GoNEXUS

FACTSHEET

European CONTINENT

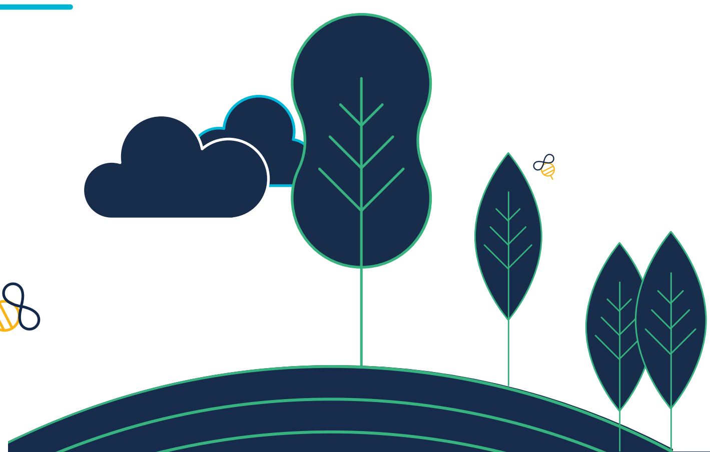
BRIEF OVERVIEW

Climate change and increasing **pressure on natural resources** have been identified as major challenges that will affect Europe in the coming decades. These challenges are expected to lead to issues such as **migration pressure, food price shocks, water scarcity, inefficient irrigation,** and **imbalances in energy markets.**

IDENTIFIED WEFE CHALLENGES & PROSPECTED SOLUTIONS

The primary identified challenges are:

- **Growing water scarcity** due to rising water demand from macroeconomic factors (e.g. demographic pressure, growing demand) and climate change (warmer, drier conditions).
- **The transition to green energy** and the reduction of CO_2 emissions.
- **Balancing water, energy, and food security with ecosystem conservation** and other environmental impacts.
- **Weak governance** of the Water-Energy-Food-Ecosytem (WEFE) nexus.



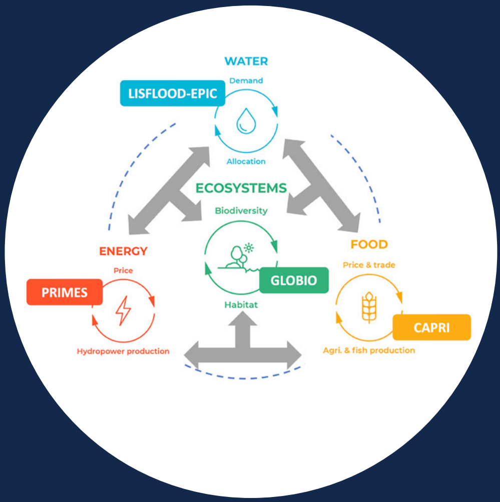
MODELLING TOOLS

Several models are used to analyse the European case study and the related policy scenarios. **The LISFLOOD-EPIC model** will provide detailed insights into the water sector, including indicators for water demand, scarcity, and allocation.

For the food sector, **the CAPRI model** will offer indicators on food production, agricultural land use, food prices, and trade.

In the energy sector, **the PRIMES model** will generate indicators on energy prices and production across different energy sources.

Lastly, **the GLOBIO model** will analyse ecosystems, providing indicators related to biodiversity conservation and habitats.



SCENARIOS

Three main policy-relevant WEFE scenarios have been selected for the European continent and aligned with **climate, socioeconomic, and land use** scenarios:

- Sustainable development aligned with SSP1-2.6
- Weak cooperation aligned with SSP3-7.0
- The wrong way aligned with SSP5-8.5

DIALOGUES

For Europe, two stakeholder Dialogues were conducted with members of a European working group, specifically the *ad hoc* task group on water scarcity and droughts (ATG WS&D) of the EU water policy common implementation strategy.

The first Dialogue, held in January 2023, focused on **refining the European nexus challenges** based on brief interventions and feedback from stakeholders.

The second Dialogue, held in March 2023, involved presenting model results. The feedback gathered was highly valuable in prioritising solutions to **address growing water scarcity** and also contributed to developing solutions for the other European nexus challenges.

EVIDENCE
ACCORDING TO MODELS

LISFLOOD-EPIC

This model can provide **projections for water demand.** Overall, the total water demand is expected to increase most in countries where industrial and domestic use are the primary sources of water abstraction, such as Germany. In these regions, **water demand is closely tied to population growth and economic development,** particularly in urban areas.

Water demand projections until 2050

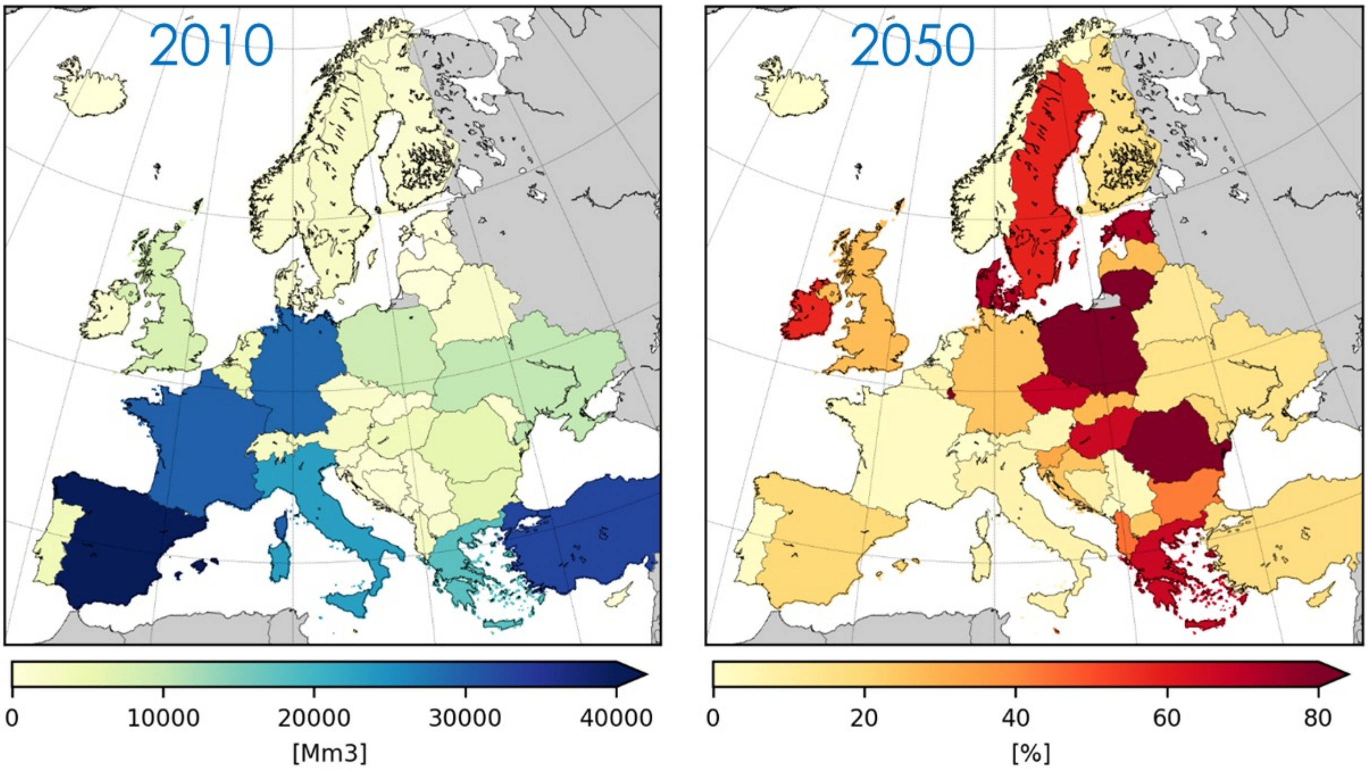


Figure 3. Water demand projections for all sectors until 2050

PRIMES

This model considers two scenarios: **the 'Current Policies' scenario** and **the 'Net Zero' scenario.** PRIMES provides greenhouse gas (GHG) and CO2 emissions projections for these scenarios. Moreover, PRIMES can provide **insights into freshwater requirements for cooling thermal power plants** in 2050 compared to 2020.

In the 'Net Zero' scenario, the EU achieves its target of net zero emissions by 2050, while the 'Current Policies' scenario only achieves a 60% reduction in GHG emissions by 2050, falling short of the EU target. In the 'Net Zero' scenario, water consumption and withdrawals for thermal power generation are lower than in the 'Current Policies' scenario in most European countries. Additionally, hydropower generation (specifically run-of-river hydropower, excluding pumping) is higher in the 'Net Zero' scenario.

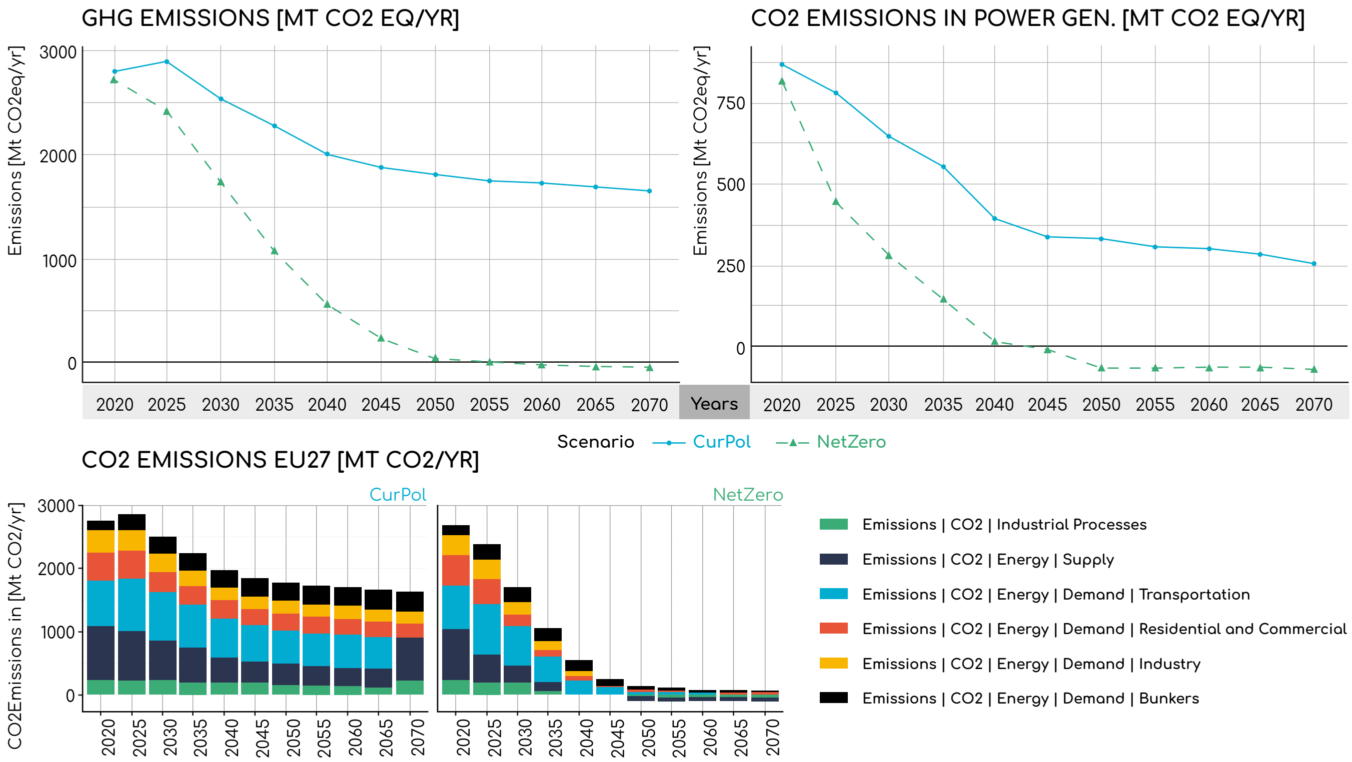


Figure 4. Emissions projections for the EU27 in Current Policies and Net Zero scenarios.

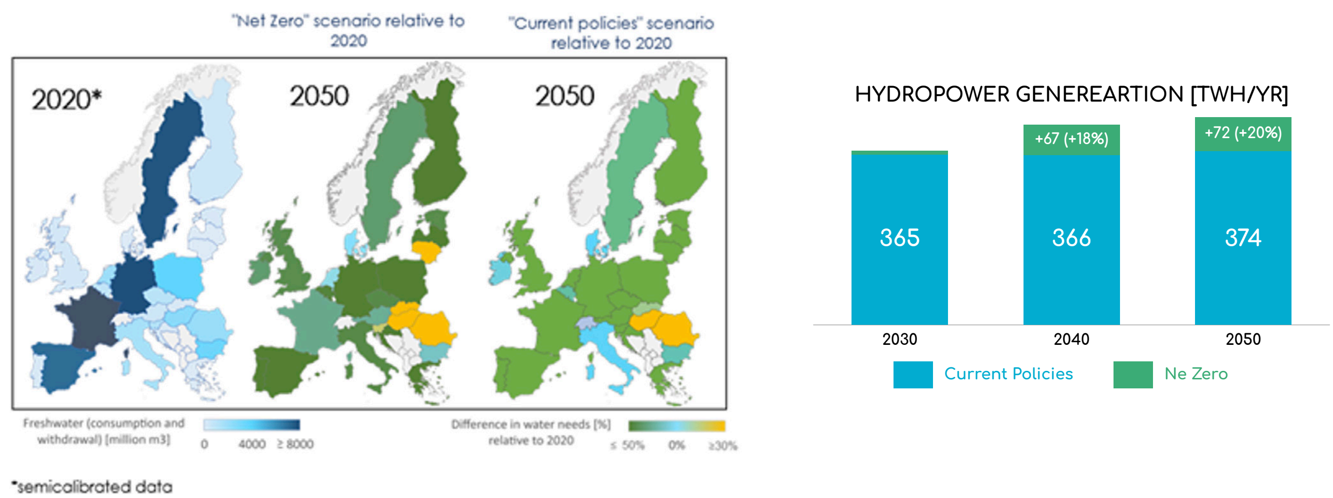


Figure 5.Freshwater needs for cooling of thermal power plants in 2050 (left) and hydropower generation (right) in the modelled scenarios.

CAPRI

CAPRI model results highlight **EU trends in irrigated area and irrigation water abstraction** when comparing 2020 to 2050. Another key finding includes trends in water withdrawal for irrigation under a no climate change scenario, as well as under various climate change scenarios (SSP1-2.6, SSP3-7.0, and SSP5-8.5). Additionally, changes in water use and reuse for irrigation across European countries under SSP5-8.5 are also highlighted.

Overall, **the total irrigated agricultural area in the EU** is projected to increase between 2020 and 2050. However, at the country level, irrigated areas are expected to decrease, particularly in southern European regions where water availability is limited in 2050 compared to 2020. However, some less water-stressed regions are projected to see an increase in irrigated cropland by 2050.

Model results (Figure 8) indicate that climate change will lead to a reduction in total water withdrawals, which will also impact water withdrawal for irrigation.

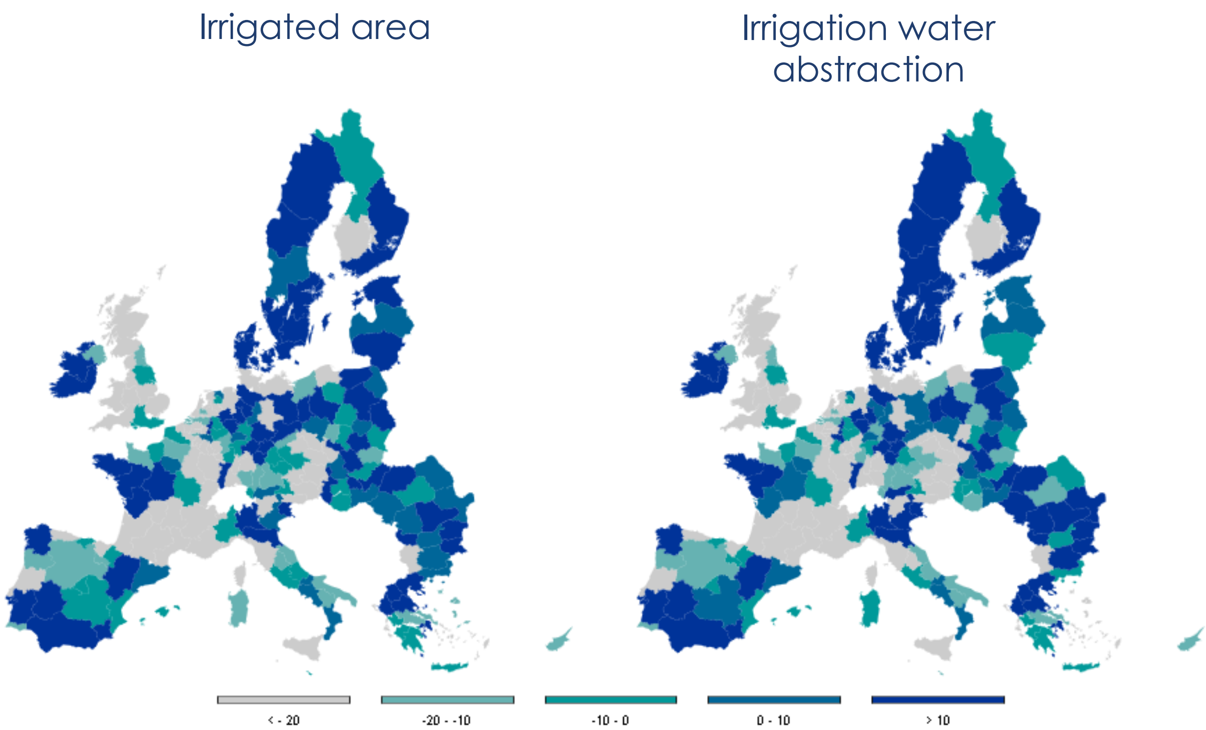
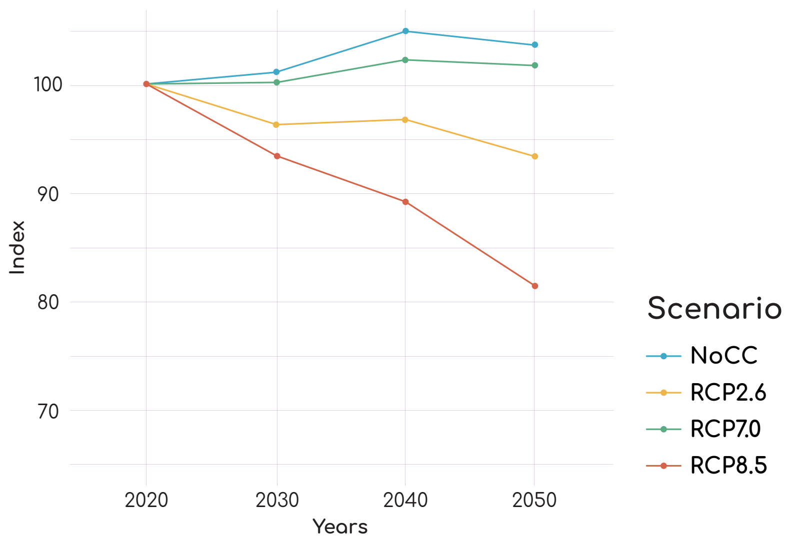


Figure 6. Irrigation trends under no climate change (% change in 2050 relative to 2020)



GLOBIO

Data from GLOBIO shows the potential percentage of **riverine fish species that could lose their habitats** by 2030 and 2050. There is a noticeable increase in the proportion of threatened habitats between these years, especially as temperatures rise. The highest threat levels are observed under the RCP8.5 warming scenario. Additionally, the presence of **dams significantly increases the proportion of threatened habitats,** compared to the effects of climate change alone.

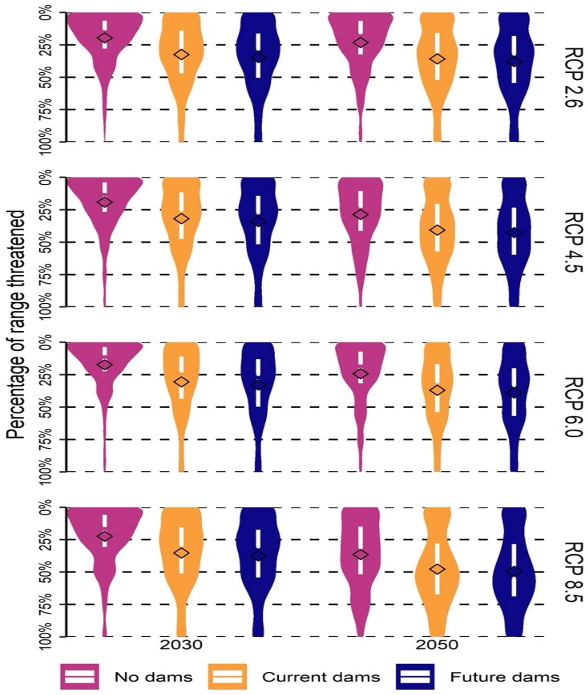


Figure 9.Potentially lost range (%) of riverine fish species in 2030 and 2050. The violin plots show the proportion of geographic range threatened by future climate extremes for 444 riverine fish species in Europe (EU27), different scenario years and three dams

SOLUTIONS

- **Water use efficiency investments**
- **Alternative water sources:** reuse of treated wastewater and desalinated water.
- **Increase in renewable energy share:** aim for 40% by 2030 and 45% in line with the Fit for 55 package. This includes promoting **solar photovoltaic energy, bioenergy,** and the use of **agroforestry waste biomass** to support a circular bioeconomy and develop alternative energy sources to reduce reliance on fossil fuels and achieve decarbonisation in the EU economy.
- **Enhance energy efficiency:** target an overall reduction of 36-39% in primary and final etnergy consumption by 2030.
- **Efficient fertilisers use:** implement technological solutions to minimise nitrate pollution.
- **Support Nature-based solutions:** focus on improving and conserving water bodies and ecosystems, flood control, and meeting water management objectives.

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