorganise to obtain drinking water and help the population. **To support the forces of law and order and calm the situation, the President of the Republic decided to mobilise part of the armed forces,** which were at the same time heavily involved in the fight against the forest fires through the Héphaïstos system in Provence-Alpes-Côte d'Azur and Bretagne. In addition, **200 soldiers have been called out to support the forces of law and order in rural areas** where violent demonstrations have been breaking out regularly since mid-July. Virulent political and media rhetoric, particularly from the far right, has fuelled the violence against environmental activists and farmers, and targeted several rural environmentalist town halls, which must be protected by the military. Secondly, the mission assigned to two army units is to guarantee access to drinking water for the local population by delivering thousands of bottles of water to 37 communes in the Lot-et-Garonne region. Finally, **mobile gendarmerie units and specialised military forces are being deployed to protect strategic infrastructure**, such as megabasins, dams and wastewater treatment plants. The government fears attacks on these infrastructures by demonstrators or terrorist groups that could take advantage of the situation to harm France, such as the Islamic State Khorassan. The aim is twofold: to protect water distribution infrastructure to avoid a health crisis at the height of the summer season, and to protect water reservoirs used for agriculture.

The **toll of these weeks of violence is very high**. On the demonstrators' side, there have been 14 deaths because of clashes with farmers and the police, and more than 650 injured, 9 of them seriously. The police also suffered 70 injuries and 4 soldiers were wounded. Faced with this debacle, the Minister of the Interior resigned. Members of parliament demanded a parliamentary commission of enquiry into the failings of the forces of law and order. The military units that had been mobilised were also the target of criticism, **and the protective role of the army was widely questioned**. **France's reputation within the EU has been affected**, with its allies believing that the government has failed to appreciate the security issues associated with water scarcity and the political polarisation associated with the consequences of climate change. The **government's strategy for managing water resources is being widely questioned in France**, and demonstrations are being organised in major cities to demand a fairer water allocation policy tailored to drought conditions. The demonstrators are focusing their

attention on the agricultural sector and calling for a real rethink of the system. In addition, **the mobilisation of the army to protect disputed infrastructures has provoked incomprehension among the public**, who are questioning the action and legitimacy of the army in the fight against climate change. Media attention has focused on the ministry's impact on water resources and is demanding information on the army's water withdrawals and consumption.

Scenario 2: 2046 - Extreme consecutive phenomena of excess and shortage of water in mainland France

This scenario explores the consequences for the armed forces of an increase in the number of extreme and contrasting water events in a structurally deteriorated climate. It highlights the threats posed by a lack of investment and adaptation of infrastructures to the challenges posed by water stress, as well as the geopolitical and reputational consequences for France and its armed forces on the national and international stage.

In 2046, several countries, led by the United States, have opted for **decarbonisation strategies based on a technological approach.** But the development of such technologies has been slowed by the consequences of climate change, and global greenhouse gas emission trajectories continue to grow. In France, **average temperatures have risen by 2.8°C compared with the pre-industrial period.** Summer droughts and the **risk of fire have increased by 40% since 1980-2010**, while rainfall has fallen by the same amount. The Aquitaine region has been particularly hard hit. In addition, the phenomenon of coastal subsidence[50], accentuated by massive withdrawals from underground aquifers, is having a major impact on the national territory. Aquifers close to the Atlantic coast are largely unusable due to salinisation of the water, and **the coastline in the Aquitaine region has receded by** an average of **65 meters**. This deteriorating climate situation has led to **a drop in agricultural yields of up to 65% for maize**, which is particularly unsuited to such conditions. However, support for conventional farming is continuing, and irrigated land has increased by 45% since 2020. In addition, the slowdown in economic activity has led to a **substantial reduction in the budget of the Ministry of Armed Forces in absolute terms since 2032**. Investment aimed at adapting the Ministry's facilities to the effects of climate change has been drastically reduced and redirected towards the development of the **SCAF** (Future Air Combat System) **and MGCS** (Main Ground Combat System) **systems,** which are designed to provide France with cutting-edge combat capabilities. It has not been possible to renovate the water networks to the extent required, and the gains made by the refurbished sections are largely offset by the fact that entire sections have been affected by the shrinking and swelling of the clay.

On 6 May 2046, after a particularly dry winter, a hurricane warning was issued by *Météo France*. The low-pressure center formed in the heart of the North Atlantic and moved rapidly towards the Bay of Biscay. The Aquitaine region seemed particularly vulnerable to the arrival of Hurricane Daria. On May

[50] See definition in the Glossary

9th, the elements were unleashed on the Gironde, with **winds up to 245 km/h** particularly destructive to pine forests. **The Bordeaux region received up to 160L/m2 hours**. Four days were enough to transform the department. **More than 45 people died and 180 were reported missing**. Bordeaux-Mérignac air base (BA) 106 was also hit hard by the bad weather. Half of the airport's control tower was blown away, the runways were devastated, and several hangars were unusable. The drilling infrastructure of the *Escadre aérienne d'Appui aux Opérations*, which the army had planned to build between 2020 and 2026, was destroyed. Two civil security Dash bomber aircraft were also taken out of service. The Ministry of Armed Forces decided to **temporarily relocate all personnel from BA 106 to BA 118 at Mont-de-Marsan**. The same applied to the 13th RDP, the Souge camp having been ransacked by Daria. Although the Mont-de-Marsan area was relatively spared by the hurricane, the region was hit hard by the winter drought. From June 14th, fires broke out in large numbers in the southern half of the country, and the Aquitaine forests hit by Daria were deeply affected. Against this backdrop, the armed forces found themselves caught in a vice.

Military personnel from Camp Souge and BA 106, as well as the 4th *Unité d'instruction et d'intervention de la sécurité civile* (UIISC), were requisitioned by the prefecture to evacuate the affected populations in Gironde, but **the clouds of smoke prevented any landings on BA 120 at Cazaux and greatly delayed the arrival of reinforcements by land** from the Mont-de-Marsan site. The latter was also called upon to support the fight against forest fires in the region, and a mobile pelicandrome was deployed there. **There is a shortage of *retardant*[51]**, and the only production plant in France is unable to meet all requirements. In addition, the quantities stored at BA 106 at Mérignac were destroyed by storm Daria. The critical nature of the situation is forcing the government to call on Spain and Portugal to support the civil security forces. In addition, the base's fire-fighting water network, particularly the flexible tanks, is rapidly running out of capacity. **The emergency services had no choice but to draw on the base's drinking water network**, shared with the Marsan conurbation, which was already experiencing severe consumption restrictions. **Salinisation of the groundwater is reducing drinking water supplies** and threatens to undermine the entire fire-fighting system. Republican American media are denouncing the lack of adaptation of the French armed forces to extreme climate hazards, citing an ally that is 'unreliable **and quickly outdated, even on its own soil'**. Meanwhile, **the failure to evacuate the village of Lugos led to the deaths of 48 people.** By June 20th, almost 40,000 hectares had been ravaged by fire. The situation at BA 118 in Mont-de-Marsan was deteriorating, and the withdrawals needed to fight the fires forced 250 military personnel to leave the site to relieve the pressure on water resources. In the commune of Lège, **16 soldiers from the 13th RDP were seriously injured during a fire containment operation**. They could not be repatriated to the Bordeaux military hospital, as the emergency and intensive care services were completely saturated. The drinking water network had been partially destroyed during the storm, and the drought is forcing surgeons to reduce the number

[51] This is a chemical solution that delays the decomposition of plant cellulose. The product increases the temperature at which the flora is destroyed from around 300°C to 700°C.

of daily operations by 15%. During their transfer to the Toulon military hospital, 3 soldiers succumbed to their injuries.

By the end of the summer, the toll was severe. The extreme weather events of the previous two months had claimed the lives of **517 civilians, 19 civil protection personnel and 12 soldiers**. Added to this was the damage caused to military installations and capabilities, including **BA 106 at Bordeaux Mérignac and Camp Souge, which are still not operational**. The lack of structural adaptation to extreme variations in water availability is glaring, and the relocation of personnel and resources to bases spared from disasters underlines the inadequacy of infrastructures in the face of new climate realities. American criticism **is tainting France's position within NATO** and raising doubts about its ability to assume a central role in European defence. Investment in SCAF and MGCS equipment to the detriment of improving resilience to water stress is attracting strong criticism from civil society. Some French politicians are warning that the army could become a **'climate enemy**' for its citizens. Some are denouncing a reckless decision by the armed forces to **concentrate so many personnel and equipment on a single base without first quantifying the resulting increase in water consumption**. The credibility of France's stance on climate change has been severely affected, and the **loss of influence is particularly salient at the COPs**, where influence is increasingly correlated with the extent to which countries are adapting to changes in the water cycle.

Scenario 3: 2045 - Corsica's water crisis exploited by a foreign power

In 2045, as Corsica faces widespread water stress, a prefectoral decree crystallises tensions and provokes an uprise in independence demands. The water crisis and the social chaos that follows are exploited by foreign powers, including Russia, to destabilise France. A cyber-attack is carried out on a water treatment plant supplying an entire region, including a French military base. This scenario confronts the armed forces with the risks associated with the various social consequences of water crises and the instrumentalisation of water.

In 2045, Corsica experiences an average warming of 3°C compared with the pre-industrial period, with average temperatures rarely falling below 31°C (IPCC RCP8.5) in summer. Although Corsica has always experienced aridity in summer, droughts are now occurring earlier and for longer periods, and heatwaves are increasing. The annual number of hot days, i.e. exceeding 25°C, is rising inexorably. Moreover, the water cycle has deteriorated sharply: the lack of snow has reduced the supply of water to rivers, and the 35% decline in rainfall since 1970 has led to a shortfall in the recharge of water reserves. The **reduction in surface and groundwater** is accompanied by episodes of extreme precipitation that the soils, which are in too poor a condition, are unable to absorb, and which are therefore accompanied by destructive **floods**. These changes in water regimes call into question the **resilience of the supply system for the island's 365,000 inhabitants**, which is already sensitive. **Corsica's vulnerability to water stress is accentuated by the island's demographics, which make it home to the oldest population in France,** with 36% of the population over the age of 65. The

proportion of senior citizens on the island is a major public health risk, as these populations are particularly vulnerable to heat and prone to dehydration. Finally, after a twenty-year period of rest, **Corsican independence movements re-emerged in the 2030s, led by the Corsica Libera group**, heir to the *Front National de Libération Corse*. These movements are instrumentalised by foreign powers, such as Azerbaijan and Russia, seeking to destabilise France.

In **Haute-Corse, where water resources have been systematically below average since the late 2030s**, the situation is particularly complex. The spring and summer of 2045 will see a record, with rainfall 87% lower than normal. **As a result, in May 2045, the population faced the most serious shortage of drinking water in the island's history** (less than 1,000m³ of water per inhabitant per year). The Prefect of Haute-Corse placed the hydrographic units of the Bastia urban community on drought alert, to preserve water resources. This prefectoral decree generated a great deal of discontent among the local population, who blamed the water crisis on mainland France and accused mainland tourists of hogging the water. In fact, prefectoral dispensations allow the tourist industry to maintain its usual water consumption. The decree also rekindles a feeling of abandonment among Corsicans, who see the constraints imposed by the government as an injustice and a lack of commitment to finding sustainable solutions to the fight against climate change. **These ideas have been taken up by the Corsica Libera group**. Social movements are gradually emerging, and demonstrations are being organised. Local anger was also fuelled by a Russian disinformation campaign, which accused mainland France of 'colonising the island's water' and 'saving the resource for the mainlanders'. These conspiracy theories are propagated by fake Corsican websites and backed up by fake news.

Anger was heightened when a press article revealed that water restrictions had caused the death of nine elderly people in a retirement home in Bastia. Overwhelming images, faked using *deepfake* (images created by artificial intelligence), supported this claim. The article, which turned out to be fabricated, was subsequently picked up on numerous social networks, generating an unprecedented furore. Dozens of similar disinformation operations were carried out simultaneously, amplifying tensions. As a result, **the violence of the protests, which until then had been contained, exploded, driven by pro-independence slogans.** State infrastructures such as the Bastia prefecture were targeted. **A movement on X encouraged acts of sabotage against water supply infrastructures** associated with the mainland. The first incidents targeted hotels and private swimming pools, but the escalation continued, accentuated by outside interference inciting violence. On July 14th, 2045, a cyber-attack hit the Calvi drinking water treatment plant, which is vital to the region and to the Raffalli military base. This attack, of Russian origin, was perpetrated thanks to the most radical faction of Corsica Libera, which passed disclosed key data on the base to Russian hackers. The choice to target this military base, where the 2nd Foreign Parachute Regiment (REP) is stationed, is significant: its installation in Corsica in 1967, following its transfer from Bou Sfer in Algeria, had attracted criticism for its colonial connotations, as the regiment was created in 1948 in Indochina. However, the staff at the water treatment plant quickly detected the incident and put the plant back into service, limiting the damage to an initial scare. Following this interference, a vulnerability assessment of French water

storage, distribution and reprocessing infrastructures was launched to better map and anticipate strategic risks. **In response to the growing violence, the forces of law and order are being mobilised to contain the independence movement**. These events are relayed abroad by the other members of the Annual Congress for Independence Formations (CAFI), organised by Russia in Baku, which Corsica Libera attended at the beginning of 2045. **Russia and Azerbaijan are taking advantage of the mobilisation of the forces of law and order and the Armed Forces to internationalise the crisis**, denouncing France's desire to monopolise water resources. This led other formerly colonised countries to take Corsica's side and call on France to withdraw from the island. These events considerably undermined France's credibility and sovereignty, by fuelling anti-metropolitan sentiment.

This interference is part of a wider strategy pursued by Russia and Azerbaijan to **destabilise France and Western countries, particularly** in Africa and overseas. A growing number of territories, initially under the jurisdiction of European states, have been ceded back in recent years. This trend began in 2024, when the United Kingdom returned sovereignty over the Chagos archipelago in the Indian Ocean to Mauritius. More recently, in 2039, New Caledonia declared its independence, after a long legal battle with France. By denouncing France as a colonial power, the aim is to weaken France's legitimacy and tarnish its international reputation. The mobilisation of the **forces of law and order accentuates the antagonism** with the population and is taken up by the authors of this narrative of interference: by responding with force and intimidation, the legitimacy of the government is challenged. The risk for France and the armed forces would be to have to grant a **change of legal status for the island.** Greater autonomy for Corsica would risk France losing its influence to another power. The presence of a foreign influence so close to mainland France would represent a major security issue. This event highlights **France's vulnerability to the instrumentalisation of water** issues, and the importance of treating water as a potential destabilising factor for other players. Indeed, with the growing interconnection of these infrastructures, their networks and equipment are prime targets for cybercriminals. Despite the minor damage caused by the cyber-attack on the drinking water treatment plant, it demonstrated **the vulnerability of water infrastructures to the damaging power of a foreign power.**

Recommendations

1

Collect and analyze data to better understand the water requirements of French military bases

- Develop a **standardised methodology** for the quantitative and qualitative collection of water-related data (withdrawals, consumption, etc.), and determine the water footprint of each military base in France.
- Analyse the data collected to **identify room for action** in terms of efficiency and sobriety.
- **Map the exposure of military bases to water stress**, considering the climate and socio-environmental challenges of their geographical location. This action is part of the Ministry of Armed Forces' strategy to map the vulnerability of military bases to climate change.

2

Implement actions to reduce the 'water footprint' on a facility scale

- **Prioritise the most vulnerable military facilities** using mapping.
- Implement objectives 2 'Secure needs and foster sobriety' and 3 'Limit the environmental footprint and reduce exposure to extreme events' of the Water Strategy in the most vulnerable facilities.
- **Monitor actions to reduce water consumption** in military facilities.

3

Strengthen cooperation between key players of water management at local, national and European level

- **Share water management best practices,** drawn from overseas operations, with national forces.
- **Generalise knowledge sharing between European armies** on water management techniques**.**
    - Example: launch a French initiative for a joint project, such as the *Smart Blue Water Camps*.
- **Collaborate with other** ministries to redefine water use from a sobriety perspective, emphasize resource efficiency and ensure equitable distribution among all stakeholders. **Strengthen interministerial and cross-border cooperation on the management of crises** linked to water stress, through planning committees.
- **List the main stakeholders and consumers of water sharing right-of-way resources** for better **multidisciplinary** anticipation of crises.

4

Adopt a resilient and comprehensive approach to anticipate the risks and threats associated with water stress for the Ministry of Armed Forces

- Develop **adaptation strategies for the Ministry** in line with **the reference warming trajectory for adaptation to climate change** (TRACC) of +4°C in 2100 adopted by the government in the third version of the National Plan for Adaptation to Climate Change (PNACC).
- **Secure long-term investment to ensure the adaptation of infrastructure**.
    - Example 1: projects to renovate the water supply network, particularly the segments with the highest losses.
    - Example 2: projects to remove waterproofing from military sites to increase absorption capacity.
- As part of operational continuity plans, **generalise the implementation of alternative supply strategies on facilities**: **assess the criticality** of operations relating to the use of water, and implement **alternative supply solutions** at the most critical points.
- Set up **training workshops** on how to react in water crisis situations (qualitative and quantitative issues).
- **Improve disease monitoring and epidemiological surveillance tools** in relation to water-borne diseases.
- **Assess the defence industry's water requirements**, to identify the industrial sector's vulnerabilities to water stress and ensure control over the Ministry's entire supply chain.

GLOSSARY

Agroecology: Production systems based on the functionalities offered by ecosystems. It enhances these functions while aiming to reduce pressure on the environment (e.g. reducing greenhouse gas emissions, limiting the use of plant protection products) and preserving natural resources. The aim is to make maximum use of nature as a production factor while maintaining its capacity for renewal.

Artificialization of land: The transformation of agricultural, natural or forest land into urbanised areas, often waterproofed, because of development linked to urbanisation, under the influence of demographic growth and economic development. This process, which is generally irreversible, has a negative impact on the environment, particularly by increasing the risk of flooding, run-off and the deterioration of the chemical and ecological quality of water, while fragmenting natural habitats and reducing biodiversity.

Climate change: Variations in the state of the climate observed since the end of the 20th century, attributed directly or indirectly to human activity, modifying the composition of the atmosphere. These variations result in the occurrence of specific, slow-onset hazards, which can have both environmental and safety implications.

Coastal subsidence: Soil subsidence is a natural or man-made downward deformation of the earth's surface. It is important to understand this phenomenon, as it can significantly affect infrastructure and the environment.

Cryosphere: The ice on the earth's surface (pack ice, glaciers, etc.).

Ecosystem services: In France, the French Evaluation of Ecosystems and Ecosystem Services (EFESE) defines ecosystem services as the socio-economic benefits or advantages derived by humans from their sustainable use of the ecological functions of ecosystems. The concept of ecosystem services is therefore fundamentally anthropocentric.

Effective precipitation: The fraction of rainfall that can feed aquatic environments and recharge groundwater. It is therefore the total volume of precipitation minus the part that returns to the atmosphere *through* evapotranspiration. Efficiency varies with the seasons (it increases in winter when there is no vegetation and decreases in summer due to heat and plant growth). The type and quality of soil is another determining factor, and the increasing impermeability of soils has a significant impact on this phenomenon.

Eutrophication: Eutrophication is the process by which nutrients accumulate in an environment or habitat (terrestrial or aquatic). The nutrients concerned are nitrogen, mainly from nitrogenous nitrates and wastewater, and phosphorus, mainly from agricultural phosphates and wastewater. Sunshine and rising temperatures can exacerbate eutrophication.

Food security: Ensuring that all people, always, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. It is based on four pillars: the availability of resources, their accessibility, their appropriate use, and the stability over time of these first three pillars.

Hydrographic basins: Term used to designate large watersheds, i.e. a geographical area bounded by a network of watercourses that all flow into the same main river, stream or lake.

Hydrological drought: Situation where the freshwater reserves available in rivers, lakes, groundwater and other hydrological resources are significantly reduced due to a prolonged shortage of precipitation.

Intensive irrigation: agricultural practice that involves supplying large quantities of water to crops on a regular basis, often using sophisticated irrigation systems, to maximise crop yields. This can lead to over-consumption of water resources.

Low flow: According to Aquaportail, a low flow corresponds to the base flow in hydrology. It measures the lowest flow level reached by a stream of water during the annual cycle, or the lowest water level in a water table. Low water is the state of any body of water or watercourse at its lowest level.

Meteorological droughts: these are rainfall deficits measured against seasonal norms over a sufficiently long period. They show disparate trends from one region to another, sometimes largely influenced by natural climate variability (in the Sahel or more recently in California, for example). A distinction is made between hydrological, agricultural or agronomic and anthropogenic droughts.

Productivist: Seeking to maximise production by all available means (labour, machinery, irrigation, inputs, etc.), with a view to global demographic growth.

Ripisylve: The riparian forest refers to all the vegetation bordering a watercourse. It can be made up of different strata: arborescent, shrubby, herbaceous, semi-aquatic plants (helophytes) and can extend over a width of more than 10 m. Connectivity within a riparian forest and with the surrounding vegetation and water features is fundamental. Riparian forests reduce the risk of flooding, regulate water temperature and limit the risk of bank erosion.

Strategic autonomy: A state's ability to define and pursue its own national, economic and political security interests and objectives independently, without excessive dependence on other countries or groups of countries.

Water consumed: Water consumed refers to the quantity of fresh water taken that is used and not reintroduced directly into nature after use, i.e. into surface water and groundwater. This corresponds to water incorporated into products and evapo-transpired water.

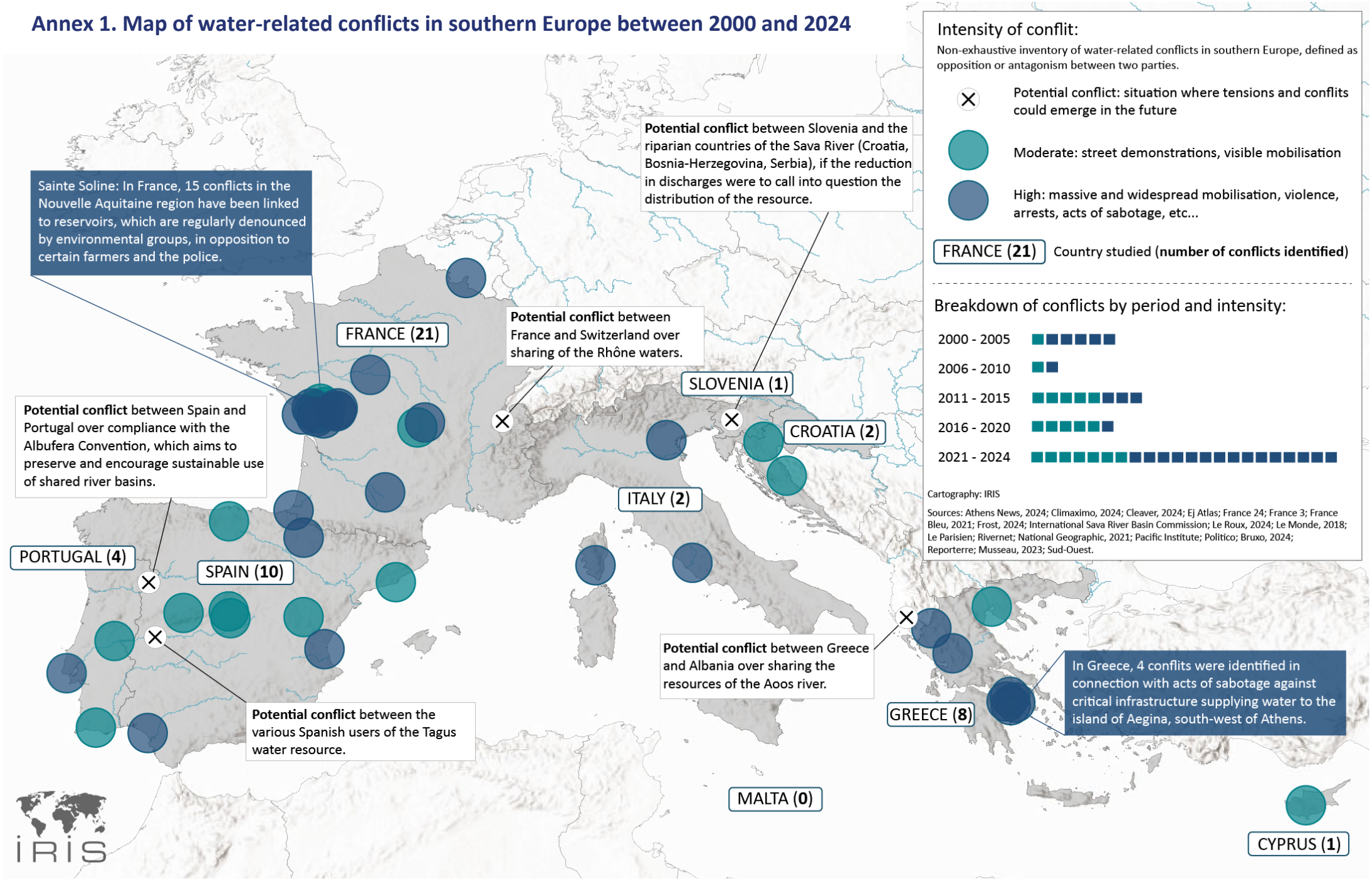
Water intended for human consumption: This is water which, either in its natural state or after treatment, is used for drinking, cooking and preparing food, as well as for all other individual and collective uses which help to guarantee good hygiene conditions: ablutions, showers, washing of clothing, cleaning of living areas, etc.

Water stress: Phenomenon of strong tension on the water resources of a territory, occurring when the demand for water exceeds the quantity of water available, or when its poor-quality limits its use. A country experiences 'water stress' when its available annual water resources are less than 1,700 m^3 per inhabitant per year.

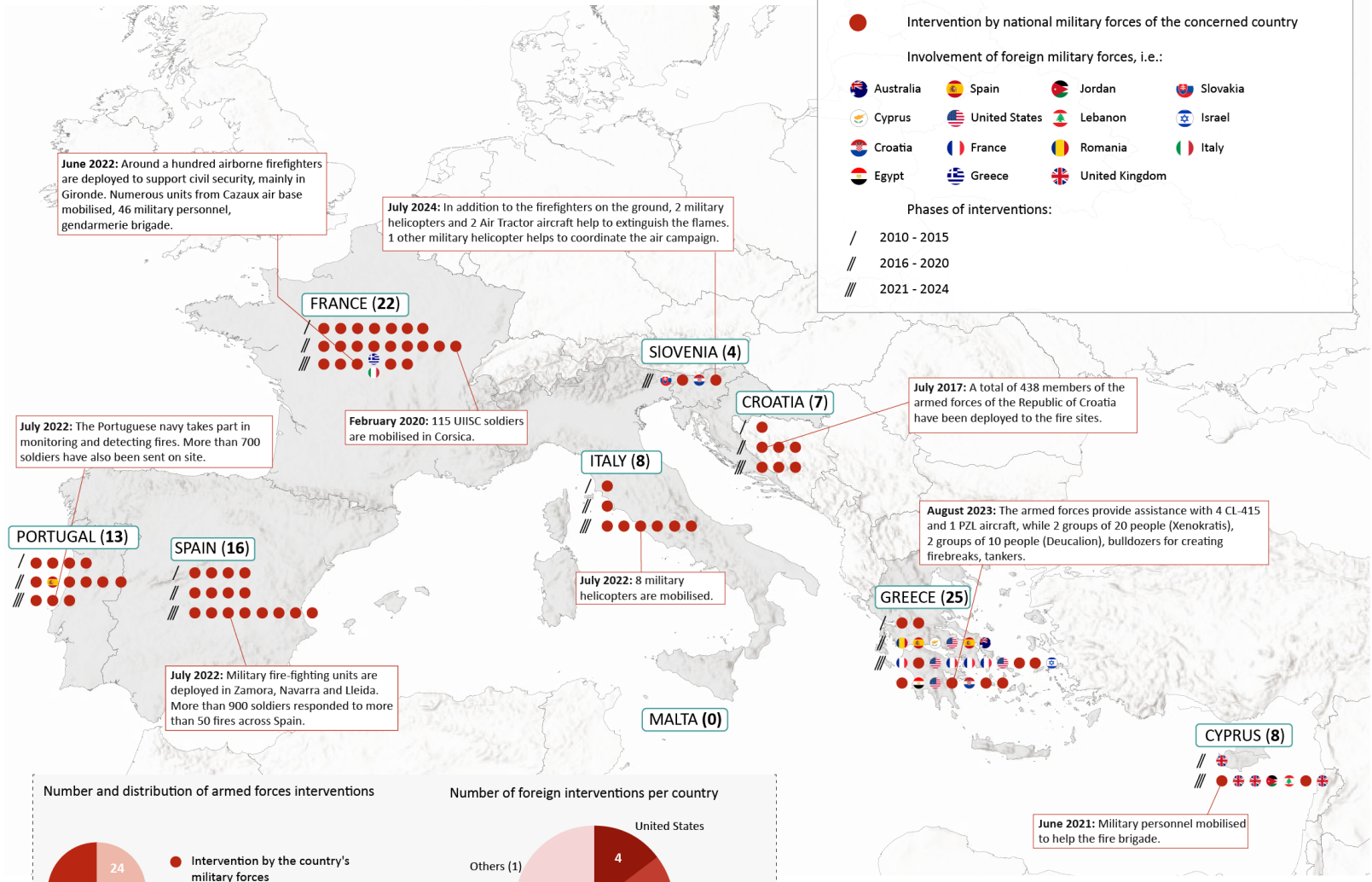
Water withdrawals: According to the OECD (2024), water withdrawals correspond to 'volumes of fresh water extracted permanently or temporarily from an underground or surface source and transported to their place of use.

APPENDICES

Annex 1. Map of water-related conflicts in southern Europe between 2000 and 2024



Annex 2. Map of Humanitarian Assistance and Disaster Relief (HADR) operations in response to forest fires in southern Europe between 2010 and 2024



Sources: ABC, 2021; Antonino, 2021; APNews; Armyvoice, 2018; Assémat, 2015; Associated Press; Australian Department of Foreign Affairs and Trade website; BBC, 2019; CdCS (MEAE); Chrisafis, 2022; Claus, 2021; Cleaver & Stern, 2024; Council on Strategic Risks, 2024; Croatian ministry of Defence, 2011; De Guglielmo Weber and al., 2024; DW; Ekathimerini, 2024 Ferenčić, 2021; Financial Mirror, 2023; ForcesNews; France24; Gamal, 2023; Itamilradar, 2023; ITVNews, 2024; JordanNews, 2023; Le Point; L'Indépendant, 2016; Lokalec, 2022; McMurty, 2023; Nad, 2022; N1Info, 2022; Facebook page of the Portuguese Navy; Prime Minister of Israel, 2023; Protezione Civile, 2022; Publico, 2010; Reuters, 2022; Romanovschi, 2018 Scordo, 2021; Italian Ministry of Defence website; French Ministry of Armed Forces website; Portuguese Ministry of Defence website; Italian Ministry of Defence website; Unité d'Instruction et d'Interventions de Sécurité civile 1 website; Unité d'Instruction et d'Interventions de Sécurité civile 7 website; French Ministry of Interior; Slayton, 2023; Total Croatia; The Slovenia Times, 2024; Vitorino, 2023; Vonberg & Cotovio, 2017.

Cartography : IRIS

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