European Environment Agency

# Monitoring progress towards the 8th Environment Action Programme

## Compilation of the 8th EAP headline indicators

European Environment Agency

# 8th Environment Action Programme

## Total net greenhouse gas emission trends and projections in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

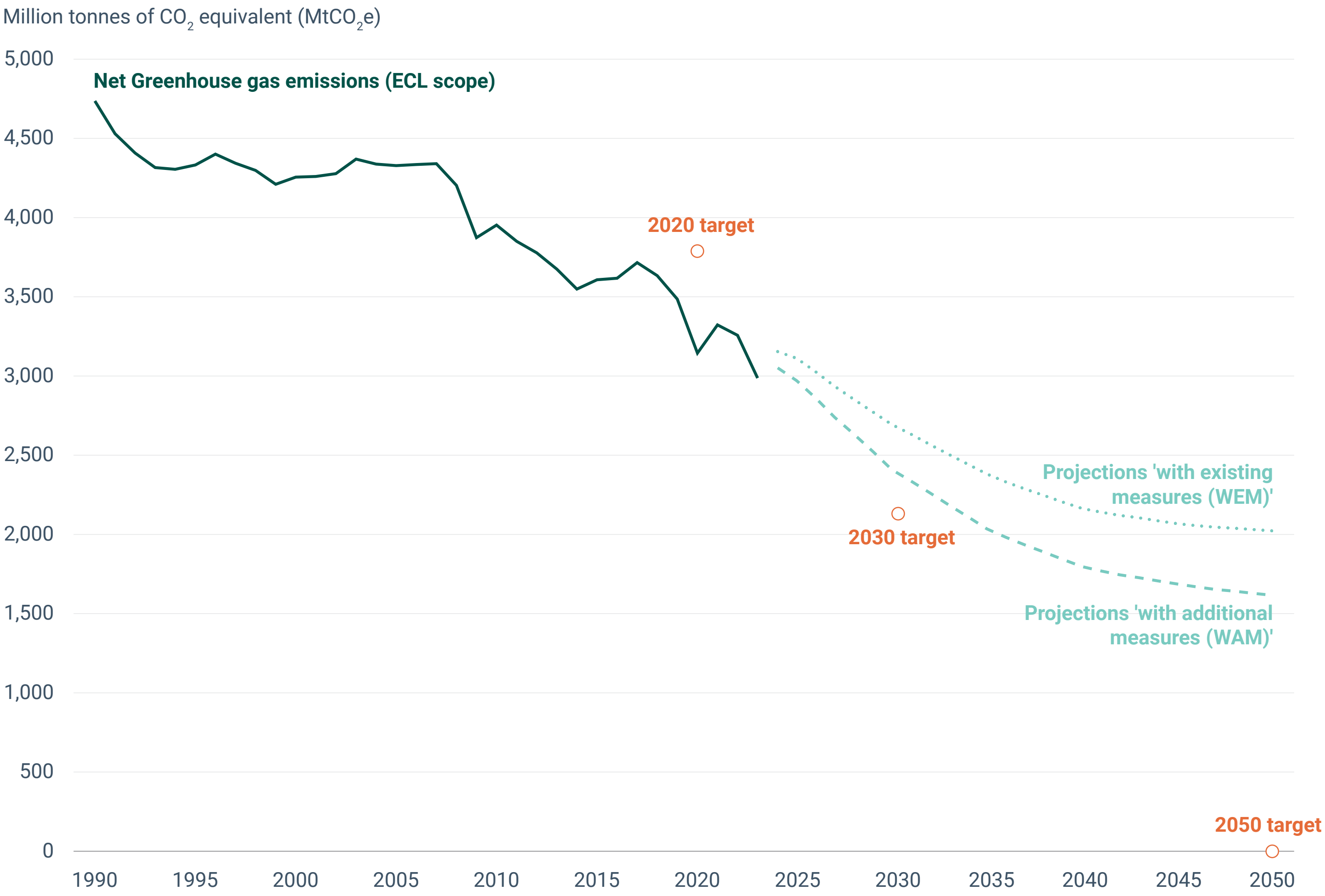
# Total net greenhouse gas emission trends and projections in Europe

Published 31 Oct 2024



Net greenhouse gas (GHG) emissions fell by 31% in the EU-27 between 1990 and 2022, including international transport as regulated by European Union law. Preliminary estimates indicate an additional record year-on-year reduction of 8% in 2023, marking significant progress towards climate neutrality for the EU. Current GHG projections, as reported by Member States, suggest that a 49% reduction in net emissions will be reached by 2030 compared to 1990 levels, missing the 55% reduction target for 2030. More ambitious policies and measures are being developed in ongoing updates of the National energy and climate plans to put the EU on track to reach the 2030 climate target, and on the trajectory towards climate neutrality.

## Figure 1. Progress towards achieving climate targets in the EU-27



The reduction of GHG emissions is vital to slow the rate of global warming and mitigate its impact on environment and human health. The EU is a front runner in climate action. The European Climate Law sets a binding **target** to achieve climate neutrality by 2050 and reduce net GHG emissions by at least 55% in 2030, compared to 1990. The EU has already taken significant steps to fulfill these ambitions.

EU net GHG emissions **reduced** in 2022 by 31%, since 1990, while GDP significantly increased over the same period. This achievement takes the carbon sink from the land use, land use change and forestry sector (LULUCF) into account and includes the emissions of international aviation and maritime, as regulated by EU law (EU target scope)[1].

The observed reduction in net GHG emissions has followed a gradual strengthening of policies to reduce GHG emissions over the past two decades. The overall decrease can be largely attributed to **shifts in energy production** methods, notably a significant decline in coal usage and growth in the adoption of renewable energy sources. There has also been a modest reduction in total energy consumption, and substantial decreases in GHG emissions linked to specific industrial production processes[2].

Preliminary estimates indicate that in 2023, net GHG emissions in the EU **fell by a further 8%** below 2022 levels. This marks the largest year-on-year emission reduction in several decades, except for the COVID-impacted year of 2020. It brings the estimated 2023 emissions to a level of 37% below 1990 levels.

Focusing on sectoral developments in 2023, estimates indicate a recent **continuation** of the past trends. The energy supply sector recorded an estimated 19% reduction in GHG emissions between 2022 and 2023, driven by the roll-out of renewable energy production and limited decrease in electricity production. GHG emissions are estimated to have decreased by 6% in the industrial sector, due to a combination of reduced output and efficiency gains in specific sectors in Europe.

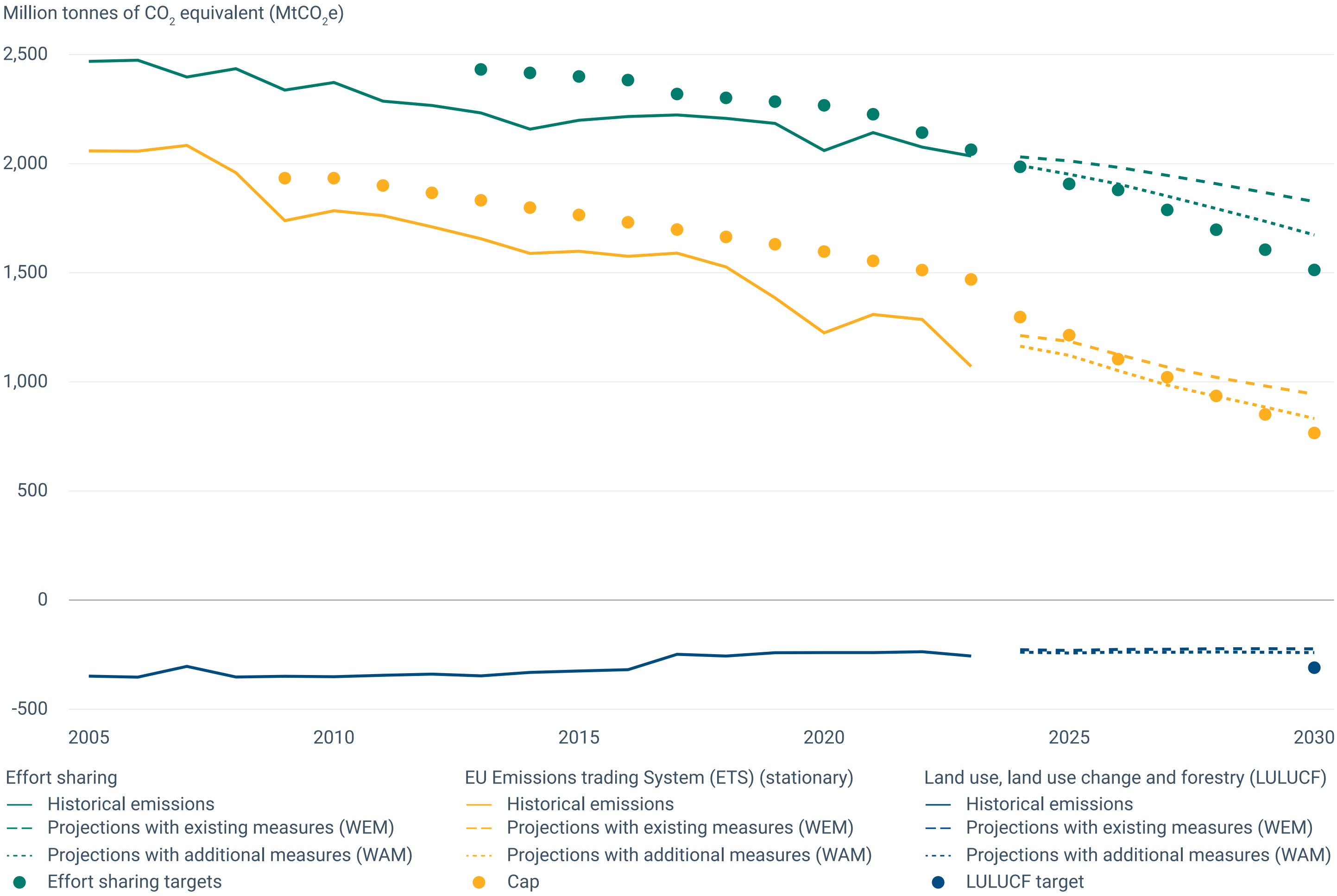
A similar reduction was observed in GHG emissions from the buildings sector. The transport sector and the agricultural sectors experienced more **limited emission reductions** of 1% and 2% respectively. Estimates indicate a modest increase in the GHG removal capacity from LULUCF.

Current and planned policy measures across the EU are expected to contribute to **sustaining** emission reductions, towards 2030. Member States' projections submitted in March 2023 and updated by some Member States in 2024 show the policies and measures currently in place combined would achieve a reduction of 43% in net emission levels by 2030 compared to 1990.

The projected reduction would reach 49% when planned **additional measures** are taken into account, still leaving a six-percentage point gap towards the minus 55% target. More ambitious policies and measures are being developed in the ongoing updates of the National energy and climate plans. New EU-wide policy tools such as the emission trading system for buildings, road transport and additional sectors provide additional incentives to reduce emissions.

The gap between the targets and projected impact of current and planned measures is wider beyond 2030. Taking into account currently adopted and planned measures, net emissions are **projected** to reach a level of 62% below 1990 levels in 2040 and 66% in 2050. These projections largely exceed the recommended 90% reduction target for 2040 and the legally binding climate neutrality target for 2050. This indicates a need to continue developing ambitious policies to reduce emissions in all sectors in the coming years and decades.

## Figure 2. Effort Sharing, ETS, LULUCF trends and projections in the EU-27




Three **pivotal EU policies** target GHG emissions and removals. Each is accompanied by clear binding targets for 2030:

- The EU Emission Trading System (**EU ETS**) covers GHG emissions from stationary installations in the power sector and large industrial plants. It also includes $CO_2$ emissions from aviation since 2012. Emissions from stationary installations have decreased by 48% between 2005 and 2023, largely driven by the decarbonisation of the power sector. Stationary emissions showed a substantial 17% decrease in 2023 compared to 2022, linked to the significant emission reduction in the energy supply sector. At the same time, aviation ETS emissions increased by more than 10%. Projections taking into account current and planned measures indicate an expected 60% reduction by 2030, compared to 2005 levels for stationary installations. This fails to meet the 62% reduction target for the EU ETS by 2030.
- The Effort Sharing legislation governs **national GHG reduction targets**, covering sectors such as transport, buildings and agriculture. The reduction in these emissions has been less pronounced compared to those governed by the EU ETS, showing an 18% decrease between 2005 and 2022, with estimates indicating a further 2% decrease between 2022 and 2023. Projections suggest a considerable gap towards the target for 2030, with Effort Sharing emissions expected to reach a reduction of 34% compared with the target of 40%.
- The land use, land use change and forestry (**LULUCF**) sector represented a net carbon sink of about 236Mt$CO_2$e in 2022, corresponding to the absorption of 7% of the EU's total GHG emissions. Although the initial estimates for 2023 show a one-year reversal of this trend, the carbon sink has been shrinking continuously over the last decade. GHG projections as submitted by Member States foresee an increase of carbon sink, but not at a rate that would permit achievement of the target level of minus 310Mt$CO_2$e by 2030.

## Supporting information

**Definition**

This indicator presents past and projected GHG emission trends in Europe and assesses the progress of the EU towards its GHG targets, with the scope of the total greenhouse gas emissions (EU target scope) aligning with that of the European Climate Law. The EU's total GHG emissions include GHG emissions from land use, land use change and forestry (LULUCF) and portions of emissions from international aviation and maritime transport, as regulated by EU law.

In addition to the overall GHG emissions, this indicator presents disaggregated trends to illustrate the development of emissions covered by the EU Emission Trading Scheme (ETS) and the Effort Sharing Legislation as well as from land use, land use change and forestry (LULUCF).

This indicator aims to present an assessment of the EU's progress towards its 2030 and 2050 ambitions under consideration of the trends of emissions covered under EU Emission Trading Scheme (ETS), the Effort Sharing Legislation as well as from land use, land use change and forestry (LULUCF).

The indicator is based on the official GHG inventories submitted by the EEA countries and the EU to the UNFCCC, as well as on the projected GHG emissions submitted by the Member States under the Regulation on the Governance of the Energy Union and Climate Action (Regulation (EU) 2018/1999). Finally, this indicator uses data and estimates from the 'Approximated GHG inventory' for the year (X-1).

The indicator covers all 27 Member States of the European Union.

**Methodology**

**Methodology for indicator calculation**

This indicator is based on the official GHG inventories submitted by the EEA countries to the EEA, as well as on the projected GHG emissions submitted by the Member States under the Regulation (EU) 2018/1999 on the governance of the energy union and climate action. The EU GHG inventory submitted by the EU to the UNFCCC is based on the same data and is also used. The estimation of historical emissions from international aviation and maritime sectors for the total greenhouse gas emissions (target scope) relies on data derived from the JRC Idees methodology [3]as documented in the JRC methodological paper [4].

The EU ETS emissions, as reported to the European Commission by operators of industrial installations and aircrafts, are also used. When available, approximate estimates of the GHG emissions for the year (X-1) are also presented.

**Greenhouse gases**

In line with the UNFCCC reporting guidelines on annual inventories, the national inventories cover emissions and removals of the following GHGs:

- carbon dioxide ($CO_2$), including indirect $CO_{2;}$

- methane ($CH_4$);

- nitrous oxide ($N_2O$);

- hydrofluorocarbons (HFCs);

- perfluorocarbons (PFCs);

- suphur hexafluoride ($SF_6$); and

- nitrogen trifluoride ($NF_3$)

from six sectors (Energy, Industrial processes and product use, Agriculture, LULUCF, Waste and Other).

The gases do not include the GHG emissions that are also ozone-depleting substances, which are controlled by the Montreal Protocol.

In order to be aggregated, non-$CO_2$ gases are weighted by their respective global warming potential (GWP) and presented in $CO_2$-equivalent units. Global warming potential (GWP) is a measure of how much a given mass of a GHG is estimated to contribute to global warming on a 100-year horizon.

Consistent with the latest Decision on the UNFCCC Reporting Guidelines adopted at COP27 in Sharm-El-Sheik, the GWP values used in this indicator are the ones from IPCC AR5:

| Gas | Global warming potential values from IPCC AR5 |
|---|---|
| Carbon dioxide ($CO_2$) | 1 |
| Methane ($CH_4$) | 28 |
| Nitrous oxide ($N_2O$) | 265 |
| Sulphur hexafluoride ($SF_6$) | 23,500 |
| Nitrogen trifluoride ($NF_3$) | 16,100 |

HFCs and PFCs comprise a large number of different gases that have different GWPs. The full list of GWPs can be found in Chapter 8 of the 5th Assessment Report.

**Greenhouse gas inventories**

For the preparation of their national inventories, countries use the methodologies of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

**Projected greenhouse gas emissions**

For projected GHG emissions, information submitted by the EEA countries under the Governance Regulation is used, with the latest submission in March 2023. The projected GHG emissions referred to in the indicator are those reported under the 'with existing measures' scenario (WEM) and the 'with additional measures' scenario (WAM).

**Emission trading system emissions**

Emissions from the EU ETS are also presented in the indicator. The EU ETS runs over three trading periods: Phase I (2005-2007), Phase II (2008-2012) and Phase III (2013-2020).

In 2013, the scope of the EU ETS was expanded to include additional references to (a) the capture, transport and geological storage of GHG emissions; (b) $CO_2$ emissions from petrochemical, ammonia and aluminium production; (c) $N_2O$ emissions from the production of nitric, adipidic and glyoxylic acids; and (d) PFC emissions from aluminium production. Since 1 January 2012, aviation has also been part of the EU ETS.

Since 2013, these emissions have been calculated by the plant operators that fall under the ETS obligations in line with Regulation No 601/2012 [5], whereas in Phase II of the EU ETS (2008-2012), the monitoring and reporting of the operators was based on Commission Decision 2004/156/EU. Croatia entered the EU ETS on 1 January 2013.

**Approximated greenhouse gas inventory**

Finally, this indicator uses data and estimates from the 'Approximated GHG inventory' for the year (X-1). These 'proxy' inventories are reported by Member States to the EEA and to the Commission under the Governance Regulation by 31 July of each year, X, and are calculated at an aggregated level on the basis of the national and international information available for the year (X-1).

**Methodology for gap filling**

**Greenhouse gas inventories (years 1990-(X-2)):**

The historic emission data presented in the indicator are based on the information reported by Member States under the Governance Regulation. However, should a Member State not submit the inventory data required to compile the EU inventory, the Commission shall prepare estimates to complete the GHG inventories submitted by Member States in consultation and close cooperation with the Member States concerned. In this case, the Member State shall use the gap-filled inventory in its official submission to the UNFCCC. The basis for these gap-filling processes is described in the Commission Delegated Regulation of 12.03.2014 (http://ec.europa.eu/clima/policies/g-gas/monitoring/docs/c_2014_1539_en.pdf )

**Projected greenhouse gas emissions (year X–2050):**

In order to ensure the timeliness, completeness, consistency, comparability, accuracy and transparency of the reporting of projections by the EU and its Member States, the quality of the reported projections is assessed by the ETC CM on behalf of the EEA. As the Member States' reporting of projections is carried out every two years by countries, in certain cases, projections are adjusted to ensure full consistency with historic GHG emission data from the latest GHG inventories. Where a country has not made a submission, data are gap-filled by the ETC CM.

**Approximated greenhouse gas inventory (year X-1):**

Under the Governance Regulation, the Commission shall also estimate a Member State’s approximated GHG inventory if the Member State does not provide it. These estimates are provided by the EEA and are country-specific. More information on the methodology used for gap-filling is provided in the 'Approximated GHG inventory report' of each year.

**Methodology references**

- Annual European Union greenhouse gas inventory and inventory report. All the data used to prepare the indicator are consistent with the latest EU GHG national inventory report (NIR). The main institutions involved in the compilation of the EU GHG inventory are the Member States, the European Commission’s Directorates-General Climate Action (DG CLIMA), Eurostat, the Joint Research Centre and the European Environment Agency (EEA) and its European Topic Centre on Air Pollution and Climate Change Mitigation

(ETC CM). This report is compiled on the basis of the inventories of the EU Member States for the EU-27. The EU GHG inventory is the direct sum of the national inventories.

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories The 2006 IPCC Guidelines for National Greenhouse Gas Inventories are the latest step in the IPCC development of inventory guidelines for national estimates of GHGs. These 2006 Guidelines build on the previous Revised 1996 IPCC Guidelines and the subsequent Good Practice reports. They include new sources and gases as well as updates to the previously published methods whenever scientific and technical knowledge have improved since the previous guidelines were issued. Since 2015, UNFCCC Parties are using the 2006 IPCC Guidelines' methodologies and reporting formats when preparing their inventories, in line with the UNFCCC reporting guidelines (Decision 24/CP.19).
- UNFCCC reporting guidelines on annual inventories This document contains the complete updated UNFCCC reporting guidelines on annual inventories for all inventory sectors.
- Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The regulation sets out the rules for the monitoring and reporting of ETS emissions by plant operators, covering the scope of Phase III of the ETS.
- IPCC Fifth Assessment Report (AR5) At regular intervals, the (IPCC) prepares comprehensive Assessment Reports of scientific, technical and socio-economic information relevant for the understanding of human induced climate change, the potential impacts of climate change and options for mitigation and adaptation. Currently used GWP are based on the AR5.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It contributes mainly to monitoring aspects of the 8th EAP priority objective Article 2a. that shall be met by 2030: ‘swift and predictable reduction of greenhouse gas emissions and, at the same time, enhancement of removals by natural sinks in the Union to attain the 2030 greenhouse gas emission reduction target as laid down in Regulation (EU) 2021/1119[6], in line with the Union’s climate and environment objectives, whilst ensuring a just transition that leaves no one behind;’[7]. For the purposes of the 8th EAP monitoring framework, this indicator assesses specifically whether the EU will ’reduce net GHG emissions by at least 55% by 2030 from 1990 levels’ [7]. This year’s projections may not fully reflect the current efforts by Member States to meet some of the measures under the Fit for 55 package that were adopted in the course of 2023 [8]. The modelling results presented by the European Commission in its impact assessments for the Fit for 55 package of legislative proposals indicate an expected full achievement of the 2030 target if strengthened policies are implemented across the sectors.

The UNFCCC sets an ultimate objective of stabilising GHG concentrations 'at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.' The 2015 Paris agreement clarifies that the overarching goal is to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels.” The European Union, as a party to the UNFCCC and the Paris Agreement, reports annually on the GHG emissions within the area covered by its Member States. The Annual European Union greenhouse gas inventory and inventory report, officially submitted to the UNFCCC Secretariat, is prepared on behalf of the European Commission (DG CLIMA) by the EEA and its European Topic Centre for Climate Change Mitigation (ETC CM), supported by the Joint Research Centre and Eurostat.

The EU is committed to reduce its GHG emissions and has taken several steps over the past decades:

In 2007, EU leaders set the target of a 20% reduction of EU GHG emissions by 2020 compared with the emissions in 1990. To attain this goal, a comprehensive legislative package known as the **EU 2020 Climate and Energy Package** was introduced. This package encompassed not only climate objectives but also a commitment to substantially expand renewable energy sources and enhance energy efficiency. To fulfill the climate objectives, a twofold legal framework was put in place:

- The implementation of a cap-and-trade system with the EU Emissions Trading Scheme (EU ETS) for regulating emissions from energy-intensive industries and the power sector. In this framework, the emission cap for 2020 was set at a 21% reduction compared to 2005 levels.
- An effort to reduce emissions not covered by the EU ETS by about 10% compared with 2005 levels, shared between the EU Member States through differentiated annual national GHG targets under the ESD.

The **European Climate Law**, published in 2021, sets the trajectory towards 2050 and beyond, with the target to reduce GHG emissions in the EU by at least 55% by 2030, and to achieve climate neutrality at the latest by 2050, with the aim of to achieve negative emissions thereafter. Contrary to the 2020 target, both targets also account for emissions and removals of the land use, land use change and forestry sector and are therefore net targets. In line with the European Climate Law, the European Commission will make a legislative proposal, as appropriate, for a Union-wide 2040 climate target within 6 months of the global stocktake under the Paris Agreement in November 2023.

Towards **2030, the 'Fit for 55' legislative" package**, a key element of the European Green Deal, sets the EU on a path to reach its climate targets in a fair, cost-effective, and competitive way. It builds on the previous 2020 energy and climate framework, but also includes many new policy instruments and targets that incentivize climate action across all sectors of society. In the area of climate mitigation, the key targets of the package are:

- The revised EU ETS Directive increases the ambition of the existing ETS to 62% emissions reductions by 2030, compared to 2005 levels, and will also apply to international maritime transport.
- For the sectors not covered by this ETS system, namely road and domestic maritime transport, buildings, agriculture, waste and small industries, a global reduction target of 40% compared with 2005 levels is set through the amended Effort Sharing Regulation (ESR). This target is shared between the EU Member States through differentiated annual national GHG targets, ranging from -10% to – 50%.
- The LULUCF regulation sets an overall EU-level objective of 310 Mt $CO_2$ equivalent of net removals, with national targets for each Member State

In addition to these key policies, a new emissions trading system (ETS2) will be introduced from 2027 onwards. ETS2 will cover emissions from fuel combustion in road transport, buildings, and other sectors, contributing to a 42% reduction in emissions compared to 2005 levels within these sectors. These emissions will also be subject to the Effort Sharing Regulation.

**Related policy documents**

State of the Energy union Report 2024

Report from the Commission to the European Parliament, the Council and the European Economic and Social Committee and the Committee of the Regions. State of the Energy Union Report 2024 (pursuant to Regulation (EU)2018/1999 on the Governance of the Energy Union and Climate Action)

EU Climate Action Progress Report 2024

Report from the Commission to the European Parliament and the Council

- Regulation (EU) 2021/1119( ‘European Climate Law’)

Regulation of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality

- Consolidated text of the Regulation (EU) 2018/1999 (Governance Regulation)

Regulation of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action

- Consolidated text of Regulation 2018/842, as amended by Regulation (EU) 2023/857 (Effort Sharing Regulation)

Regulation on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement

- Consolidated text of Directive 2003/87/EC as last amended by Directive 2023/959 (ETS Directive)

Directive of the European Parliament and of the Council establishing a system for greenhouse gas emission allowance trading within the Union,

- Consolidated text of Regulation (EU) 2018/841, as last amended by Regulation 2023/839 (LULUCF Regulation)

Regulation of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework

- Consolidated text of Commission Implementing Decision (EU) 2020/2126, as last amended by Commission Implementing Decision (EU) 2023/1319

Decision on setting out the annual emission allocations of the Member States for the period from 2021 to 2030 pursuant to Regulation (EU) 2018/842 of the European Parliament and of the Council

- Kyoto Protocol to the UN Framework Convention on Climate Change

Kyoto Protocol to the United Nations Framework Convention on Climate Change; adopted at COP3 in Kyoto, Japan, on 11 December 1997

- Paris Agreement

The Paris Agreement. Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 11 December 2015.

- European Green Deal

- UNFCCC

UNFCCC reporting guidelines on annual inventories

**Accuracy and uncertainties**

**Methodology uncertainty**

**Greenhouse gas inventories**

(a) Difference in methodologies between countries

Since Member States use different national methodologies, national activity data or country-specific emission factors in accordance with IPCC and UNFCCC guidelines, these different methodologies are reflected in the EU GHG inventory data. The EU believes that it is consistent with the UNFCCC reporting guidelines and the 2006 IPCCC guidelines to use different methodologies for one source category across the EU territory, especially if this helps to reduce the uncertainty and improve the consistency of the emission data, provided that each methodology is consistent with the 2006 IPCC guidelines. At the same time, the EU is making an effort to promote and support the use of higher tier methodologies across Member States. At the EU level, and for most of the key categories of the EU inventory, more than 75% of the EU emissions are calculated using higher tier methodologies, resulting in lower uncertainty rates.

(b) Global warming potential

According to the IPCC, the GWP values used in the IPCC AR4 have an uncertainty of ±35% for the 5-95% (90%) confidence range.

**Projected greenhouse gas emissions**

The methodology proposed consists of simple additions of data reported by Member States. However, uncertainty arises from the following:

- projections can be subject to updates that might not be reflected in the assessment if these updates were recently developed;
- the projections taken into account are fully consistent with Member State submissions under the Governance Regulation. However, other sets of projections with different data might have been published by countries (e.g. national allocation plans, national communications to the UNFCCC).

Several countries carry out sensitivity analyses on their projections.

**Approximated greenhouse gas inventory**

The uncertainty ranges estimated in the approximated GHG inventories are derived by comparing the official national data submitted to the UNFCCC in year X with the proxy estimates of the same year. The uncertainty for the approximated emissions at the EU level is estimated as the weighted mean of the differences described: weighted again by the relative contribution that each Member State makes to total EU-27 emissions. More details about these methodologies are provided each year in the 'Approximated GHG inventory report'.

**Data sets uncertainty**

The 2006 IPCC Guidelines provide approaches on how Parties should estimate uncertainties, suggesting different values for the uncertainty of activity data and emission factors for most of the emission source categories. On the basis of this guidance, EU Member States and other EEA countries perform their own assessment of the uncertainty of reported data and provide an uncertainty analysis in the National Inventory Report to account for uncertainty per source category, as well as the total uncertainty of their national inventory.

Section (1.6) of the annual EU GHG inventory report considers the uncertainty evaluation, describing the methodology used to estimate it. The results suggest that the uncertainty level in the EU is about 5% for total GHG emissions (including LULUCF).

Total EU-27 GHG emission trends are likely to be more accurate than individual absolute annual emission estimates, because the annual values are not independent of each other. The IPCC suggests that the uncertainty in total GHG emission trends is approximately 4-5%. For the EU, the trend uncertainty is estimated to be close to 1%. Total GHG emission estimates are quite reliable and the limited number of interpolations used to build the indicator do not introduce much uncertainty at the EU level.

Uncertainties in the projections of GHG emissions can be significant but have not been assessed.

**Data sources and providers**

- Approximated estimates for greenhouse gas emissions, 2023, European Environment Agency (EEA)
- National emissions reported to the UNFCCC and to the EU under the Governance Regulation, April 2024, European Environment Agency (EEA)
- Member States' greenhouse gas (GHG) emission projections 2024, European Environment Agency (EEA)
- Greenhouse gas emissions under the Effort Sharing Legislation, 2005-2023, European Environment Agency (EEA)
- European Union Emissions Trading System (EU ETS) data from EUTL, v1.1 Jul. 2024, European Environment Agency (EEA)

## Metadata

**DPSIR**

Pressure

**Topics**

# Climate change mitigation

**Tags**

# CLIM050 # Climate # Progress to target # Energy # Greenhouse gases # climate change mitigation # Trends # Projections # Energy efficiency # Renewable energy # 8th EAP

**Temporal coverage**

1990-2050

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France

Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Performance indicator (Type B - Does it matter?)

**UN SDGs**

SDG13: Climate action

**Unit of measure**

This indicator expresses GHG emissions in 'million tonnes of $CO_2$ equivalent' ($MtCO_2e$).

**Frequency of dissemination**

Every 2 years

## References and footnotes

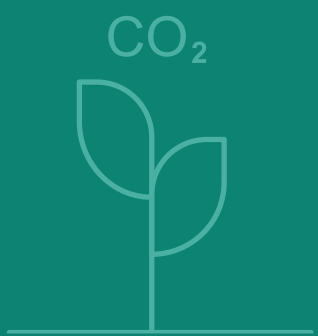
1. In the previously published indicator, all net GHG emissions (including Land Use, Land Use Change, and Forestry) and emissions from international aviation based on bunker fuels were accounted for. This year, the scope (EU target scope) more closely aligns with that of the European Climate Law. In addition to net GHG emissions from within the EU, it now includes portions of emissions from international aviation and maritime transport, as regulated by EU law. ↩
2. EEA, 2020, *Trends and drivers of EU greenhouse gas emissions*, EEA Report, 3/2020, European Environment Agency. ↩
3. JRC: Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., 2024, *JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation*, Joint Research Centre, Luxembourg. ↩
4. JRC, 2024, *Aligning historical international aviation and maritime transport data to the scope of EU climate policies*, Joint Research Centre, Luxembourg. ↩

5. EU, 2018, Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012
↩
6. EU, 2021, Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality (OJ L 243, 9.7.2021, p. 1–17).
↩
7. EC, 2022, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives
a b
8. EEA, 2023, *Trends and Projections in Europe 2023*, Publication, 07/2023,
↩

European Environment Agency

# 8th Environment Action Programme

## Greenhouse gas emissions from land use, land use change and forestry in Europe




8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

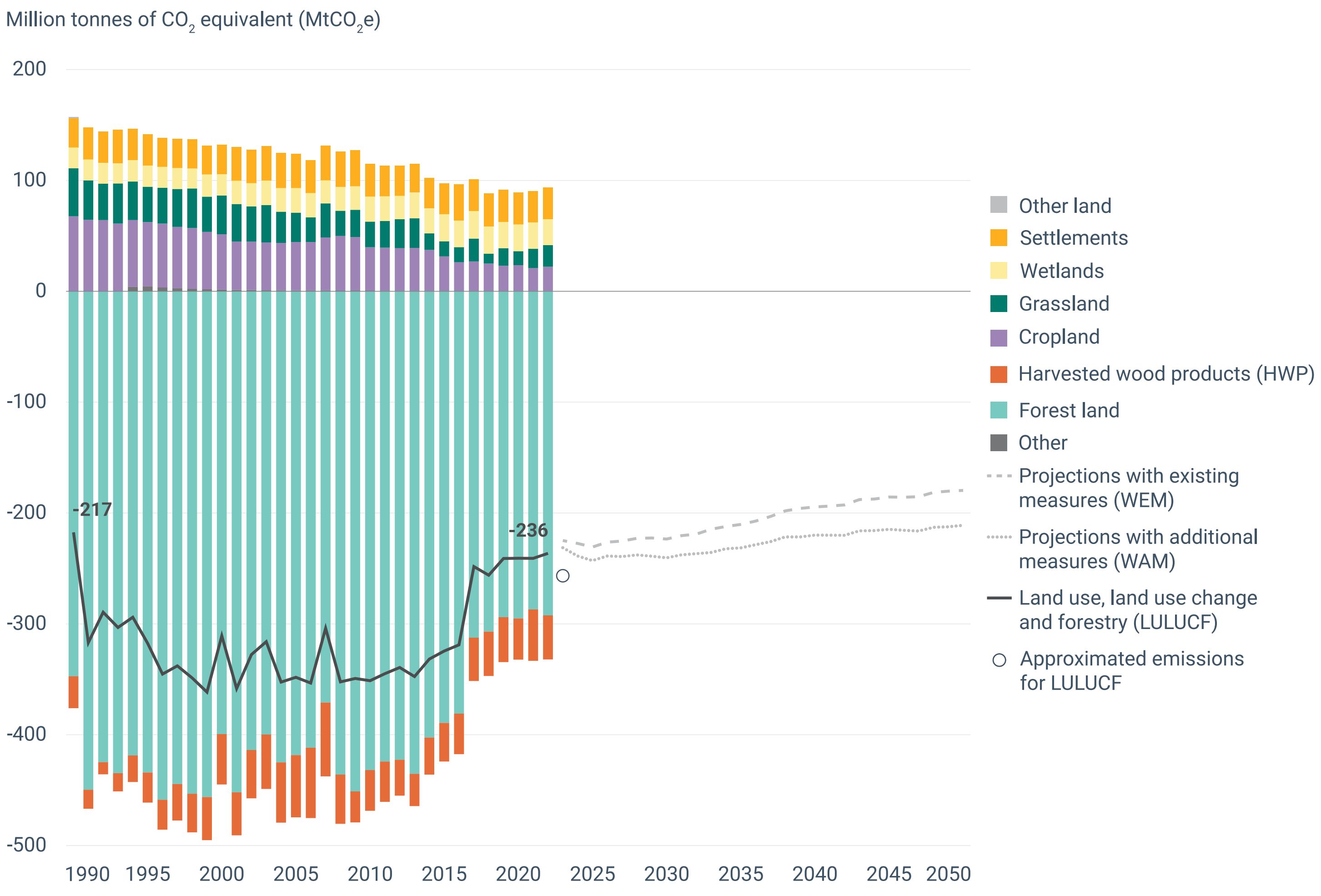
# Greenhouse gas emissions from land use, land use change and forestry in Europe

Published 31 Oct 2024



The land use, land use change and forestry (LULUCF) sector plays a key role in achieving the European Union's goal of zero net emissions by 2050. LULUCF activities removed net 236 million tonnes of $CO_2$ equivalent ($MtCO_2e$) from the atmosphere in 2022, equal to 7% of the EU's annual greenhouse gas emissions. Removals are estimated to have grown to 257$MtCO_2e$ in 2023. The LULUCF Regulation sets an EU-level net removal target of an additional 42$MtCO_2e$ by 2030, as compared to the 2016-2018 average. Based on Member State projections submitted, this target will not be met. Projections that include planned additional measures foresee a reduction in removals compared with the 2016-2018 average. The 2024 update of National energy and climate plans is expected to contribute to bridging the gap toward the target.

## Figure 1. EU emissions and removals of the LULUCF sector by main land use category



The EU aims to be **climate neutral** by 2050, as set out in the European Climate Law. Achieving this depends on reducing greenhouse gas emissions, and on increasing $CO_2$ removals from the atmosphere. The land use, land use change and forestry (LULUCF) sector has the potential to contribute by removing $CO_2$ from the atmosphere.

The LULUCF Regulation[1] sets an EU-level **net removal target** of an additional 42Mt$CO_2$e by 2030 as compared to the 2016-2018 average. In 2024, this is reported to be removals of 274Mt$CO_2$e. In 2022, the EU's LULUCF sector accounted for the net removal of 236Mt$CO_2$e, equal to 7% of the EU's total greenhouse gas emissions and it is estimated to account for 257Mt$CO_2$e in 2023. Overall, removals have decreased in the past 10 years, mainly as a result of increased harvesting of wood and lower sequestration of carbon by ageing forests.

Natural disturbances (e.g. wind throws, forest fires, droughts) cause inter-annual variations, and their increasing frequency has been negatively affecting long-term trends. A decreased rate of net forest area gain has also contributed to the **reduction** in removals. Cropland, grassland, wetland and settlements are sources of LULUCF emissions at EU level. Soils containing large proportions of organic matter (mainly peat) account for a large proportion of these emissions, although such "organic soils" are only found in wetter and colder parts of Europe.

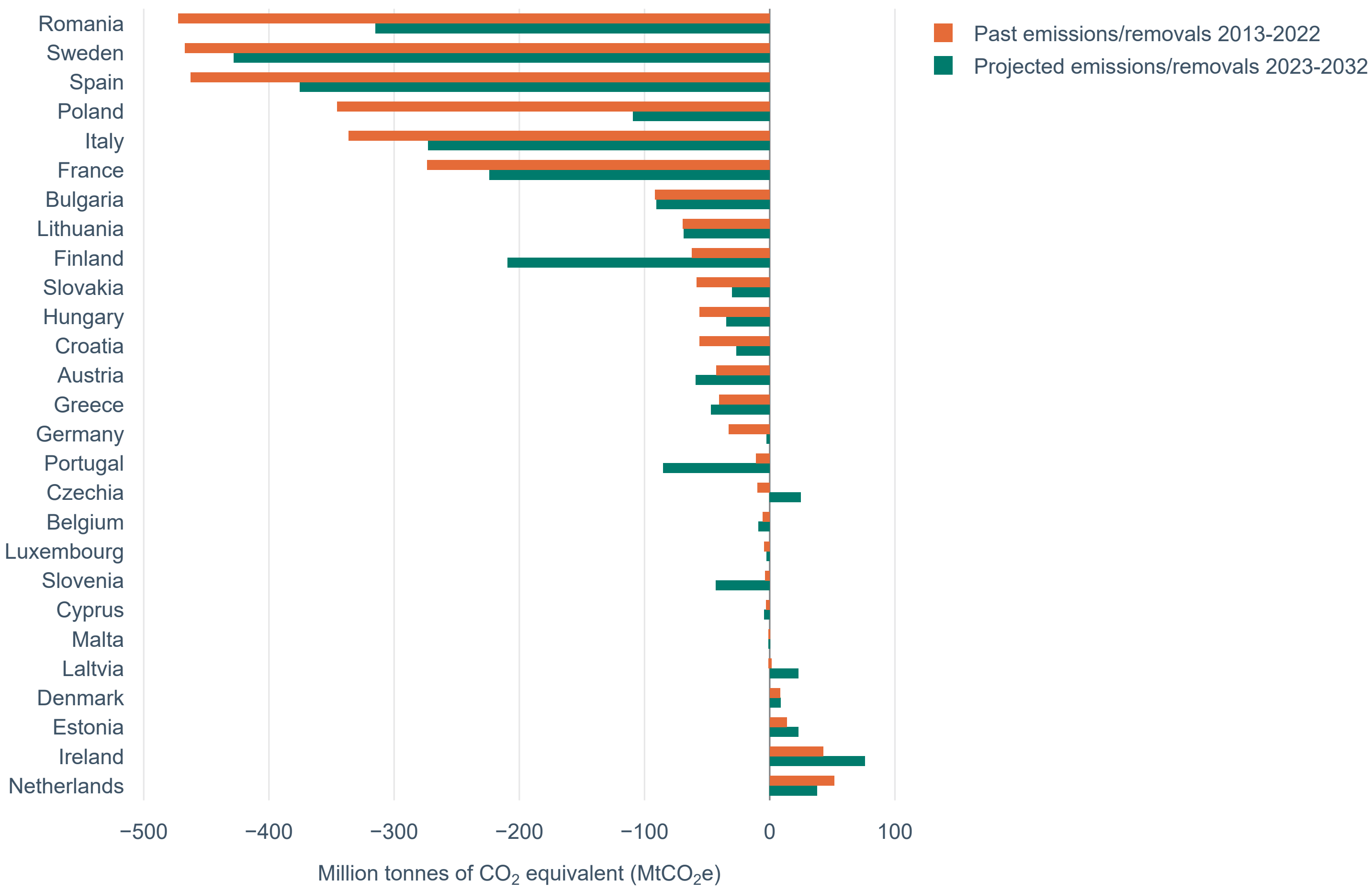
Member State projections submitted in 2023 and 2024 suggest that net removals will decrease at EU level, from an average of 315Mt$CO_2$e per year in 1990-2021 to 206Mt$CO_2$e in 2022-2050 with existing measures. Additional measures reported by Member States are expected to increase average net removals in 2022-2050 (by 10% compared to existing measures scenario). Projections show that 2030 net removals of 224Mt$CO_2$e are expected with existing measures and 240Mt$CO_2$e with planned additional measures. This means at present, the EU is **not on track** to meet the 2030 net removal target of additional 42Mt$CO_2$e compared to the 2016-2018 average.

The combination of less carbon sequestration in forests as they age, increased harvesting levels, faster decomposition of dead organic matter in ecosystems driven by higher temperatures and other climate change impacts make it challenging to increase carbon stocks and **reverse the current trend.**

Discounting preliminary 2023 data, the last 10-year trend has consistently pointed in the **wrong direction**. There is, therefore, a need to both reverse the trend as well as to accelerate in the right direction. This requires significantly more ambitious removal measures to be implemented in the coming years.

**Measures** with additional mitigation potential are increased afforestation, decreased deforestation, improved forest management, reduced harvesting levels, rewetting of drained soils with a high carbon content such as peatlands, improved crop rotation and improved grassland management. The challenge for many measures is the time lag between when a mitigation measure is implemented and the results.

## Figure 2. Comparison of cumulative historical and projected LULUCF emissions and removals per Member State




Among the EU Member States, Romania, Sweden, Spain, Italy, Poland, and France were responsible for the **largest** cumulative net removals from the LULUCF sector in the past 10 years, contributing to approximately 85% of the EU's LULUCF sink. Although these countries are expected to remain large contributors, all project a reduction in removals in the coming decade.

However, Austria, Belgium, Cyprus, Finland, Greece, Netherlands, Portugal and Slovenia project increasing cumulative removals in the next decade. The LULUCF sectors in Denmark, Estonia, Ireland, Latvia, Malta and the Netherlands were a **net source** of emissions in the past decade and are projected to remain so in the coming decade. Czechia which had net cumulative removals in the past decade is projected to have net emissions in the coming decade.

## Supporting information

### Definition

Land use categories

• Forest land: land areas covered by forests and woody vegetation as defined by the national forest definition. Forest land areas can be temporarily without trees if harvest or storms occurred and if trees will re-grow on this land area.

• Cropland: cropped land including orchards, vineyards or agro-forestry systems if the woody vegetation falls below the thresholds of the national forest definition.

• Grassland: rangelands, pastures or grassland. Woody vegetation on grassland is included if the woody vegetation falls below the thresholds of the national forest definition.

• Wetlands: areas covered or saturated by water for all or part of the year such as peatlands or water reservoirs.

• Settlements: areas with human settlements or infrastructure.

• Other lands: bare soil, rock, ice and land that does not fall in the other categories above.

$CO_2$equivalent. There are three greenhouse gases relevant for the LULUCF sector: carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). $CO_2$ equivalent is a common unit that allows these different gases to be added up based on their warming potential. Following the IPCC 5$^{th}$ Assessment report and as agreed for the Paris agreement, 1 tonne $CH_4$ = 28 tonne $CO_2$equivalent, 1 tonne $N_2O$ = 265 tonne $CO_2$equivalent and 1 tonne $CO_2$ = 1 tonne $CO_2$equivalent.

Organic soils and mineral soils. Organic soils are soils with a high carbon content while the rest is mineral soils. In the EU only 8% of the soils are organic soils according to the GHG inventories. Due to the higher carbon content, organic soils have generally higher emissions than mineral soils.

**Methodology**

## Methodology for indicator calculation

Historical and projected emissions estimates from all 27 EU Member States and aggregated for the EU-27 were obtained from the publicly available databases published by the EEA based on official submissions by the Member States.

For individual Member State emissions and removals, the cumulative 10-year LULUCF total for 2013-2022 and the projected 10-year LULUCF total for 2023-2032 for the 'with existing measures' scenario are shown.

The latest available version of the historical inventory and projected emissions were used to compile the indicator, but it should be noted that this may introduce slight inconsistencies between the historical and projected emissions, if projections for some Member States are not based on the latest inventory data submitted and recalculations have been made.

## Methodology for gap filling

No methodology for gap filling has been specified.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Programme (8$^{th}$ EAP). It contributes mainly to monitoring aspects of the 8$^{th}$ EAP priority objective Article 2a. that shall be met by 2030: 'swift and predictable reduction of greenhouse gas emissions and, at the same time, enhancement of removals by natural sinks in the Union to attain the 2030 greenhouse gas emission reduction target as laid down in Regulation (EU) 2021/1119[2], in line with the Union's climate and environment objectives, whilst ensuring a just transition that leaves no one behind;' (EU, 2022). For the purposes of the 8$^{th}$ EAP monitoring framework, this indicator assesses specifically whether the EU will 'increase net GHG removals by carbon sinks from the LULUCF sector to -310 million tonnes $CO_2$ equivalent by 2030' (EC, 2022).

**Accuracy and uncertainties**

No uncertainties have been specified.

**Data sources and providers**

- National emissions reported to the UNFCCC and to the EU under the Governance Regulation, April 2024, European Environment Agency (EEA)

## Metadata

**DPSIR**

State

**Topics**

# Climate change mitigation # Land use # Forests and forestry

**Tags**

# CLIM057 # 8th EAP # Land use # LULUCF # Land use change # Trends and projections

**Temporal coverage**

1990-2050

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Policy-effectiveness indicator (Type D)

**UN SDGs**

SDG13: Climate action

**Unit of measure**

Million tonnes of $CO_2$ equivalent ($MtCO_2e$)

**Frequency of dissemination**

Once a year

## References and footnotes


1. EU, 2023, Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review ↵
2. EU, 2021, Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1-17., Regulation (EU) 2021/1119 ↵

European Environment Agency

# 8th Environment Action Programme

## Economic losses from weather- and climate-related extremes in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

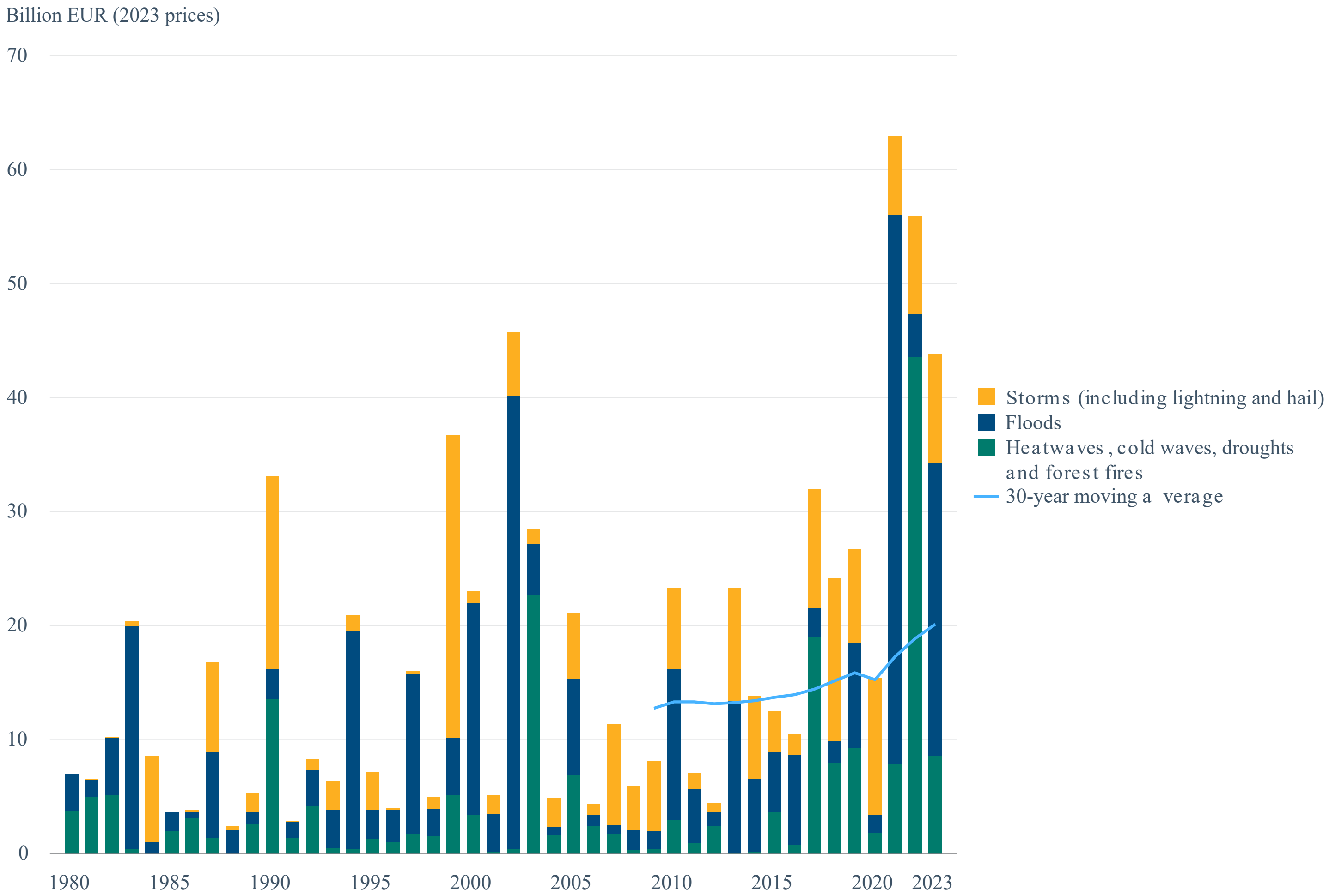
# Economic losses from weather- and climate-related extremes in Europe

Published 14 Oct 2024



Weather- and climate-related extremes caused economic losses of assets estimated at EUR 738 billion during 1980 - 2023 in the European Union, with over EUR 162 billion (22%) between 2021 and 2023. Analysing trends in economic losses is challenging, primarily due to large annual variability. Statistical analyses revealed, that economic losses increase over time and the last three years are all in the top five of years of highest annual economic losses. As severe weather- and climate-related extreme events are expected to intensify further, it seems unlikely that associated economic losses will reduce by 2030.

## Figure 1. Annual economic losses caused by weather-and climate-related extreme events in the EU Member States



Climate-related **hazards**, such as temperature extremes, heavy precipitation and droughts, pose risks to human health [1] and ecosystems and can lead to substantial **economic losses**[2]. These losses equally create pressures on public finances[3].

The 2021 EU Adaptation Strategy aims to build **resilience** and ensure that the EU is well prepared to manage these risks. It also adapts to the impacts of climate change. The EU aims, to ultimately reduce the overall monetary losses from weather- and climate-related events[4].

Between 1980 and 2023, climate-related **extremes** amounted to an estimated EUR 738 billion (2023 prices) in the EU. Hydrological hazards (floods) account for 44% and meteorological hazards (storms, including lightning and hail) for almost 29% of the total. For the climatological hazards, heat waves cause almost 19% of the total losses (but are responsible for 95% of the fatalities) while the remaining 8% are caused by droughts, forest fires and cold waves together.

Relatively few events are **responsible** for most of the economic losses: 5% of climate-related events with the biggest losses are responsible for 61% of losses, and 1% of the events cause 28% of losses. However, 66% of events with the smallest losses recorded total only 5% of the losses (calculations based on the original dataset). The total losses vary significantly from year to year. This interannual variability is due to the development of assets in vulnerable areas and potential reporting bias over time[5] and because most types of weather- and climate-related extremes across the world have become more severe and frequent as a result of human-caused climate change[6][7].

The average **annual** (constant 2023 EUR prices) economic losses were around EUR 8.5 billion in 1980-1989, 14.0 billion in 1990-1999, 15.8 billion in 2000-2009, 17.8 billion in 2010-2019 and 44.5 billion for the period 2020-2023. A statistical analysis of a 30-year moving average reveals that economic losses increased over time. A linear trendline through these 30-year averages represent a 53% increase from 2009 to 2023, or 2.9% per year[8].

The five years with highest annual values are:

- 2021 (EUR 63.0 billion);
- 2022 (56.0 billion);
- 2002 (45.7 billion);
- 2023 (43.9 billion);
- 1999 (36.7 billion).

The Intergovernmental Panel on Climate Change predicts that climate-related extreme events will become more frequent and severe around the world[9]. This affects multiple sectors and causes **systemic failures** across Europe, creating greater economic losses[10][11].

The first European Climate Risk Assessment concluded that **climate risks** are accelerating. Several of the 36 key climate risks are at critical levels and of high urgency. Climate-related extreme events are expected to intensify further and the adaptation pace is not following the same speed[12] . It seems unlikely, although uncertain, that the EU will be able to mitigate the impact of these events by building resilience and the associated economic losses will reduce by 2030.

The future cost of climate-related hazards depends on the frequency and severity of events and several other factors, such as the value of the assets exposed[13][10]and the effectiveness of the implemented climate adaptation measures. Studies show the **benefits of adaptation** measures, including nature-based solutions, to mitigate the impacts of weather- and climate-related extremes in Europe[14][15]. A comprehensive, integrated approach is required to adapt to and manage the risks, and develop strategies that deal with the remaining and residual risks not mitigated by adaptation measures.

Enhancing society's resilience to climate change through a focus to increasing **adaptive capacity** is key to the EU's adaptation strategy. If fully implemented the strategy, together with national regional and local strategies and plans, can contribute to limiting the economic costs of weather- and climate-related events and close the climate protection gap[16][17][18][19][20]. An example of such an activity coordinated by the European Commission is the Climate Resilience Dialogue[21].

## Figure 2. Economic losses and fatalities caused by weather - and climate - related extreme events (1980-2023) - per country

| Country | Total losses (Million EURO) | Loss per sq.km (EURO) | Losses per capita (EURO) | Insured losses (Million EURO) | Insured losses (%) | Fatalities |
|---|---|---|---|---|---|---|
| Austria | 14726 | 175564 | 1806 | 2786 | 19 | 771 |
| Belgium | 16988 | 553942 | 1612 | 6679 | 39 | 4693 |
| Bulgaria | 5168 | 46564 | 650 | 93 | 2 | 265 |
| Croatia | 4154 | 73402 | 943 | 101 | 2 | 910 |
| Cyprus | 441 | 47626 | 618 | 8 | 2 | 68 |
| Czechia | 18533 | 234974 | 1783 | 2168 | 12 | 716 |
| Denmark | 8751 | 203867 | 1618 | 5443 | 62 | 533 |
| Estonia | 332 | 7333 | 236 | 51 | 15 | 5 |
| Finland | 2380 | 7034 | 457 | 73 | 3 | 7 |
| France | 129897 | 203449 | 2092 | 46052 | 35 | 50461 |
| Germany | 180372 | 504438 | 2225 | 54759 | 30 | 104544 |
| Greece | 16350 | 124155 | 1548 | 849 | 5 | 4690 |
| Hungary | 10444 | 112291 | 1026 | 587 | 6 | 874 |
| Ireland | 3955 | 56542 | 965 | 541 | 14 | 68 |
| Italy | 133934 | 443373 | 2311 | 5916 | 4 | 21822 |
| Latvia | 1250 | 19348 | 544 | 71 | 6 | 88 |
| Lithuania | 2283 | 34976 | 690 | 58 | 3 | 103 |
| Luxembourg | 1262 | 486143 | 2694 | 627 | 50 | 170 |
| Malta | 51 | 162361 | 128 | 2 | 4 | 5 |
| Netherlands | 10970 | 293491 | 688 | 4297 | 39 | 3918 |
| Poland | 20630 | 66138 | 545 | 1379 | 7 | 2553 |
| Portugal | 16671 | 180755 | 1628 | 578 | 3 | 10339 |
| Romania | 19628 | 82335 | 916 | 199 | 1 | 1445 |
| Slovakia | 1956 | 39893 | 367 | 84 | 4 | 121 |
| Slovenia | 17484 | 862448 | 8693 | 271 | 2 | 321 |
| Spain | 95966 | 189662 | 2258 | 5243 | 5 | 32053 |
| Sweden | 3703 | 8276 | 406 | 957 | 26 | 44 |
| **EU-27** | **738280** | | | **139872** | | **241587** |
| | | | | | | |
| Iceland | 26 | 250 | 88 | 0 | 0 | 3 |
| Liechtenstein | 21 | 134250 | 653 | 10 | 48 | 0 |
| Norway | 4416 | 11486 | 950 | 3079 | 70 | 46 |
| Switzerland | 19893 | 481820 | 2685 | 7278 | 37 | 2309 |
| Turkey | 6896 | 8837 | 104 | 456 | 7 | 1855 |

The economic impact of climate-related extremes varies across the EU. In absolute terms, the **highest** economic losses in the period 1980-2023 were gauged in Germany, Italy and France. Highest losses per capita were reckoned in Slovenia, Luxembourg and Italy, and the highest losses per area (in $km^2$) were in Slovenia, Belgium, and Germany.

According to estimates, less than 20% of total losses were (privately) insured. This varied among countries, from less than 2% in Romania, Slovenia, Cyprus and Bulgaria to over 35% in Denmark, Luxembourg, Belgium, the Netherlands and France. There were significant **differences** between the types of events. For meteorological events, over one-third of the losses were insured. It was less than 15% for hydrological events and slightly over 10% for all climatological events, including heatwaves, droughts and forest fires.

The EU adaptation strategy aims to promote action at **national level**. All countries have a national adaptation policy[22][20]adopted using different instruments such as strategies and national, regional and sectoral plans, also laws with adaptation relevance reflecting differences in governance in between countries[20]. The Climate-ADAPT platform — developed by the European Commission and the EEA — supports action by sharing knowledge on climate change and its impacts, adaptation strategies and plans, and case studies.

No coherent mechanism is currently in place for countries to report losses to the European Commission or the EEA. This could be a key element under development as part of the implementation of the 'smarter adaptation' objective of the EU adaptation strategy.

## Supporting information

### Definition

This indicator considers estimated values for the number of fatalities, the overall and insured economic losses from weather- and climate-related events in the EEA member countries, i.e., in the 27 EU Member States and in Iceland, Liechtenstein, Norway, Switzerland and Türkiye. Focus of the indicator is on total economic losses for the EU-27. Further details are provided on the Climate-ADAPT dashboard presenting information on total economic losses, insured economic losses and fatalities for the EU-27 and for all member countries of the European Environment Agency per country, per year and per hazard type. Hazards considered are those classified as meteorological hazards, hydrological hazards and climatological hazards, based on the classification by the International Council for Science (ICSU)[23].

### Methodology

Data have been adjusted to account for inflation. They are presented in 2023 prices (Euro). The implicit GDP deflator is used as an economic metric that measures the price level changes of all new, final goods and services produced in an economy over a specific period, relative to the base year, including those that are not included in the consumer price index (CPI), such as investment goods and exports. As the CPI only reflects the price changes of a specific basket of goods and services that consumers purchase, the implicit GDP deflator is a more comprehensive measure of price changes than the CPI.

Definition of a loss event: the event can occur in several countries; events are counted by country and by year and type of natural hazard[24]. The 30-year moving averages are based on the value of the year and the 29 preceding years. The estimated annual increase over the period from 2009 to 2023 is based on a linear trendline determined with the least squares method[25].

The European Commission is working with Member States, the ISDR and other international organisations to improve data on disaster losses. The JRC, with the disaster risk management knowledge centre and the risk data hub, has prepared guidance for recording and sharing disaster damage and loss data, status and best practices for disaster loss data recording in EU Member States and recommendations for a European approach for recording disaster losses. Once comparable national databases on disaster losses are available for all EU Member States and EEA member countries and these data are reported, this EEA indicator can build on such data.

**Data sources & providers**

This assessment is based on the estimates provided by the RiskLayer CATDAT dataset (dataset url is not available) and the Eurostat collection of economic indicators, whereas data from earlier years not covered by Eurostat have been completed using data from the Annual Macro-Economic Database of the European Commission (AMECO), the International Monetary Fund's (IMF) World Economic Outlook (WEO), the Total Economy Database (TED) and the World Bank database.

Data are received from the RiskLayer CATDAT under institutional agreement.

## Methodology for gap filling

Data gap filling is not necessary.

**Policy/environmental relevance**

In February 2021, the European Commission presented the new EU Strategy on adaptation to climate change. One of the objectives is 'smarter adaptation', within which a key action is 'more and better climate-related risk and losses data'. This is further developed in the Staff Working Document, Closing the climate protection gap - scoping policy and data gaps[17] and in the activities of the Climate Resilience Dialogue, publishing its final report in July 2024 [21]. In 2024, the European Commission presented the Communication on Managing Climate Risks-Protecting People and Prosperity which sets out how the EU can effectively get ahead of the growing climate-related risks and build greater resilience to the impacts of climate change including to address economic losses. It responded to the first ever European Climate Risk Assessment Report.

Article 6 of the European Union Civil Protection Mechanism (2013) (EUCPM) obliges the EU Member States to develop risk assessments at national or appropriate sub-national levels and to make a summary of the relevant elements thereof[26]. The amendment of the EUCPM of March 2019 introduced joint reporting on national risk assessments, risk management capability assessments and information on the priority prevention and preparedness measures. This with a focus on key risks with cross-border impacts, and, where appropriate, low probability risks with a high impact.

The Sendai Framework for Disaster Risk Reduction (2015-2030), including 'Understanding disaster risk', requires that the signatory countries systematically evaluate, record, share and publicly account for disaster losses and understand the economic impacts at national and sub-national levels.

This indicator is an EU indicator for the sustainable development goals (SDGs, for SDG13 Climate) and a headline indicator for monitoring progress towards the 8th Environment Action Programme [27][4]. It contributes to monitoring aspects of the 8$^{th}$ EAP priority objective Article 2.2. b that shall be met by 2030: 'continuous progress in enhancing and mainstreaming adaptive capacity, including on the basis of ecosystem approaches, strengthening resilience and adaptation and reducing the vulnerability of the environment, society and all sectors of the economy to climate change, while improving prevention of, and preparedness for, weather- and climate-related disasters' [27]. The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor whether the EU is reducing the overall monetary losses from weather- and climate-related events [4].

**Targets**

No targets have been identified for this indicator.

**Accuracy and uncertainties**

No uncertainties have been specified.

**Data sources and providers**

- CATDAT (Dataset URL is not available), RiskLayer GmbH

## Metadata

**DPSIR**

Impact

**Topics**

# Climate change adaptation

**Tags**

# CLIM039 # 8th EAP # Climate losses insurance # Economic losses # Disasters # Natural hazards

**Temporal coverage**

1980-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Netherlands
Norway
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG13: Climate action, SDG1: No poverty

**Unit of measure**

Losses in Euros, million and billion Euros, 2023 prices, fatalities as absolute numbers.

**Frequency of dissemination**

Once a year

## References and footnotes

1. For details, see also the European Climate and Health Observatory (https://climate-adapt.eea.europa.eu/en/observatory). ↲
2. Geophysical hazards, like earthquakes and volcanoes are also natural hazards. As they are not seen as directly impacted by climate change, they are not included in this indicator. ↲
3. EC, 2022, *The fiscal impact of extreme weather and climate events: Evidence for EU countries*, Discussion Paper 168, European Commission, Brussels. ↲
4. EC, 2022, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives*, a b c
5. There is an increase of records per decade in the CATDAT data source from 378 for the period 1980-1989 to 836 for the decade 2010-2019 and already with 1311 records for the period 2020-2023 for the EU-27 countries. ↲
6. CarbonBrief, 2022, 'Mapped: How climate change affects extreme weather around the world', *Carbon Brief* ( https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world/) accessed September 1, 2023. ↲
7. XAIDA, 2024, 'Many devastating extremes in 2023 were amplified by Global Warming, XAIDA H2020 project Media briefing', ( https://drive.google.com/file/d/12mj4JDBHzzwKxVPtQKQtNV3qMEVoTDje/view?pli=1) accessed August 25, 2024. ↲
8. When expressing the impacts relative to the size of the economy exposed to these hazards, the increase in 30 year average GDP for the EU between 2009 and 2023 is half of the increase rate of the losses (based on an estimate using Worldbank data). Hence half of the increase in losses over this period can be linked to increased wealth and exposure and the losses have increased twice as fast as GDP. ↲

9. Seneviratne, S. I., Zhang, X., Adnan, M., Badi, W., Dereczynski, C., Di Luca, A., Ghosh, S., Iskandar, I., Kossin, J., Lewis, S., Otto, F., Pinto, I., Satoh, M., Vicente-Serrano, S. M., Wehner, M. and Zhou, B., 2021, 'Weather and climate extreme events in a changing climate', in: Masson-Delmotte, V., Zhai, P., Pirani, A., et al. (eds), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press.
↵

10. Bednar-Friedl, B., Biesbroek, R., Schmidt, D. N., Alexander, P., Børsheim, K. Y., Carnicer, J., Georgopoulou, E., Haasnoot, M., Cozannet, G. L., Lionello, P., Lipka, O., Möllmann, C., Muccione, V., Mustonen, T., Piepenburg, D. and Whitmarsh, L., 2022, 'Chapter 13: Europe', in: Pörtner, H. O., Roberts, D. C., Tignor, M., et al. (eds), *Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, pp. 1817–1927.
a b

11. CMCC, 2021, 'G20 Climate Risk Atlas: Impacts, policy, economics - European Union', *CMCC* ( https://files.cmcc.it/g20climaterisks/Eu27.pdf) accessed November 9, 2021.
↵

12. EEA, 2024, *European Climate Risk Assessment Executive summary*, EEA Report, 01/2024, European Environment Agency.
↵

13. Ranasinghe, R., Ruane, A. C., Vautard, R., Arnell, N., Coppola, E., Cruz, F. A., Dessai, S., Islam, A. S., Rahimi, M., Ruiz Carrascal, D., Sillmann, J., Sylla, M. B., Tebaldi, C., Wang, W. and Zaaboul, R., 2021, 'Climate change information for regional impact and for risk assessment', in: Masson-Delmotte, V., Zhai, P., Pirani, A., et al. (eds), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press.
↵

14. Dottori, F., Mentaschi, L., Bianchi, A., Alfieri, L. and Feyen, L., 2023, 'Cost-effective adaptation strategies to rising river flood risk in Europe', *Nature Climate Change* 13(2), pp. 196–202 ( https://www.nature.com/articles/s41558-022-01540-0) accessed April 4, 2023.
↵

15. Vousdoukas, M. I., Mentaschi, L., Hinkel, J., Ward, P. J., Mongelli, I., Ciscar, J.-C. and Feyen, L., 2020, 'Economic motivation for raising coastal flood defenses in Europe', *Nature Communications* 11(1), pp. 2119 ( http://www.nature.com/articles/s41467-020-15665-3) accessed July 13, 2020.
↵

16. The term 'climate protection gap' is used in reference to the share of non-insured economic losses in total losses after a wether- and climate-related extreme event. In recent years, it has also been used to refer to the notional gap between likely climate-related impacts and existing resilience measures (EC, 2021, p. 3).
↵

17. EC, 2021, Commission Staff Working Document — Closing the climate protection gap - Scoping policy and data gaps, SWD(2021) 123 final.
a b

18. EC, 2021, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Forging a climate-resilient Europe — the new EU strategy on adaptation to climate change', COM(2021) 82 final.
↵

19. EEA, 2022, *Advancing towards climate resilience in Europe —Status of reported national adaptation actions in 2021*, EEA Report, 11/2022, European Environment Agency.
↵

20. EEA, 2023, 'Is Europe on track towards climate resilience?  Status of reported national adaptation actions in 2023', ( https://www.eea.europa.eu/publications/national-adaptation-actions-of-2023).</div>
a b c

21. EC and Climate Resilience Dialogue, 2024, *Climate Resilience Dialogue Final Report*, European Commission, Brussels.
a b

22. EEA, 2020, *Monitoring and evaluation of national adaptation policies throughout the policy cycle*, 6/2020, Europeam Environment Agency (EEA), Copenhagen  Denmark.
↩

23. IRDR, 2014, *IRDR Peril Classification and Hazard Glossary*, Integrated Research on Disaster Risk.
↩

24. Chapgain, S., 2024, 'Natural disaster or natural hazard? Even experts interchangeably use these terms', ( https://english.onlinekhabar.com/natural-disaster-or-natural-hazard.html) accessed August 25, 2024.
↩

25. For the dataset 1980-2023, the trendline through 30-year moving average (2009-2023): y=0.4479(x-1979)-1.6548.
↩

26. EC, 2024, Report from the Commission to the European Parliament and the Council on progress on implementation of article 6 of the Union Civil protection Mechanism (Decision No1313/2013/EU) – Preventing and managing disaster risk in Europe, COM(2024) 130 final.
↩

27. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22–36.
a b

European Environment Agency

# 8th Environment Action Programme

## Drought impact on ecosystems in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

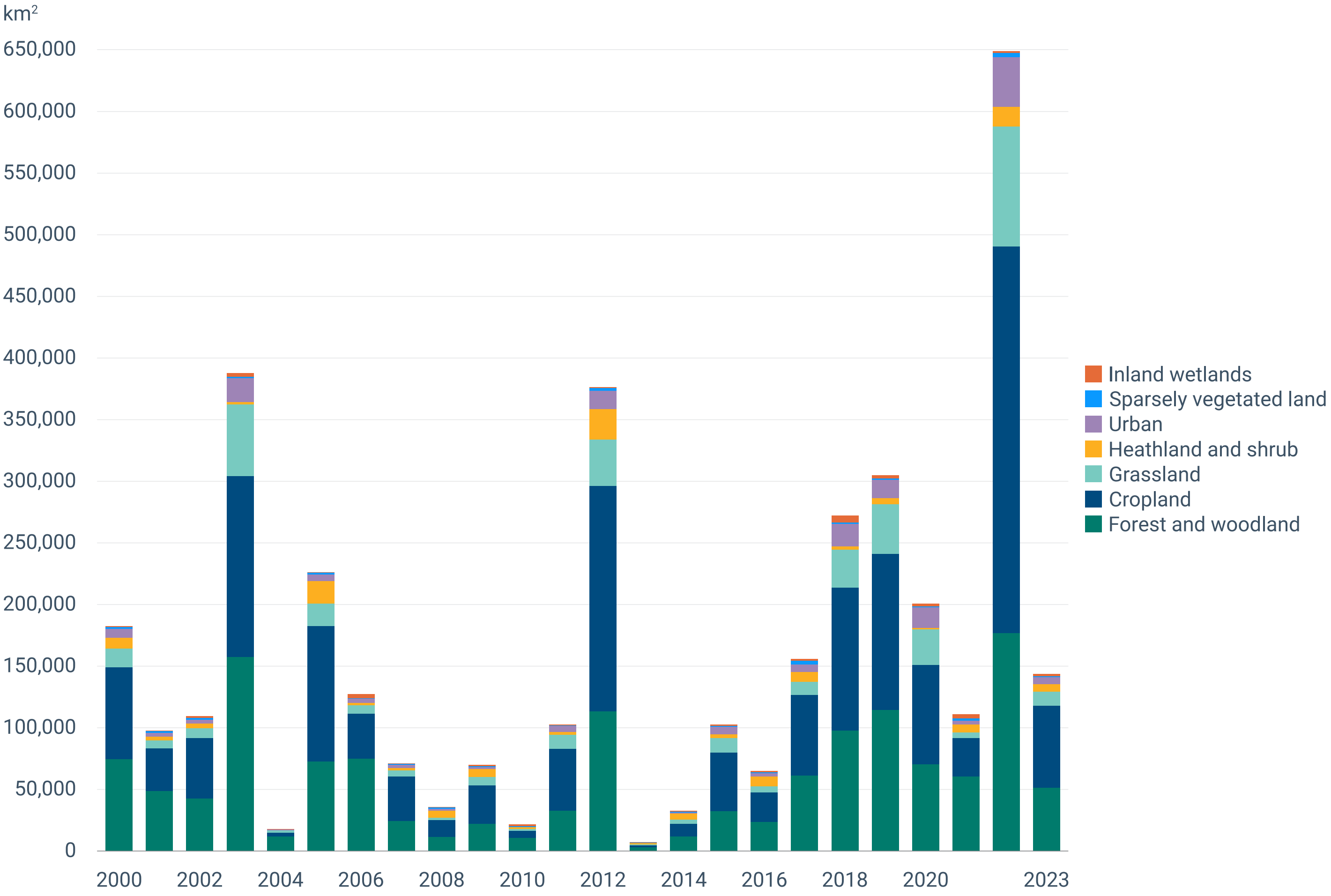
# Drought impact on ecosystems in Europe

Published 24 Oct 2024



The EEA's European Climate Risk Assessment concludes that Europe is the fastest-warming continent in the world. Monitoring impacts of meteorological droughts supports policy measures, targeting greenhouse gas removals and the adaptation of ecosystems to climate change. In 2023 drought impact on European ecosystems eased after the devastating previous year. The European Union aggregated drought impact area was 143,513 $km^2$, larger than the 2000-2020 long-term average drought impact. If global mitigation and EU and national adaptation strategies are not effectively implemented, drought impacts will increase.

## Figure 1. Area of drought impact on vegetation productivity in the EU-27




Droughts **hamper** nature's ability to deliver a wide range of environmental, social and economic benefits. They impact the EU's ability to achieve its climate change mitigation objective, influence adaptation and implement the EU biodiversity and soil strategies. Viable food production, sustainable management of natural resources and balanced territorial development, long-term objectives of the EU common agriculture policy, are also affected by drought.

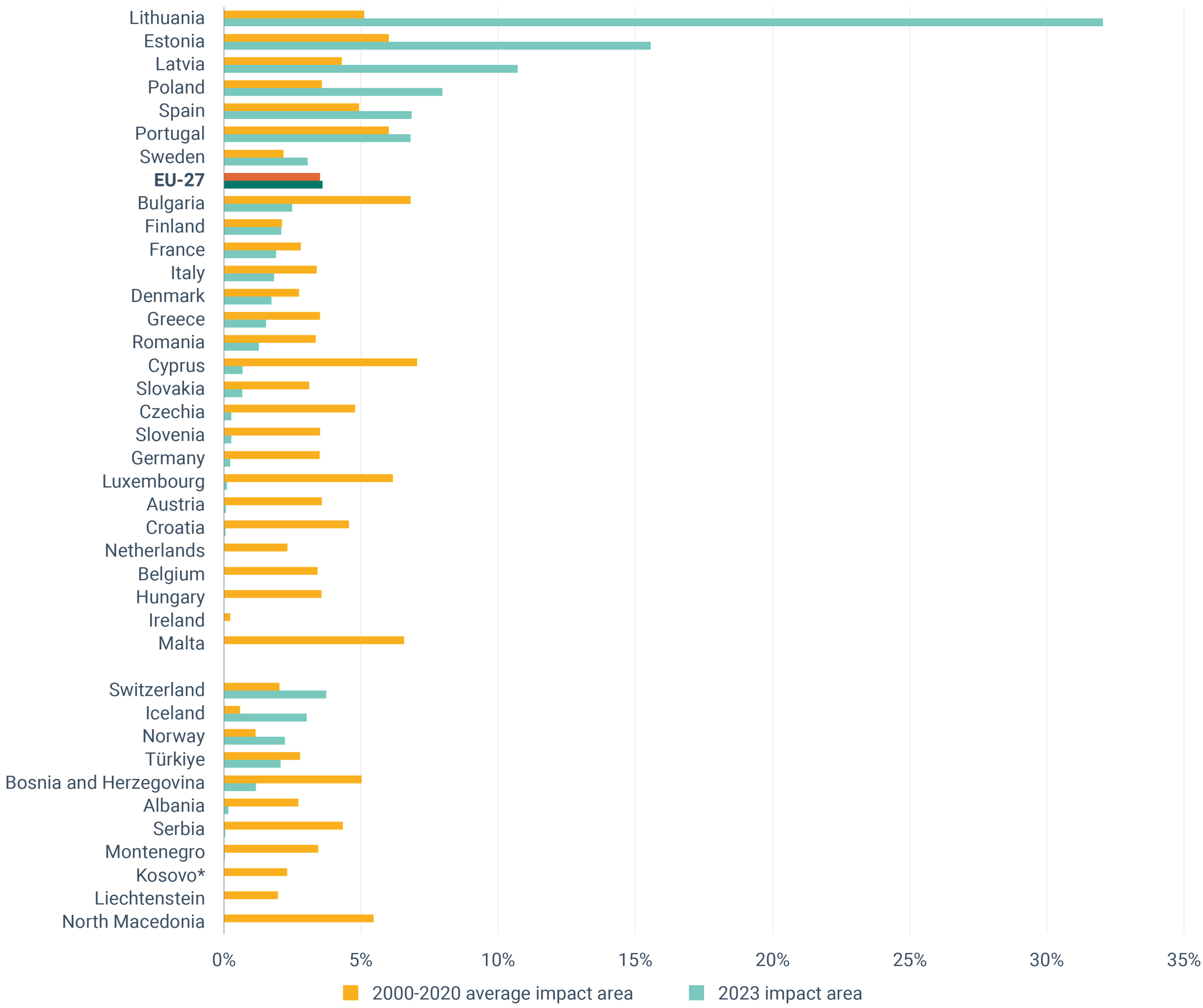
After the devasting drought in 2022, **drought impact** on European ecosystems eased in 2023. Excess precipitation at the end of summer counterbalanced the effects of soil moisture deficit and heatwaves over the spring and summer in many places[1]. The 2023 drought impacted area was 143,000 km$^2$. This is slightly above the average annual impact in the period 2000-2020 when ca. 141,229km$^2$ (3.5%) of EU land was affected by droughts. The annual extent of intense drought impacts in the EU shows an increasing trend (Figure 1) despite the 2023 recovery year.

EU-27 cropland area with lower-than-average vegetation productivity was almost 66,500 km$^2$ in 2023, hence above the 2000-2020 average impact (59,000 km$^2$, ca 4% of croplands). The drought impact of other land cover types was around or slightly lower than their 2000-2020 average impact, making **croplands** the main contributor for the 2023 drought impact. Forest vegetation productivity suffered with over 52,000km$^2$, larger than the area of Slovakia. Forests and woodlands sequester large amounts of carbon, but drought conditions slow this process that may jeopardise the EU's ambition of becoming climate neutral by 2050.

Grasslands and heathlands are among the **most biodiverse areas** in the EU, storing a large amount of carbon in the below ground biomass pool[2]. These two land cover types combined were impacted over an area of 18,000km$^2$ in 2023, just below the size of Slovenia. In absolute values, the 2023 impacted wetland area was only around 3% of the EU wetlands. Slightly more than the average, as well as the 2022 impacted area, and hence an increasing trend can also be observed here (dashboard).

By mid-century, the frequency and intensity of heatwaves and drought are **projected to increase** over most parts of Europe[3]. During 2000-2023, eight years showed above average drought impacted area, where five years were in the last 10 year period (dashboard). Based on the recurrent and increasingly strong drought events during the 24 year period, drought impacted areas may not decrease by 2030. It is therefore important that land management practices are adequately adjusted in a timely manner and that the EU and national adaptation strategies [4] are effectively implemented.

## Figure 2. Drought impact area during 2023 in comparison to the 2000-2020 average for the EEA-38 regions




Drought impacted **area** in most of the EU member countries remained much lower than or equal to the 2000-2020 average impacted area (Figure 2). The 2023 impact in the Baltic states is much larger than previous drought conditions in the EU region.

The most striking result was found in Lithuania, where 32% of the country endured less than average **vegetation productivity** compared to 5% of the country being impacted during 2000-2020. Drought impacted 16% of Estonia and 10% of Latvia in 2023. Both countries' long-term average impact was less than 10% of the territory. Northern Poland and the southern part of Portugal and Spain drought impact was also above the long-term average impacted area, yet remained below 10% of their territories.

When considering the **absolute impacted** areas in 2023, Spain had the largest territory under drought (34,000km$^2$), followed by Poland (24,000km$^2$) and Lithuania (20,000km$^2$). From the non-EU countries, Norway and Switzerland experienced drought impact in 2023 that exceeded the long-term average impact, yet in both cases, it was less than 4% of the territory. Turkiye was most affected by drought accounting for 16,000km$^2$.

## Supporting information

### Definition

The indicator only addresses droughts, hence the annual deficit in soil moisture due precipitation shortages. The indicator does not address hydrological droughts which occur when low water levels become evident in hydrological systems, especially in streams, reservoirs, and groundwater, usually after many months of meteorological drought.  The indicator monitors anomalies and long-term trends in vegetation productivity based on remote sensing observed time series data of vegetation indices in areas that are under pressure from soil moisture deficit.

Drought pressure is computed as soil moisture deficit within the growing season, using the Soil Moisture Index (SMI)10 time series of the Copernicus EMS European Drought Observatory of the European Commission Joint Research Centre (EDO, 2019).

Drought impact during the growing season is indicated as a severe negative annual productivity anomaly in drought-pressured areas, i.e. areas with negative annual soil moisture anomalies. Detailed indicator specifications are described under 'Methodology'.

**Methodology**

**Soil moisture deficit** is calculated at the pixel level by deriving z-score anomalies from the Soil Moisture Index, such as:

SMA = SMI-SMI**MN (2001-2020)**/SMI**SD (2001-2020)**, (Equation 1)

Where SMA is Soil Moisture Anomaly, MN is the 2001-2020 average SMA and SD is the 2001-2020 standard deviation of the SMI. The calculated SMA values are then averaged within the growing season to derive the SMA(gs) time series.

The aggregation is performed by averaging the monthly SMA values extracted from the EDO within the vegetation growing season. The vegetation growing season was defined by using the start and the end date of the growing period (SOS or Start of Season and EOS or End Of Season, respectively) extracted from the Medium Resolution Vegetation Phenology and Productivity product of the Copernicus Land Monitoring Service. The SOS and EOS datasets can be explored and downloaded from EEA's data repository under sdi.eea.europa.eu. Direct links to the datasets:

SOS:

https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/a7b2369b-dd62-4d02-99e2-e5d74a8ec83a

EOS:

https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/a3cfb2c4-156a-413c-a73b-15ebbb016557

**Annual drought pressure** is derived at the pixel level and is simply defined as:

SMA(gs) < -1, (Equation 2) .

Negative soil moisture anomalies indicate that the annual average availability of soil moisture for plants is lower than the long-term normal condition and drops to such a level that it might impact vegetation productivity.

To indicate **drought pressure area**, strong negative soil moisture anomalies are selected by setting a maximum value at -1 standard deviation (std). The drought pressure area is the sum of those grid cells within each analytical unit (see later), where the growing season aggregated SMA values are < -1. This threshold was selected to allow the monitoring of vegetation responses to only considerable soil moisture deficits. Choosing the threshold of -1 std follows the recommendations of the European Drought Observatory (EDO11) of the European Commission's Joint Research Centre. This approach is also followed in the EEA indicator addressing soil moisture deficit (EEA, 2021). By applying this threshold, drought impacts can better be distinguished from response in vegetation anomalies due to other environmental pressures such as e.g. wildfires, storms or insects infestations. As vegetation productivity decline may be also caused by anthropogenic impacts, pixels with land use change were excluded from the statistical population based on the Copernicus Corine Land Cover 2000-2018 accounting layers datasets.

The **drought pressure intensity** is defined as the annual, growing season aggregated SMA values where SMA < -1, where aggregation is performed by temporal and spatial averaging within analytical units (see later).

**Annual drought impact** is quantified as:

SMA(gs)<0 and LINTa<-0.5, (Equation 2) ,

where LINTa (lLarge Integral anomaly) refers to the 2000-2022 annual anomalies in growing season productivity derived from remote-sensing data and approximated using vegetation indices (see more explanation below).

The LINT anomalies were calculated as standard deviations from the long-term mean:

LINTa(year xi-n)=(LINT(xi)-LINT(LTA))/LINT(std)), (Equation 3)

Where xi-n indexes the time series (from i=2000 till n=2021), LINT(LTA) is the long term (using the background of 2000-2020) average of the LINT values and LINT(std) is the long term (using the background) standard deviation of the LINT values for the same period.

The threshold of a -0.5 standard deviation for the vegetation anomalies was selected to indicate small deviations from the long-term mean and to allow for moderate productivity levels under drought impact to be accounted for. In a Europe-wide study, this is a pragmatic solution that provides a wide overview of drought impact situations in Europe. However, local studies might consider setting a lower or higher threshold to reflect local conditions.

The drought impact area is the sum of those grid cells within each analytical unit (see below) where the growing season aggregated SMA values are < -1 and the LINT anomalies are < -0.5. The drought impact intensity is defined as the annual aggregated LINT anomalies where SMA < -1 and LINTa < -0.5. Aggregation is performed by temporal and spatial averaging within analytical units.

For the analytical units of this indicator the following datasets were combined:

1. Administrative boundaries, aligned with the Corine Land Cover: https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/08c0e074-4a98-4545-bd85-f58fe3f74d82
2. Environmental Zones:
3. https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/6ef007ab-1fcd-4c4f-bc96-14e8afbcb688
4. Corine Land Cover accounting layers 2000 and 2018:

https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/fa9bd2f5-8006-42e7-8090-7b9f9b09bf29 and

https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/5a5f43ca-1447-4ed0-b0a6-4bd2e17e4f4d.

1. MAES ecosystem types derived from the Corine Land Cover as Look Up Tables (can be distributed upon request).
2. Land cover flows:

https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search#/metadata/835d25e0-b9dc-4fb9-a8b6-f9e5336fa357 .

The combination of the above datasets resulted in analytical units with 2,700,000 records in the database, which is easy to handle with desktop computers.

**Vegetation productivity: LINT, or Large Integral**

In summary, vegetation productivity is derived from remote-sensing observed time series data of vegetation indices. The vegetation index used for the LINT index is the Plant Phenology Index (PPI) (Jin and Eklundh, 2014). The PPI is based on the MODIS Nadir BRDF-adjusted reflectance product (MODIS MCD43 NBAR). The product provides reflectance data for the MODIS 'land' bands (1-7), adjusted using a bidirectional reflectance distribution function. This function models values as if they were collected from a Nadir view to remove so-called cross-track illumination effects. The PPI is a new vegetation index optimised for the efficient monitoring of vegetation phenology. It is derived from radiative transfer solution using reflectance in the visible-red (RED) and near-infrared (NIR) spectral domains. The PPI is defined as having a linear relationship with the canopy green Leaf Area Index (LAI) and its temporal pattern is very similar to the temporal pattern of gross primary productivity (GPP) estimated by flux towers at ground reference stations. The PPI is less affected by the presence of snow than other commonly used vegetation indices such as the Normalized Difference Vegetation Index (NDVI) or the Enhanced Vegetation Index (EVI).

The product is distributed with a 500m pixel size (MODIS Sinusoidal Grid) with an 8-day compositing period. The large integral, or LINT, used in this indicator is the mathematical integral calculation of the smoothed and gap-filled PPI time series data between the start and end of the growing season points, being the SOS and EOS datasets described above.

All input data sets are derived with wall-to-wall coverage of the land surface of the EEA-38 region.

No gap filling was needed.

**Policy/environmental relevance**

The indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme. It contributes mainly to monitoring aspects of the 8th EAP priority objective Article 2.2.b that shall be met by 2030: ‘continuous progress in enhancing and mainstreaming adaptive capacity, including on the basis of ecosystem approaches, strengthening resilience and adaptation and reducing the vulnerability of the environment, society and all sectors of the economy to climate change, while improving prevention of, and preparedness for, weather- and climate-related disasters’ [5]. More specifically, and in accordance with the European Commission Communication on the 8th EAP monitoring framework, the indicator assesses whether the EU will ‘decrease the area impacted by drought and loss of vegetation productivity’ by 2030 [6].

**Justification for indicator selection**

Droughts are extreme climate events that are induced by temporary water deficits and may be related to a lack of precipitation, soil moisture, streamflow or any combination of the three taking place at the same time. Droughts can occur in most parts of the world, even in wet and humid regions, and can have profound impacts on agriculture, industry, tourism and ecosystems and the services they provide. In arid and semi-arid ecosystems (including the Mediterranean regions), limited water availability is a recurrent phenomenon and governs plant growth and phenology. On the other hand, in temperate and boreal regions, sporadic prolonged dry periods can lead to water-limited conditions and have far-reaching impacts on ecosystems’ carbon balance and structure. The immediate impacts of droughts within the growing season (i.e. a few weeks in duration) are, for example, lead to decline in crop production, pasture growth and fodder supplies from crop residues. Prolonged water shortages (e.g. of several months) may, among other things, potentially increase wildfire occurrences.

The monitoring and assessment of drought impacts are complex because they vary in their severity and often depend on the different phases of the given drought event. Differences in the physiological response of vegetation to water deficits cause differences in the sensitivity and resilience of terrestrial ecosystems to drought, and ultimately influence the types of impacts that droughts have, i.e. slow growth or reduced greenness, that lead to loss of biomass or may even result in plant mortality. Consequently, significant changes in vegetation productivity provide an indication/early warning of imminent impacts on ecosystems’ equilibrium states.

**Context description**

In June 2024, the EU adopted the Nature Restoration Law (3) which requires member states to restore at least 30% of habitats covered by legislation from a poor to a good condition by 2030, increasing to 60% by 2040, and 90% by 2050.

Droughts have an impact on the condition of ecosystems covered by the Nature Restoration law such as forests and grasslands and wetlands and might hamper reaching the restoration targets.

The EU Strategy on Adaptation to Climate Change (COM(2021) 82 final) sets out important objectives around mainstreaming adaptation across different policy areas. It shows the importance of healthy soils in minimising impacts of floods and droughts. Droughts negatively affect the adaptative capacity of agricultural ecosystems, the resilience of forest ecosystems and in urban ecosystems droughts indirectly affect the ability of green urban spaces to protect people against heatwaves.

The EU legislation for LULUCF as part of the 2030 climate target sets clear targets for the LULUCF sector for each Member States. The capacity of forests and other land uses to store and remove carbon from the atmosphere will depend on management as well as a number of natural circumstances. The latter include variations in growing conditions and droughts, which can have an important effect on reaching the national carbon removal targets of Member States by impacting the amount of carbon storge in ecosystems.

Targets

No specific targets.

**Accuracy and uncertainties**

Methodology uncertainty

The approach cannot account for all land use or land cover changes that have occurred within a pixel in the whole period of analysis. For example, clear cuts within forest ecosystems or the use of irrigation systems as part of management processes in agricultural areas might increase or decrease vegetation productivity independently of drought occurrences. This can introduce noise to the data sets that might further bias the assumed pixel-based relationships between drought pressure and vegetation productivity.

Another source of uncertainty is related to the simplification of the drought impact model for its implementation in the operational setting. On one hand, the same thresholds for deviations in soil moisture and vegetation production imply similar impacts/impact severity in different sectors (agriculture, forestry, etc), which gives an acceptable approximation on the continental scale but might need to be adjusted to local conditions. Still, in some cases, the start, end, severity and spatial extent of a drought, as well as the propagation of its impacts through the whole land systems, might change as a result of additional climate and/or surrounding biophysical conditions, such as temperature, snowpack, albedo and soil's water-holding capacity.

Lastly, insect infestations, wildfires and land use change, in most extreme case soil sealing will also reduce vegetation productivity. For the latter the analytics has excluded those grid cells with known land use change processes. Data on insect infestation are not available on the EU scale and wildfires will be included in the next version of the indicator. However, the analytics of anomalies for every 500m grid cells only retained those events where soil moisture deficit and negative vegetation anomalies occurred the same time and place. As vegetation productivity and soil moisture deficit have been shown to show a strong correlation, we think that the method is appropriate to indicate drought impact to an acceptable certainty.

Data set uncertainty

The datasets represent the average impact on the productivity of all terrestrial ecosystems within an area covered by a pixel of 500m×500m. Therefore, the indicator can be used at coarse resolution only, indicating drought impacts on main terrestrial ecosystems. As opposed to field measurements, remote-sensing products measure vegetation's light absorption from a satellite at a height of several hundred kilometres, which might introduce bias due to atmospheric disturbances.

In some land use types like e.g. in forestry, land management practices like e.g. clearing and thinning are practices that affect the measurements of vegetation productivity derived from satellite data. These measures are not captured by CORINE land cover and could therefore affect the results. Furthermore, the short vegetation period in the Nordic countries and high degree of cloudiness may potentially affect the results regionally.

Rationale uncertainty

No uncertainty has been identified.

**Data sources and providers**

- Medium Resolution Vegetation Phenology and Productivity: Large integral (raster 500m), Oct. 2022, European Environment Agency (EEA)
- EDO Soil Moisture Index (SMI) (version 2.1.3), European Drought Observatory (JRC)

## Metadata

**DPSIR**

Impact

**Topics**

# Agriculture and food   # Biodiversity   # Climate change adaptation

**Tags**

# Biodiversity # Productivity # Land cover # 8th EAP # LSI011 # Drought impact # Ecosystems

**Temporal coverage**

2000-2023

**Geographic coverage**

Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG13: Climate action

**Unit of measure**

FIG1: Area of drought impact ($km^2$)

FIG2: Percentage

**Frequency of dissemination**

Once a year

## References and footnotes


1. European Commission. Joint Research Centre., 2023, *Drought in Europe: August 2023 : GDO analytical report.*, Publications Office, LU.
↵
2. Global assessment of soil carbon in grasslands, 2023, FAO.
↵

3. 231031_EUCRA_TechnicalReport_comments_compiled.xlsx, ( https://eea1.sharepoint.com/:x:/r/teams/2.3.1EU-wideclimateriskassessment/_layouts/15/Doc.aspx?sourcedoc=%7B3E971390-BA99-42DD-B4C6-235D3AB3D370%7D&file=231031_EUCRA_TechnicalReport_comments_compiled.xlsx&action=default&m accessed November 24, 2023.
↩

4. EEA, 2023, 'National climate change adaptation planning and strategies [2023] Article 19(1) Implementing Regulation 2020/1208, Annex I — Reportnet 3', *European Environment Agency* ( https://reportnet.europa.eu/public/dataflow/895) accessed May 9, 2023.
↩

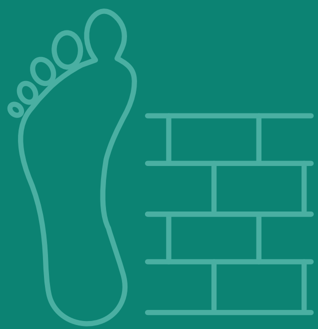
5. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union environment action programme to 2030, OJ L 114, 12.4.2022, p. 22-36.
↩

6. EC, 2022, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives - COM/2022/357 final
↩

European Environment Agency

# 8th Environment Action Programme

## Raw material consumption: Europe's material footprint



8TH EAP HEADLINE INDICATOR, 2024

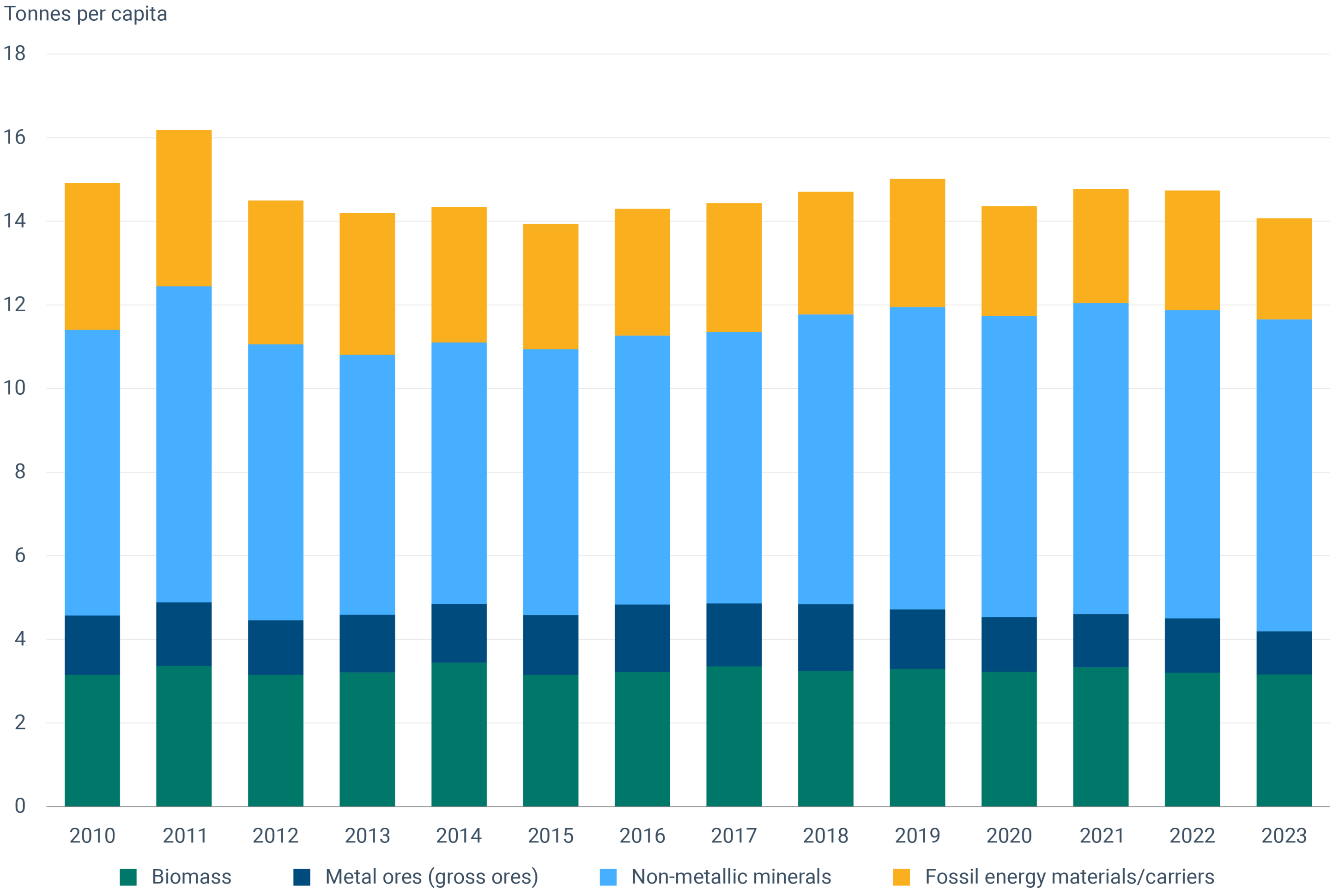
# Europe's material footprint

Published 13 Dec 2024



The 8th Environment Action Programme aims to significantly reduce the EU's material footprint, meaning the amount of raw material extracted to produce goods and services. The per capita material footprint remained stable during 2010-2022 and dropped by 4.5% in 2023. Raw material extraction was 14.1 tonnes per capita in 2023, which is considered unsustainable and above the global average. Based on historical trends, It appears unlikely that the EU will significantly reduce the per capita material footprint in the coming decade unless the 2023 drop continues. Major effort is needed to reduce extraction and consumption, by switching to goods and services that require less material.

## Figure 1. EU Material Footprint, expressed in tonnes of raw material equivalent per capita



The European Union's material footprint refers to the amount of material extracted from nature, both inside and outside the EU, to manufacture or provide the goods and services **consumed by EU citizens**. The 8th Environment Action Programme aim to significantly decrease the EU's material footprint to safeguard precious natural resources and to mitigate environmental impacts, such as climate change and biodiversity loss[1].

From 2010 to 2023, the EU per capita material footprint **decreased** by 5.7%. The material footprint fell markedly in 2020 — influenced by the economic slowdown due to the COVID-19 pandemic — yet increased again by 2021. Another sharp decrease of 4.5% occured between 2022 and 2023, mainly caused by a decrease in the consumption of metals and fossil fuels.

While the fossil fuels' decreasing consumption reflects the EU's decarbonisation efforts and market diversification due to the Russian aggression in Ukraine, the **metals consumption** decrease of 20% is more substantial and pronounced. The EU decreased its imports of metals from Russia and increased its exports to Ukraine, overall resulting in a lower metals' footprint. It is uncertain if this is a temporary decrease and the market will recalibrate using different supply chains, or if it remains a permanent phenomenon with sustained lower metals consumption.

Consumption of non-metallic minerals is the **highest** of the various material groups, accounting for 53% of the footprint in 2023. Consumption changes in this group were largely responsible for the overall trend during the entire time period. Biomass was the next largest group (22%), followed by fossil fuels (17%) and metals (7%). The share of fossil fuels decreased (24% in 2010), while the share of non-metallic minerals increased from 46% in 2010. Non-metallic minerals account for a large part of the total material footprint, yet they have less environmental and climate impact than metals and fossil fuels. This is because they are mostly composed of inert materials such as gravel, limestone[2].

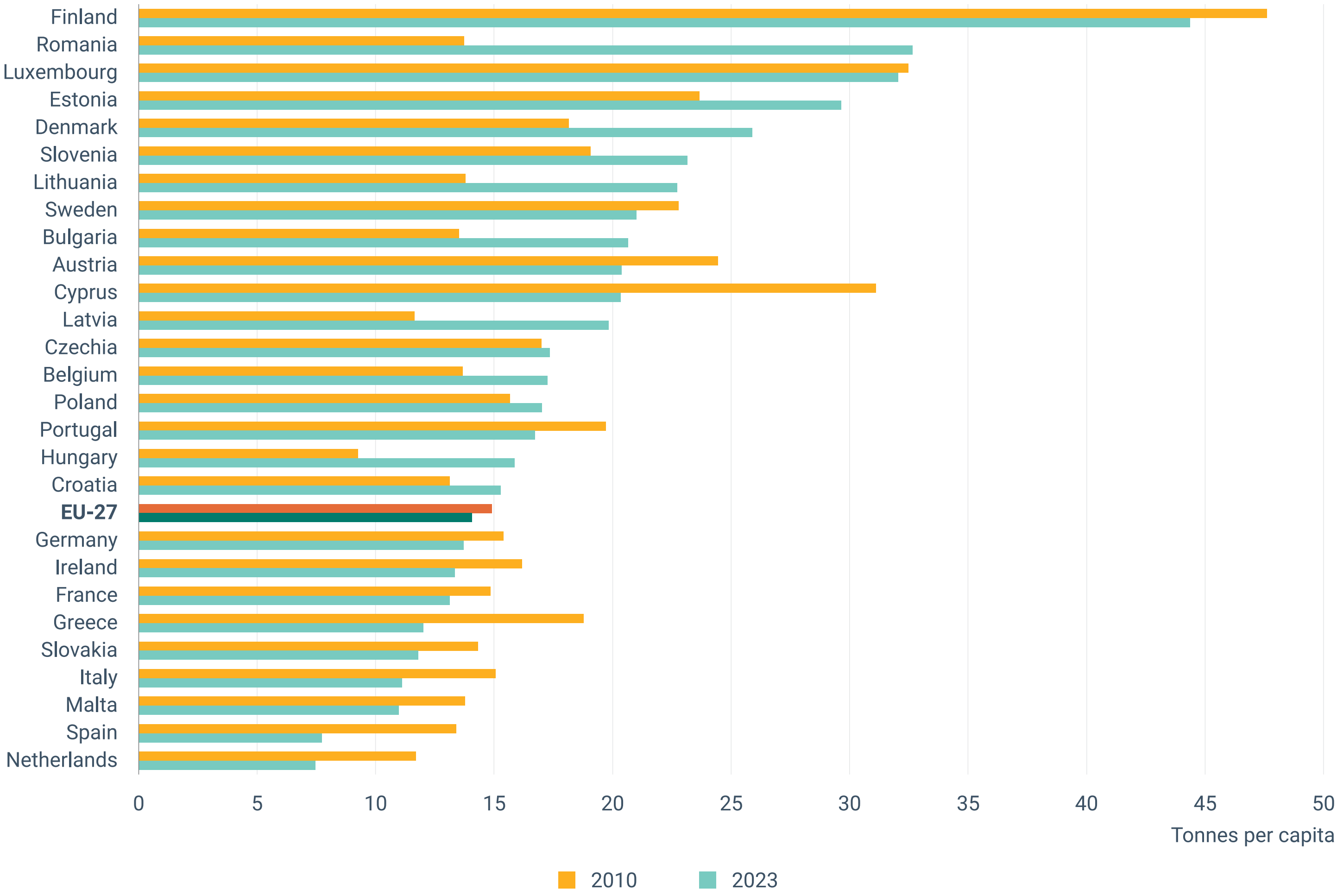
The material footprint provides a comprehensive **measure** of all materials extracted to satisfy consumption demand in the EU, including materials extracted outside the EU and imported. The reliance on external suppliers differs by material. Demand for metals and fossil fuels is mainly met by imports, while demand for biomass and non-metallic minerals is largely met by domestic extraction.

The EU's total material footprint is **above the global average** and greater than those of low- and middle-income non-EU countries. The level of resource consumption exceeds the planet's 'safe operating space' for resource extraction[3]. This indicates, if the world were to consume resources at this level, the capacity of the planet to provide these resources would be exceeded.

Material footprints could be reduced by decreasing consumption or choosing goods or services whose production or provision needs less material. Various circular economy **policies** (as part of the EU circular economy action plan) aim to reduce the need for primary material extraction, by keeping materials in the economy for as long as possible, their value as high as possible, and boosting high-quality recycling.

Excluding the temporary dip in 2020, the level of the material footprint was relatively stable until 2022. Available projections for material use, such as the OECD Global Material Resources Outlook, predict an increased future demand for materials in the EU[4]. However, if the recent sharp decrease in 2023 continues, it may lead to significant reductions. Given this uncertainty, it appears **unlikely** that the EU will significantly reduce its material footprint in the coming decade.

## Figure 2. EU Member States' Material footprint in t/cap for the years 2010 and 2023, ranked according to the 2023 footprint




Material footprints **vary substantially** across EU countries, from 7.5 tonnes/capita in the Netherlands to 44.4 tonnes/capita in Finland. Since 2010, 15 of the 27 Member States have reduced their material footprint. Spain, the Netherlands, Greece and Cyprus reduced their footprints by more than 30%. However, Romania, Hungary, Latvia, Lithuania and Bulgaria's increased theirs by more than 50%.

Differences in material footprints among countries are difficult to explain, as they are based on the structure and efficiency of the economy and citizens' consumption patterns. However, elements such as high levels of circularity in the national economy are particularly important. High levels of circularity partly explain the low footprint value in the Netherlands, which has the lowest material footprint in the EU and also the highest circular material use rate. On the other hand, Finland and Romania with the highest material footprint display the lowest circular material use rate.

## Supporting information

### Definition

The material footprint indicator is based on two components:

· domestic extraction of materials, by material group, as reported to Eurostat;

· estimates of raw material equivalents (RMEs) for imports and exports.

The term ‘RME’ indicates the full accounting for resources extracted to produce final products. While, for domestic extraction, RMEs equal domestic material extraction, RMEs need to be estimated for imports to the EU of raw materials, and semi-finished and finished products.

The difference in the calculations, compared with the more well-known domestic material consumption (DMC) is that the material footprint includes all materials needed to produce the products imported into the EU, while the DMC only includes the weight of imports when these cross the EU border. The material footprint, therefore, is more comprehensive in revealing the actual materials used by EU citizens. For example, in 2019, imports made up 27% of DMC, while they made up 53% of the material footprint.

**Methodology**

The Eurostat-derived data are described in Eurostat (2021)[5]. Eurostat nowcasts material footprint values for 2022.

For country data, gap filling was performed for (1) missing values at the start or end of time series, where the value was assumed equal to the first available value; and (2) missing values between reported values, calculated by extrapolation.

**Policy/environmental relevance**

The European Green Deal[6] explicitly calls for a decoupling of economic growth from resource extraction, which translates into continuously decreasing resource consumption in a growing economy. The material footprint accounts for a life cycle approach to material extraction, accounting not only for the weight of materials imported/exported to the EU, but also for the materials needed to produce these imports/exports. The footprint provides a fuller picture of the resources needed to satisfy EU demand.

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It contributes to monitoring aspects of the 8th EAP Article 3.s that requires ‘significantly decreasing the Union’s material and consumption footprints to bring them into planetary boundaries as soon as possible, including through the introduction of Union 2030 reduction targets, as appropriate’. It also helps monitor progress towards achieving, by 2030, aspects of the 8th EAP priority objective set out in Article 2.2.a: ‘advancing towards a well-being economy that gives back to the planet more than it takes and accelerating the transition to a non-toxic circular economy, where growth is regenerative, resources are used efficiently and sustainably, and the waste hierarchy is applied’. The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor that the EU ‘significantly decrease the EU’s material footprint, by reducing the amount of raw material needed to produce the products consumed in the Union.’

**Accuracy and uncertainties**

No uncertainties have been specified.

**Data sources and providers**

- Material footprints - main indicators (env_ac_rme), Statistical Office of the European Union (EUROSTAT)
- Material flow accounts in raw material equivalents - modelling estimates, Statistical Office of the European Union (EUROSTAT)

## Metadata

**DPSIR**

State

**Topics**

# Waste and recycling   # Resource use and materials   # Sustainability challenges

**Tags**

# Material extraction   # WST007   # Material footprint   # Consumption   # 8th EAP

**Temporal coverage**

2010-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG12: Responsible consumption and production

**Unit of measure**

Tonnes per capita

**Frequency of dissemination**

Once a year

## References and footnotes

1. IRP, 2019, *Global Resources Outlook 2019: Natural Resources for the Future We Want*, International Resource Panel, Nairobi, Kenya.
↵
2. IRP, 2019, 'Global Resources Outlook 2019: Natural Resources for the Future We Want', ( https://www.resourcepanel.org/reports/global-resources-outlook) accessed July 4, 2022.
↵
3. EC, 2022, 'Consumption Footprint Platform', *European Platform on Life Cycle Assessment, European Commission* ( https://eplca.jrc.ec.europa.eu/ConsumptionFootprintPlatform.html) accessed June 26, 2022.
↵
4. The OECD projections refer to the same material categories as the ones used in this indicator. However, the OECD refers to material use, not to material footprint. Material use is defined as domestic material consumption (DMC) which is calculated by the extraction of materials domestically plus imports minus exports. The difference with the material footprint approach is that DMC accounts only for the physical weight of goods imported at the point of entrance into a territory (in our case, the EU). The material footprint, on the other hand, accounts for the full weight of materials extracted in the value chain abroad in order to construct the goods imported. Therefore, the material footprint of a territory (e.g. the EU) is always higher than the DMC. However, the expected increase in the EU's material footprint based on the OECD projections is still valid, because these projections predict increases in material use in all world regions.
↵
5. Eurostat, 2021, 'Population on 1 January', *Data Browser* ( https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en) accessed March 4, 2022.
↵
6. EC, 2022, 'A European Green Deal: striving to be the first climate-neutral continent', *European Commission* ( https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en) accessed June 27, 2022.
↵

European Environment Agency

# 8th Environment Action Programme

## Waste generation in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

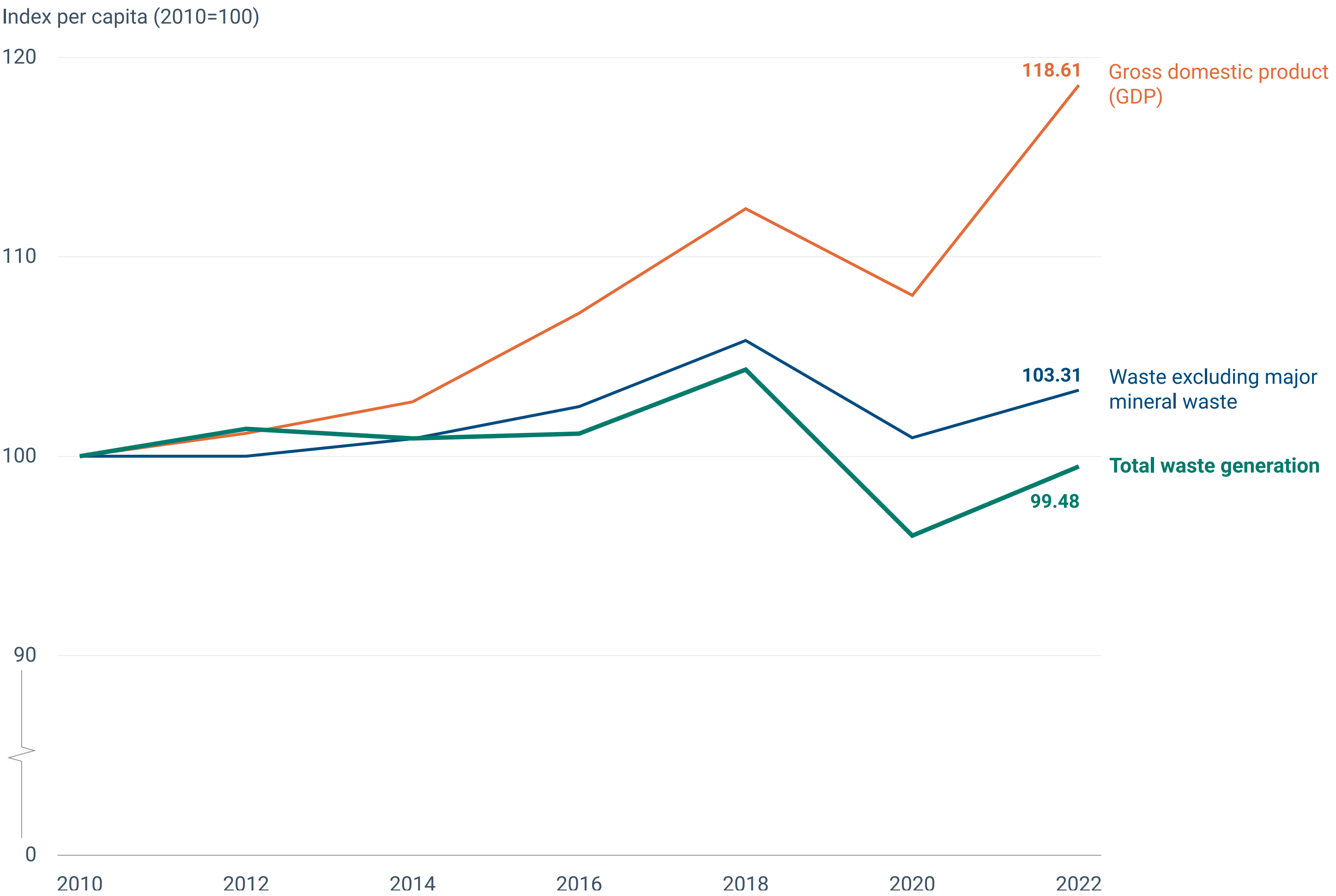
# Waste generation in Europe

Published 02 Dec 2024

Analysis and data > Indicators > Waste generation in Europe

> Total per capita waste generation remained near stable in the European Union between 2010 and 2022. Waste generation historically follows trends in economic growth, e.g. during the 2020 economic slowdown and recovery thereafter. The EU aims to signficantly decrease its total waste generation by 2030. Although the observed stability and decoupling of waste generation from economic growth is encouraging, the latest data indicates that the link between economic growth and waste generation remains. Therefore, it is unlikely that waste generation will substantially decrease by 2030.

## Figure 1. Waste generation per capita in the EU-27




For a long time, the EU has set a policy objective to reduce waste though prevention, which is the first step of the waste hierarchy laid down in the Waste Framework Directive[1]. The circular economy and zero pollution **ambition** of the EU is to significantly reduce total waste by 2030[2].

Total **waste generation** per capita decreased very slightly by 0.5% (decrease of 26 kg/capita) in the EU-27 between 2010 and 2022 and reach 5 tonnes per capita in 2022. A sharp decrease occurred in 2018-2020, following an increase in 2016-2018, due to the COVID-19 pandemic and economic slowdown. Waste generation has bounced back since, with an increase of 4% (174 kg/capita) between 2020 and 2022.

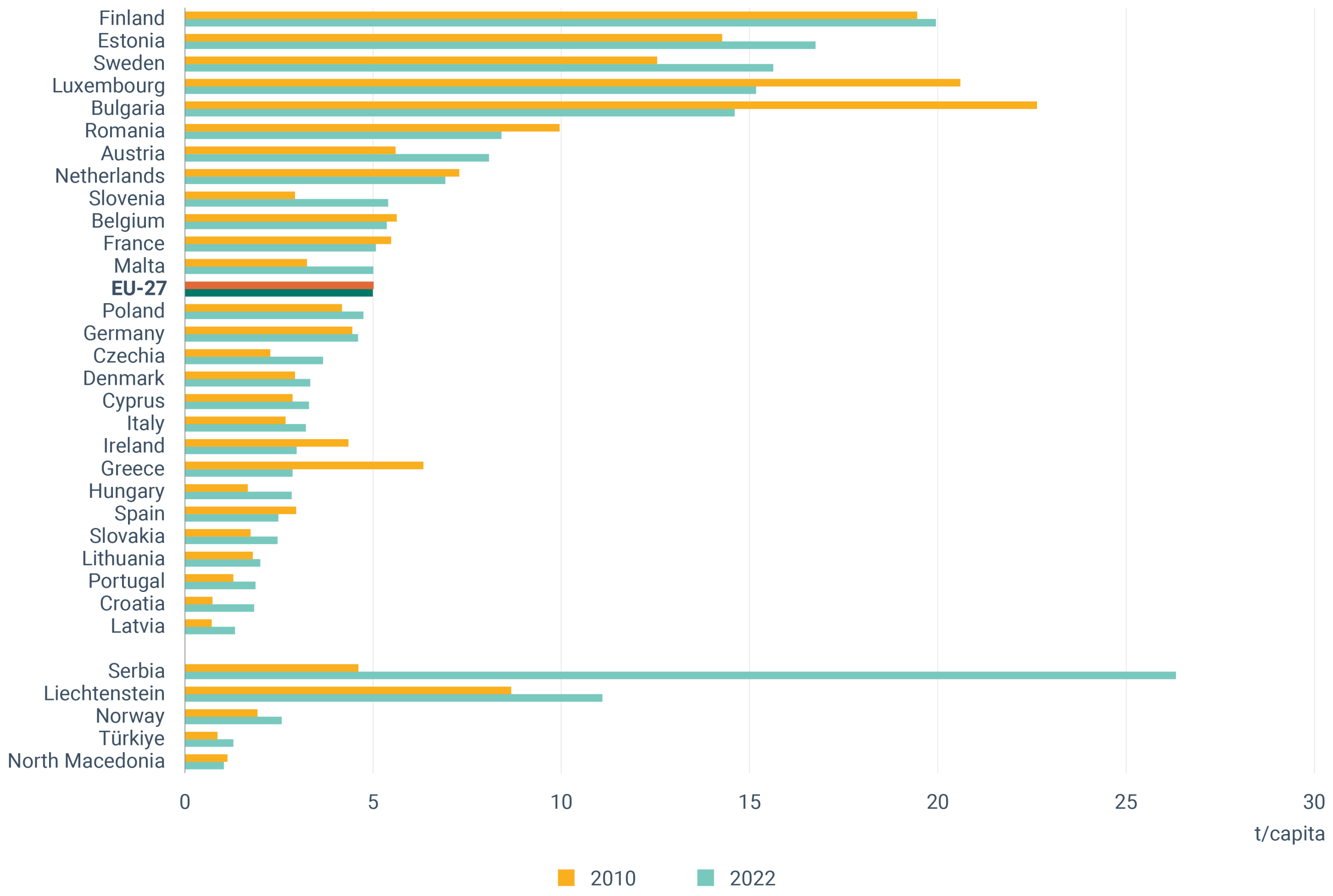
Total waste generation remained stable, yet underlying waste streams show variations, modifying the composition. Sorting residues[3] almost doubled from 2010 to 2022 (indicating increases in collection of recyclables), while excavated soils and mineral waste from construction and demolition increased by more than 100kg/capita. The **stability** of the total waste is mainly due to a high decrease in generation of other mineral waste by around 400kg/capita in the reporting time period, due to a slowdown of mining activities in Europe.

Major **mineral wastes** (hard rocks, concrete, soil and others) mainly produced in mining and construction sectors, feature in large quantities in relation to other waste types. They usually represent less of an environmental concern because of their inert nature. If excluded from the totals, the remaining and more environmentally significant waste streams increased by 3.3% between 2010 and 2022, a rise of 57 kg/capita.

The main driver for trends in total waste volumes is considered to be **economic growth**, with gross domestic product (GDP) the most common parameter used to track the economy's size. During 2010-2022, the EU's per capita GDP increased in real (deflated) terms by almost 19%. While waste generation remained stable in the same period, it followed overall trends in GDP development (the drop in 2020), indicating a relative decoupling of waste generation from economic growth.

Latest data indicates that a **link** remains between waste generation and economic growth, albeit weaker. Therefore, it seems unlikely that the per capita total waste generation will significantly decrease by 2030. The only significant decrease observed (around 8%) in waste generation is very recent (2018-2020) and coincided with negative GDP growth rates. Waste generation has historically followed GDP growth closely and GDP growth rates have been positive since 2020. The European Central Bank projects this to remain as such in the coming years. Additional effort on implementing waste prevention is needed to significantly waste generation by 2030.

## Figure 2. Generation of waste per capita and by European country (2010 and 2022)




On average, **5 tonnes** of total waste was generated per EU citizen in 2022, almost identical to the per capita generation in 2010. This average masks large country differences both in total waste volumes per capita and in waste generation trends.

Amounts generated for EU Member States in 2022 range from less than 1.35 tonnes per capita in Latvia to 20 tonnes per capita in Finland. Other European countries range from 1 tonne in North Macedonia to 26 tonnes in Serbia. Extreme numbers and differences can be affected by specific country situations and partly reflect variant structures of countries' economies. In 2022, 12 EU Member States (14 of 32 countries with available data) were **above the EU average** for 2022.

**Trends** over time also show a mixed picture between countries. The total waste generated per capita increased in 18 Member States (22 of the 32 countries with available data). The largest relative decrease within the EU was observed in Greece and the largest relative increase in Bulgaria. The highest increase overall was reported in Serbia.

## Supporting information

### Definition

This indicator consists of two figures about waste generation. Figure 1 shows indexed values of waste generation, waste generation excluding major mineral waste and GDP with 2010 taken as a reference year (2010=100%). GDP was chosen as a basic indicator of economic growth. Figure 2 shows total waste generation per capita by European country. Data presented in the form of a bar chart are displayed as a comparison of the reference year (2010) and the last available year.

**Methodology**

Figure 1: Raw data for waste generation (total and excluding major mineral wastes) and GDP were retrieved from Eurostat. Eurostat aggregates for the EU-27 were used. Data on waste generation contain all NACE activities and households. Frequency of data publishing varies from every 2 years (for waste generation) to every year (for GDP). The aggregated figures are indexed to 2010, which means that the figure for each year is divided by the figure for 2010 and then multiplied by 100. Information on data sets uncertainties can be found directly in the metadata and explanatory notes provided by Eurostat. Only official datasets by Eurostat have been used.

Figure 2: Data for waste generation were retrieved from Eurostat. Data are displayed for country level, contain all NACE activities and households, and are expressed in kg per capita. To provide the broadest possible picture of European countries, geographical coverage was extended to the EEA-32 member countries and West Balkan cooperating countries. Frequency of data publishing is every 2 years. Gap filling was applied for three countries where 2018 data were used to fill the 2020 data gap. Information on data sets uncertainties can be found directly in the metadata and explanatory notes provided by Eurostat. Only official datasets by Eurostat have been used.

**Policy/environmental relevance**

One of the symbols of the linear economy system, which predominated in recent decades, is the high consumption of resources followed by high waste generation ('take-make-dispose'). This economic model is based on increasing profits generated by the consumption of primary resources and increasing demand for short-cycle products. In 2015, 2018 and 2020, the European Commission adopted Circular Economy packages to make the transition to a circular economic model where resources are used in a more sustainable way. The waste hierarchy serves to set priorities for EU and national waste policies and gives the highest priority to waste prevention, followed by preparing for reuse, recycling, and other methods of recovery and disposal. These priorities are highlighted by recent waste and resource efficiency policies and strategies at EU and national levels.

This indicator is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Programme (8$^{th}$ EAP)[4][5]. It contributes mainly to monitoring aspects of the 8$^{th}$ EAP priority objective Article 2.2.c that shall be met by 2030: ‘advancing towards a well-being economy that gives back to the planet more than it takes and accelerating the transition to a non-toxic circular economy, where growth is regenerative, resources are used efficiently and sustainably, and the waste hierarchy is applied’. For the purposes of 8$^{th}$ EAP monitoring, this indicator assesses specifically whether the EU will significantly reduce the per capita total amount of generated waste by 2030[6].

The zero pollution ambition of the EU calls for a significant reduction in EU waste generation by 2030 and this indicator also monitors progress towards this EU policy objective.

**Accuracy and uncertainties**

## Methodology uncertainty

No uncertainty has been specified.

## Data sets uncertainty

## Rationale uncertainty

No uncertainty has been specified.

**Data sources and providers**

- Generation of waste by waste category, hazardousness and NACE Rev. 2 activity, Statistical office of the European Union (EUROSTAT)

## Metadata

**DPSIR**

Pressure

**Topics**

# Waste and recycling # Resource use and materials # Circular economy

**Tags**

# WST004 # Waste generation # Industrial waste generation # 8th EAP

**Temporal coverage**

2010-2022

**Geographic coverage**

| | |
|---|---|
| Austria | Belgium |
| Bulgaria | Croatia |
| Cyprus | Czechia |
| Denmark | Estonia |
| Finland | France |
| Germany | Greece |
| Hungary | Ireland |
| Italy | Latvia |
| Liechtenstein | Lithuania |
| Luxembourg | Malta |
| Netherlands | North Macedonia |
| Norway | Poland |
| Portugal | Romania |
| Serbia | Slovakia |
| Slovenia | Spain |
| Sweden | Türkiye |

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG12: Responsible consumption and production

**Unit of measure**

· Figure 1: Index (2010=100)

· Figure 2: t/capita

**Frequency of dissemination**

Every 2 years

## References and footnotes

1. EU, 2018, Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, OJ L 150, 14.6.2018, p. 109-140. ↵
2. EC, 2021, 'Zero pollution action plan', ( https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en) accessed November 10, 2022. ↵
3. Waste generated by the sorting of separately collected recyclables ↵
4. EC, 2022, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives ↵
5. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22–36. ↵
6. EC, 2021, COMMISSION STAFF WORKING DOCUMENT Digital Solutions for Zero Pollution Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Pathway to a Healthy Planet for All EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' ↵

European Environment Agency

# 8th Environment Action Programme

## Premature deaths due to exposure to fine particulate matter in Europe

8TH EAP HEADLINE INDICATOR, 2024

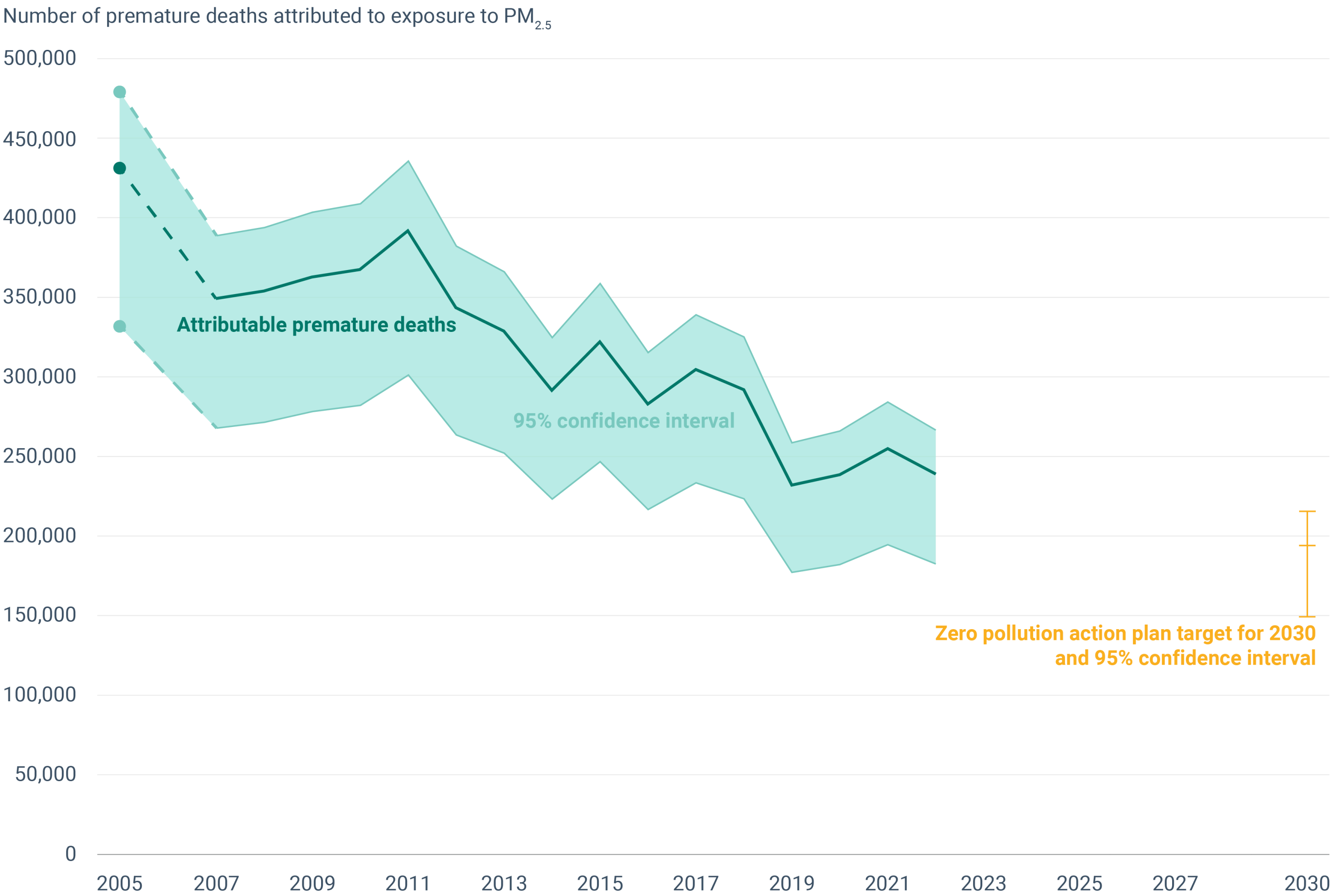
# Premature deaths due to exposure to fine particulate matter in Europe

Published 10 Dec 2024



The European Commission zero pollution action plan sets a target to reduce the health impacts of air pollution by at least 55% by 2030, compared to 2005. Between 2005 and 2022, the number of premature deaths in the EU attributable to $PM_{2.5}$ fell by 45%. If this trend continues, the target will be achieved and likely exceeded. The European Commission has separately projected that this target will be surpassed if EU policies on air, climate and energy are adequately implemented. Despite ongoing improvement, 239,000 premature deaths attributable to $PM_{2.5}$ occured in the EU during 2022.

## Figure 1. Premature deaths attributable to exposure to fine particulate matter ($PM_{2.5}$), EU



Air pollution is a major cause of **mortality and disease** and the largest single environmental health risk in Europe. The air pollutant with the strongest evidence for adverse health outcomes is fine particulate matter ($PM_{2.5}$).

The European Green Deal calls for further improvements in air quality and to revise the EU's air quality standards, aligning them more closely with the World Health Organization (WHO) recommendations on air quality. The **target** of reducing the number of premature deaths caused by air pollution by 55% by 2030, relative to those in 2005 (based on premature deaths attributable to $PM_{2.5}$) is set by the zero pollution action plan (ZPAP).

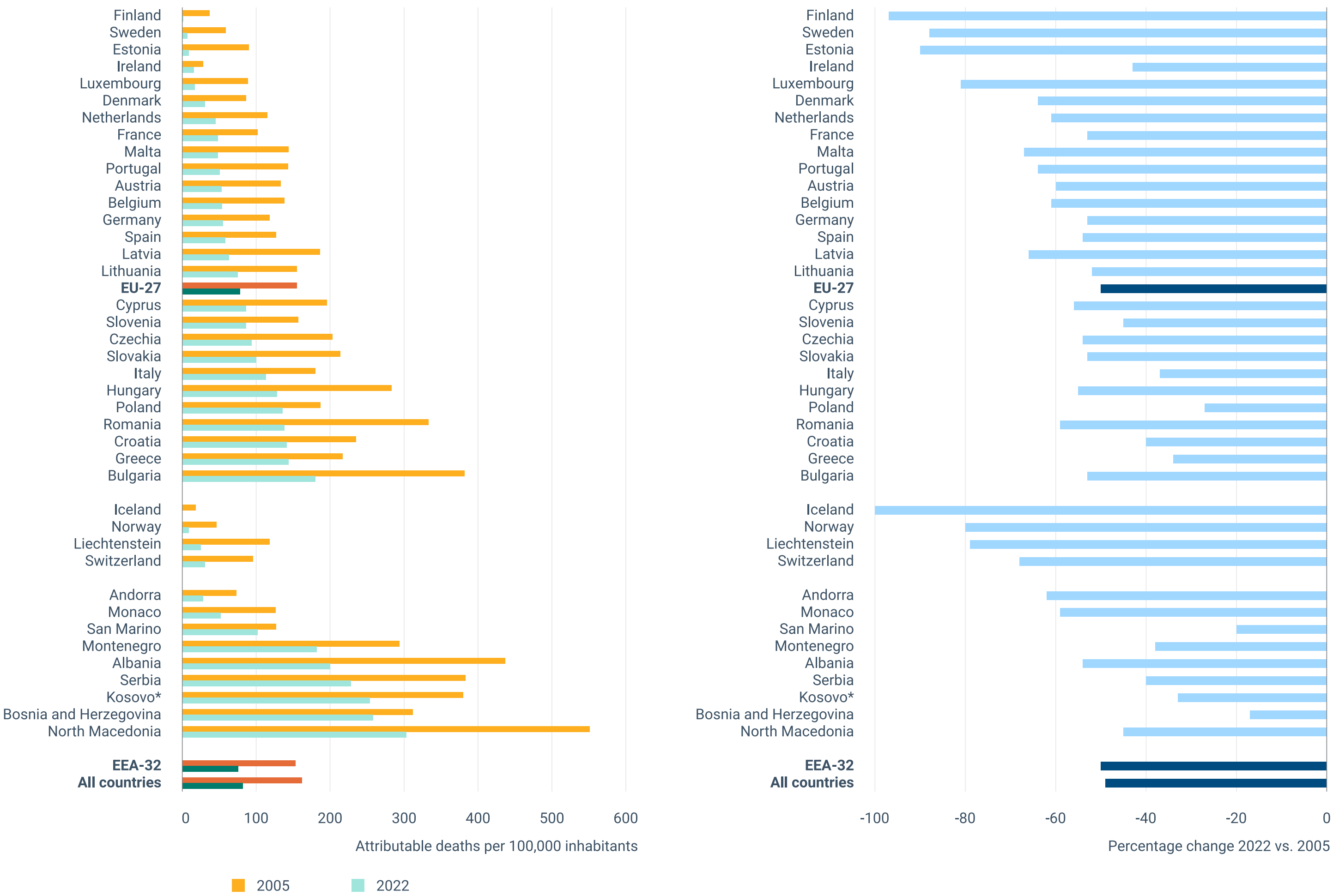
In October 2022, the European Commission proposed a revision of the EU Ambient Air Quality Directives. As agreed by the co-legislators and published in November 2024, the revised Directive introduces new standards to be attained in 2030 that align closer with WHO recommendations and an obligation to monitor additional pollutants such as ultrafine particles and ammonia.

Between 2005 and 2022, premature deaths attributable to $PM_{2.5}$ exposure above the WHO air quality guideline level of 5µg/$m^3$ **fell by 45%** in the EU Member States (Figure 1). The decrease was caused by a decline in concentrations of $PM_{2.5}$, hence a decrease in the exposure of the population to this air pollutant. Yet, more than 70% of the EU population live in urban areas and in 2022, 96% of the urban population was exposed to $PM_{2.5}$ concentrations above the WHO guideline level.

The **premature mortality decline** is a result of EU, national and local policy implementation to improve air quality (e.g. the EU Ambient Air Quality Directives and the plans and measures derived from them) and to reduce emissions of air pollutants, including particulate matter (e.g. the National Emission Reduction Commitments Directive). These policies succeeded in reducing fine particulate matter emissions from domestic heating, their main source, and other sources such as industry and transport. Emissions of ammonia, a secondary PM precursor, from agriculture have also been reduced to a lesser extent.

If the past 17 year trend should continue, the decline in premature mortality attributable to $PM_{2.5}$ would reach 63% by 2030 (from 2005 levels) and the 55% zero pollution reduction target would be **exceeded**. The 2022 Third Clean Air Outlook also estimates that the target may be exceeded if the foreseen clean air measures, together with climate and energy polices of the 'Fit for 55' package are implemented. It envisions a similar reduction of 66% by 2030 if the conditions are met.

## Figure 2. Premature deaths normalized by population attributable to exposure to $PM_{2.5}$ at country level in 2005 and 2022, and percentage of change




The ZPAP target is set at EU level and there are many differences in the change of mortality due to exposure to $PM_{2.5}$ at country level during 2005 to 2022. Mortality per capita has **decreased** in all EU Member States, by more than half in 21 countries (Figure 2).

A decrease in mortality can also be seen in non-EU member countries. Seven have reduced the number of premature deaths attributable to exposure to $PM_{2.5}$ by more than half. The country level decrease partly reflects the reduction in $PM_{2.5}$ concentrations over the years.

For comparison of the impact of air pollution on human health across the different NUTS3 regions of Europe, **this map** shows the number of premature deaths attributable to $PM_{2.5}$ (per 100,000 inhabitants aged above 30 years). The highest relative number of attributable deaths in 2022 within the EU were in the regions of Sofia and Vidin (Bulgaria), and Miasto Kraków (Poland). In contrast, several Finnish and Swedish regions and one Austrian region had very low attributable deaths (i.e. below one per 100,000 inhabitants aged above 30 years).

The **highest** number of relative attributable deaths for European countries outside the EU in 2022 were in the regions of Skopski, Vardarski and Pelagoniski (North Macedonia) and Nišavska oblast (Serbia). The **lowest** numbers were seen in all Icelandic and four Norwegian regions with less than one attributable death per 100,000 inhabitants aged above 30 years.

## Supporting information

### Definition

This indicator provides information on the number of premature deaths in the EU-27 attributable to long-term exposure to fine particulate matter ($PM_{2.5}$) since the year 2005.

It also shows a comparison in the mortality attributable to $PM_{2.5}$ between years 2005 and the most recent year with available data, at country level, for 40 European countries.

Furthermore, it provides European NUTS3 regional-level information on the number of premature deaths adjusted for the number of inhabitants aged above 30 years attributable to long-term exposure to $PM_{2.5}$ for the most recent year with available data. Nomenclature of territorial units for statistics, or NUTS classification, is a system for dividing up the European territory for the collection of regional statistics, where NUTS3 corresponds to small regions.

**Methodology**

The EEA has been estimating the mortality attributable to air pollution in the last years. Until year 2021 (when the mortality for year 2019 was estimated), it used the recommendations provided by the WHO Europe in its 2013 report. This methodology has been explained in several documents, among them:

· the EEA briefing 'Assessing the risks to health from air pollution';

· ETC/ATNI (2019, 2021) .

After the publication of the new **WHO global air quality guidelines in 2021**, and to reflect the updated recommendations, there has been some changes in the data used in that methodology; those changes were implemented for the first time in 2022 (to estimate the mortality in year 2020):

· The relative risk has been updated from the previous 0.062 to 0.08; this implies that the risk of dying prematurely increases by 8% per each increase in $10 µg/m^3$ in the $PM_{2.5}$ concentrations (previously the increment in the risk was 6.2%).

· The concentration from which the effect of exposure to $PM_{2.5}$ is considered has changed from $0 µg/m^3$ to $5 µg/m^3$; in this way the EEA estimates the mortality attributable to not reaching the air quality guideline level recommended by **WHO**, and considers in this way the concentrations for which the form of the concentration-response function is linear and for which this function is more certain. Nevertheless, it should be considered that there is no evidence of a threshold below which air pollution does not impact on health. (Please see additional information at the **EEA's briefing *Health impacts of air pollution in Europe, 2022***).

Finally, in the 2024 update, the mortality per number of inhabitants has been calculated considering only the population aged above 30 years, since this is the population for which the total mortality is calculated, following the concentration-response functions recommended by **WHO**.

Mortality calculations for all years back from 2005 have been recalculated using this updated methodology.

The aggregations are either at European, EU, country or at NUTS3 level.

**Policy/environmental relevance**

The zero pollution action plan, adopted in the context of the European Green Deal, has, among other things, set the goal to reduce by 2030 the number of premature deaths in the EU caused by air pollution by at least 55%, relative to 2005 levels and specified that this will be monitored via the premature deaths attributed to $PM_{2.5}$.

This indicator is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Progamme. It mainly contributes to monitoring aspects of the 8$^{th}$ EAP priority objective Article 2.2.d that shall be met by 2030: 'pursuing zero pollution, including in relation to harmful chemicals, in order to achieve a toxic-free environment, including for air, water and soil, as well as in relation to light and noise pollution, and protecting the health and wellbeing of people, animals and ecosystems from environment-related risks and negative impacts', (European Union Decision on the 8th EAP). In line with the zero pollution action plan, the European Commission's Communication on the 8th EAP monitoring framework specifies that this indicator monitors progress towards reducing 'premature deaths from air pollution by 55% (from 2005 levels) by 2030', (European Commission Communication on the 8th EAP monitoring framework).

**Accuracy and uncertainties**

The main uncertainties are those derived from the health risk calculations. They are described at the EEA briefing 'Assessing the risks to health from air pollution'.

**Data sources and providers**

- Burden of disease of air pollution (Countries & NUTS), European Environment Agency (EEA)

## Metadata

**DPSIR**

Impact

**Topics**

# Environmental health impacts # Air pollution # Pollution

**Tags**

# mortality by exposure to PM2.5 # health impacts # Zero pollution # 8th EAP # Particulate matter # PM2.5 # AIR007 # environmental burden of disease

**Temporal coverage**

2005-2022

**Geographic coverage**

Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway

Poland
Portugal
Principality of Andorra
Principality of Monaco
Romania
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

FIG1: Number of attributable premature deaths

FIG2: Attributable deaths per 100,000 inhabitants and percentage change 2022 vs. 2005

**Frequency of dissemination**

Once a year

## References and footnotes

European Environment Agency

# 8th Environment Action Programme

## Nitrate in groundwater

8TH EAP HEADLINE INDICATOR, 2024

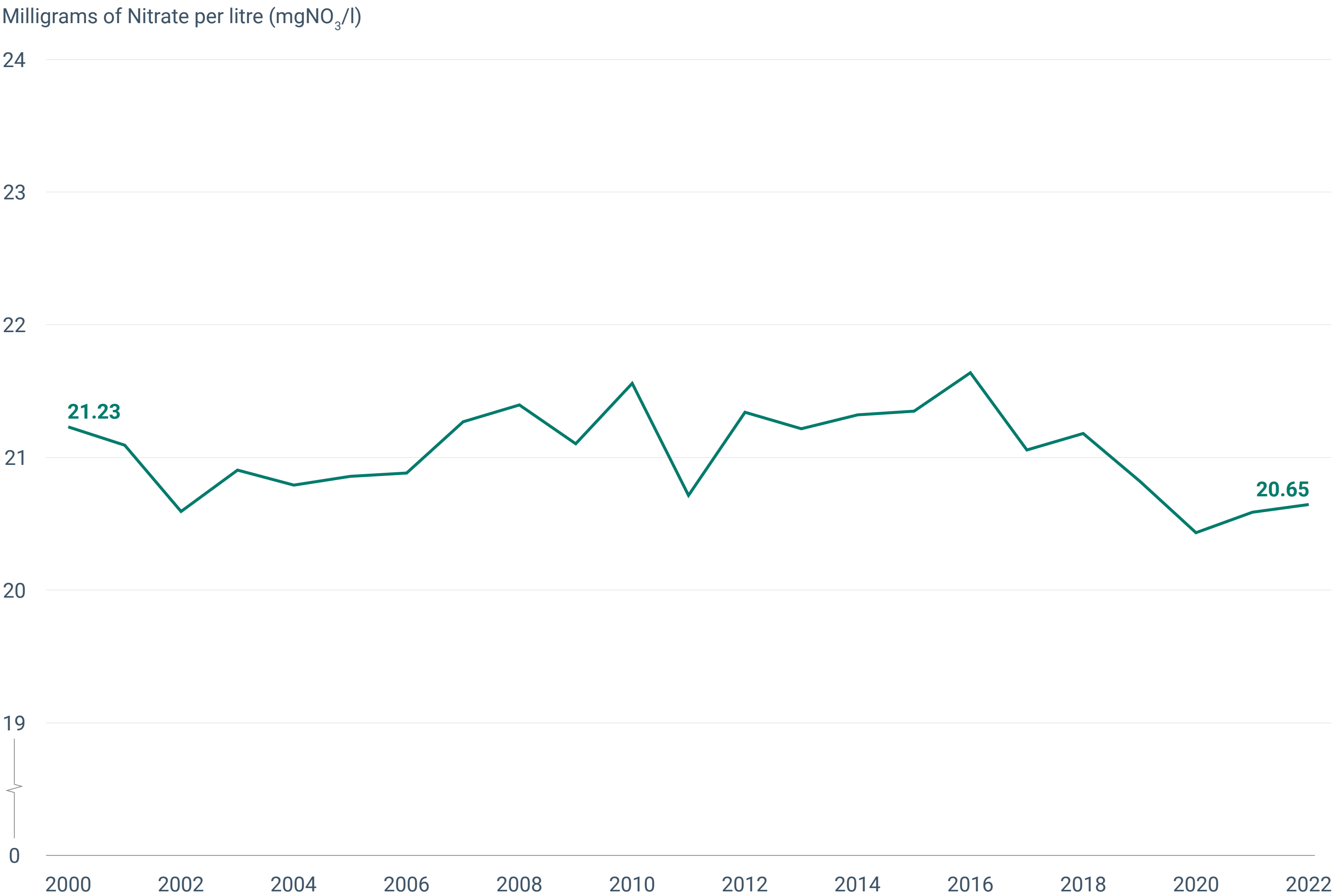
# Nitrate in groundwater in Europe

Published 12 Dec 2024



Despite legislation addressing nutrient pollution, the average nitrate concentration in European Union groundwaters did not change significantly from 2000 to 2022. The number of groundwater monitoring stations with nitrate concentrations greater than 50mg/l also remains unchanged. Results from a high ambition model scenario show that potential nutrient load reductions are substantial, but still below the 2030 target. Currently, it remains unlikely that the trend is sufficient to achieve EU obligations or the 50% nutrient loss reduction target.

## Figure 1. Groundwater nitrate 2000-2022




Nutrients such as nitrogen and phosphorus, not absorbed by plants, are lost and become pollutants when present in excessive amounts. This includes high levels of nitrate ($NO_3$) in groundwater, which poses a **threat** to the environment and human health.

Reducing high levels of nitrate in groundwater has been a target of EU policy since the adoption of the Nitrates Directive. Mineral fertilisers and livestock manure are the **main sources** of nitrate concentrations in EU groundwaters. An estimated 80% of the nitrogen discharge to the aquatic environment stems from agriculture and large amounts of nutrients lost to surface- and groundwaters extends to the sea. Around 30% of surface water and 80% of marine waters monitored under the Nitrates Directive have been assessed as eutrophic[1][2][3][4].

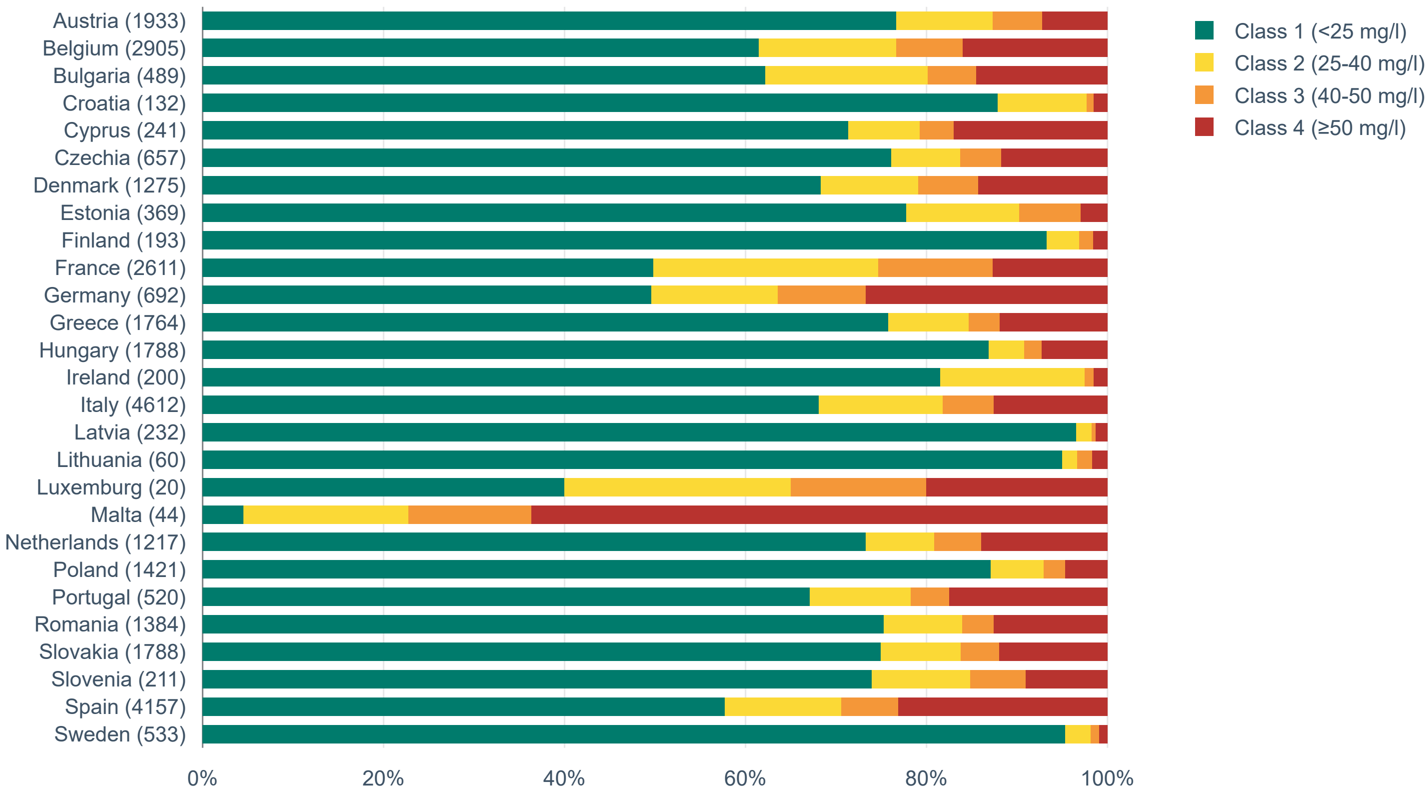
Several directives address nitrogen losses to the environment[1][5][6][7][8] . The Groundwater Directive and the Drinking Water Directive set the maximum **allowable concentration** for nitrate at 50mg$NO_3$/l in order to protect human health and water resources.

The Zero Pollution Action Plan, Biodiversity Strategy, and Farm to Fork Strategy are initiatives of the European Green Deal. The Deal aims for the EU to **reduce nutrient losses** to the environment by 50%, by 2030. The reduction could lower groundwater nitrate concentrations and decrease the number of monitoring stations with nitrate concentrations above 50mg/l, compared to the reference period 2012-2015[9][10].

Despite legislation addressing nutrient pollution, the average nitrate ($NO_3$) concentration in EU groundwaters monitored did not change significantly from 2000 to 2022, oscillating around 21mg$NO_3$/l. Additionally, the Nitrates Directive reporting data over the period 2016-2019 shows 14.1% of groundwater monitoring stations **exceeded** the maximum allowable concentration of 50mg$NO_3$/l. This is slightly higher than the observed 13.2% from the reporting period of 2012-2015.

An analysis from the Joint Research Centre modelled impacts in a high ambition scenario of improvements in domestic wastewater treatment and reduction of nutrient emissions to air. It used measures under the CAP 2023-2027 needed to achieve the Biodiversity and Farm to Fork strategy targets. The measures, where CAP measures are relevant for groundwater, could in combination, reduce the nutrient load in European seas by 30% for nitrogen and 20% for phosphorus by 2030[11]. While these potential reductions would be substantial, they are still **below the target** of 50% reduction overall in nutrient losses.

## Figure 2. Nitrate in Groundwater - Nitrates Directive reporting period 7 (2016-2019)




EU Member States report groundwater nitrate concentrations under the Nitrates Directive. At country level, nitrate concentrations in groundwater monitoring stations for the period 2016-2019 are distributed into four **classes** (Figure 2). Class 1 represents monitoring stations where concentrations are below 25mg/l. At the other end of the scale, class 4 shows the share of stations that exceed the 50mg$NO_3$/l maximum allowable concentration.

All 27 EU member countries had some groundwaters with **reported** nitrate concentrations above the maximum allowable concentration of 50mg$NO_3$/l (class 4). The seven countries with more than 15% of their groundwater monitoring stations exceeding this maximum level were Belgium, Cyprus, Germany, Luxemburg, Malta, Portugal, and Spain. In contrast, the seven countries with more than 80% of groundwater monitoring stations below 25mg/l (class 1) were Croatia, Finland, Hungary, Ireland, Latvia, Poland and Sweden.

## Supporting information

### Definition

This indicator shows concentrations of nitrate in groundwater bodies. The indicator can be used to illustrate geographical variations in current concentrations and temporal trends. Large inputs of nitrogen to water bodies from urban areas, industry, and agricultural areas, can have negative impacts on the use of water for human consumption and other purposes.

### Methodology

This indicator uses data reported under two different obligations. For the time series of average concentrations in figure 1 data from WISE SoE - Water quality (WISE-6) reporting obligation are used used (published in Waterbase – Water Quality ICM). For the country level assessment in figure 2 data from the Nitrates Directive reporting obligation are used.

For the time series in figure 1, annual mean concentrations are used as a basis in the analyses. Unless the country reports aggregated data, the aggregation to annual mean concentrations is done by the EEA. Automatic quality control procedures are applied both to the disaggregated and aggregated data, excluding data failing the tests from further analysis. In addition, a semi-manual procedure is applied, focusing on suspicious values having a major impact on the country time series and on the most recently reported data. This comprises:

- Outliers;
- Consecutive values deviating strongly from the rest of the time series;
- Whole time series deviating strongly in level compared to other time series for that country and determinant;
- Where values for a specific year are consistently much higher or lower than the remaining values for that country and determinant.

Such values are removed from the analysis and checked with the country. For time series analyses, only complete series after inter/extrapolation are used. This is to ensure that the aggregated time series are consistent, i.e. include the same sites throughout.

Inter/extrapolations of gaps up to three years are allowed, i.e. to increase the number of available time series. At the beginning or end of the data series, missing values are replaced by the first or last value of the original data series, respectively. In the middle of the data series, missing values are linearly interpolated. The selected time series are aggregated to country and European level by averaging across all sites for each year.

For analysis of the present state on country level (figure 2), data reported under the Nitrates Directive[1] for reporting period 2016-2019 are used, where data on monitoring station level are collected for each reporting period (four year period) and include characteristics on the water monitoring stations and values for the concentrations of $NO_3$ for each station. The data is summarised by country and by concentration classes. This information can also be viewed in the JRC exploratory dashboard for reporting period seven. While 2016-2019 is the last period for which there are consolidated data available at EU level, Member States are currently in the process of reporting data for 2020-2023.

**Policy/environmental relevance**

The quality of freshwater, with respect to nutrient concentrations, is an objective of several directives: The Nitrates Directive[1], aimed at reducing nitrate pollution from agricultural land; the Urban Waste Water Treatment Directive[5], aimed at reducing pollution from sewage treatment works and certain industries; the Industrial Emissions Directive[6], aimed at reducing emissions from industry; the Water Framework Directive[7], which requires the achievement of good ecological status; the Groundwater Directive[12] on the protection of groundwater against pollution and deterioration. The Water Framework Directive also requires the reversal of significant and sustained upward trends in the concentrations of pollutants. Based on the Drinking Water Directive[13], the Nitrates Directive and the Groundwater Directive under the Water Framework Directive, set the maximum allowable concentration for nitrate at 50mg $NO_3$/l. This is to eliminate the need for expensive water treatment because it has been shown that drinking water in excess of the nitrate limit can result in adverse health effects [3].

Reducing nutrient losses by 50% by 2030 is an important aspect of the European Green Deal[14] initiatives: ‘Farm to Fork’ Strategy; Biodiversity strategy; Zero pollution action plan[15][16][17]. The Common Agricultural Policy[18][19] (CAP) is a key tool in this respect. The assessment of the 50% target is set out in the Annex to the Recommendations for the CAP Strategic Plans[10] and is evaluated in the context of the Zero Pollution Monitoring Assessment[20] published on 8 December 2022.

The 8th Environment Action Programme[9] supports the objectives of the European Green Deal[14] and forms the basis for the EU to achieve the Sustainable Development Goals of the United Nations.

The ‘nitrate in groundwater indicator’ is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Programme (8$^{th}$ EAP). It mainly contributes to monitoring aspects of the 8$^{th}$ EAP priority objective Article 2.2.d that shall be met by 2030: ‘pursuing zero pollution, including in relation to harmful chemicals, in order to achieve a toxic-free environment, including for air, water and soil, as well as in relation to light and noise pollution, and protecting the health and wellbeing of people, animals and ecosystems from environment-related risks and negative impacts’. The European Commission’s Communication on the 8$^{th}$ EAP monitoring framework[9] specifies that this indicator should monitor progress towards reducing nutrient losses by at least 50% in safe groundwater resources by 2030.

**Accuracy and uncertainties**

The indicator is meant to give a representative overview of nitrate conditions in the groundwaters of the European Union. This means it should reflect the variability in conditions over space and time. Countries are asked to provide data on groundwater bodies according to specified criteria.

The Waterbase - Water Quality ICM data for groundwater include almost all countries within the EU, while the Nitrates Directive data includes all EU countries. It is assumed that the data from each country represents the variability in space in their country. Likewise, it is assumed that the sampling frequency is sufficiently high to reflect variability in time. In practice, for Waterbase data, the representativeness will vary between countries, while for the Nitrates Directive data the coverage is more complete but reported at lower frequency.

Annual updates of Waterbase - Water Quality ICM data means that, due to changes in the database, the derived results of the assessment may vary in comparison to previous assessments. Database changes include changes in the QC procedure that excludes or re-includes individual sites or samples and retroactive reporting of data for past periods - which may re-introduce lost time series that were not used in the recent indicator assessments. Through communication with the reporting countries, the quality of the database can be, and incrementally is, further improved.

**Data sources and providers**

- Nitrates Directive reporting period 7 (2016-2019)(direct link to the dataset is not available), European Environment Agency (EEA)
- Waterbase - Water Quality ICM, European Environment Agency (EEA)

## Metadata

**DPSIR**

State

**Topics**

**# Water** **# Agriculture and food**

**Tags**

**# 8th EAP** **# WAT004** **# Freshwater quality** **# Groundwater** **# Nitrates**

**Temporal coverage**

2000-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG6: Clean water and sanitation

**Unit of measure**

FIG1: the concentration of nitrate in groundwater is expressed as milligrams of nitrate per litre ($mgNO_3/l$)

FIG2: percentage

**Frequency of dissemination**

Once a year

## References and footnotes


1. EU, 1991, Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, OJ L 375, 31.12.1991, p. 1-8.
   a b c d
2. EEA, 2022, 'Europe's groundwater — a key resource under pressure', European Environment Agency", *Briefing, European Environment Agency* ( https://www.eea.europa.eu/publications/europes-groundwater).</div>
   ↵
3. WHO, 2003, 'Nitrate and nitrite in drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality (WHO/SDE/WSH/04.03/56)', ( https://cdn.who.int/media/docs/default-source/wash-documents/wash-chemicals/who-sde-wsh-04-03-56-eng.pdf?sfvrsn=e2fe0837_4).</div>
   a b
4. EC, 2021, *REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016–2019*, COM/2021/1000 final, European Commission.
   ↵
5. EC, 1991, Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment
   a b
6. EU, 2010, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJ L 334, 17.12.2010, p. 17-119.
   a b
7. EC, 2000, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, 2000/60., 2000/60
   a b
8. EU, 2001, Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants, OJ L 309, 27.11.2001, p. 22-30.
   ↵
9. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives - COM/2022/357 final
   a b c
10. EC, 2020, *ANNEXES to the COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - Recommendations to the Member States as regards their strategic plan for the Common Agricultural Policy*, COM(2020) 846 final, European Commission.
    a b
11. European Commission. Joint Research Centre., 2022, *Zero pollution :outlook 2022.*, EUR 31248 EN, Publications Office, LU.
    ↵
12. EC, 2014, Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration
    ↵
13. EU, 2020, Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption, OJ L 435, 23.12.2020, p. 1-62.
    ↵

14. EC, 2019, *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions 'The European Green Deal'*, COM(2019) 640 final,
a b

15. EC, 2020, 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (COM(2020) 381 final)', ( https://eur-lex.europa.eu/resource.html?uri=cellar:ea0f9f73-9ab2-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF).</div>
↩

16. EC, 2020, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - EU Biodiversity Strategy for 2030 Bringing nature back into our lives*,
↩

17. EC, 2021, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Pathway to a Healthy Planet for All EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' COM/2021/400 final, 2021/400.
↩

18. EU, 2021, Regulation (EU) 2021/2116 of the European Parliament and of the Council of 2 December 2021 on the financing, management and monitoring of the common agricultural policy and repealing Regulation (EU) No 1306/2013, OJ L 435, 6.12.2021, p. 187.
↩

19. Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013, 2021, OJ L.
↩

20. EEA, 2022, *Zero pollution monitoring assessment*, EEA Web Report, 03/2022, European Environment Agency.
↩

European Environment Agency

# 8th Environment Action Programme

## Designated terrestrial protected areas in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

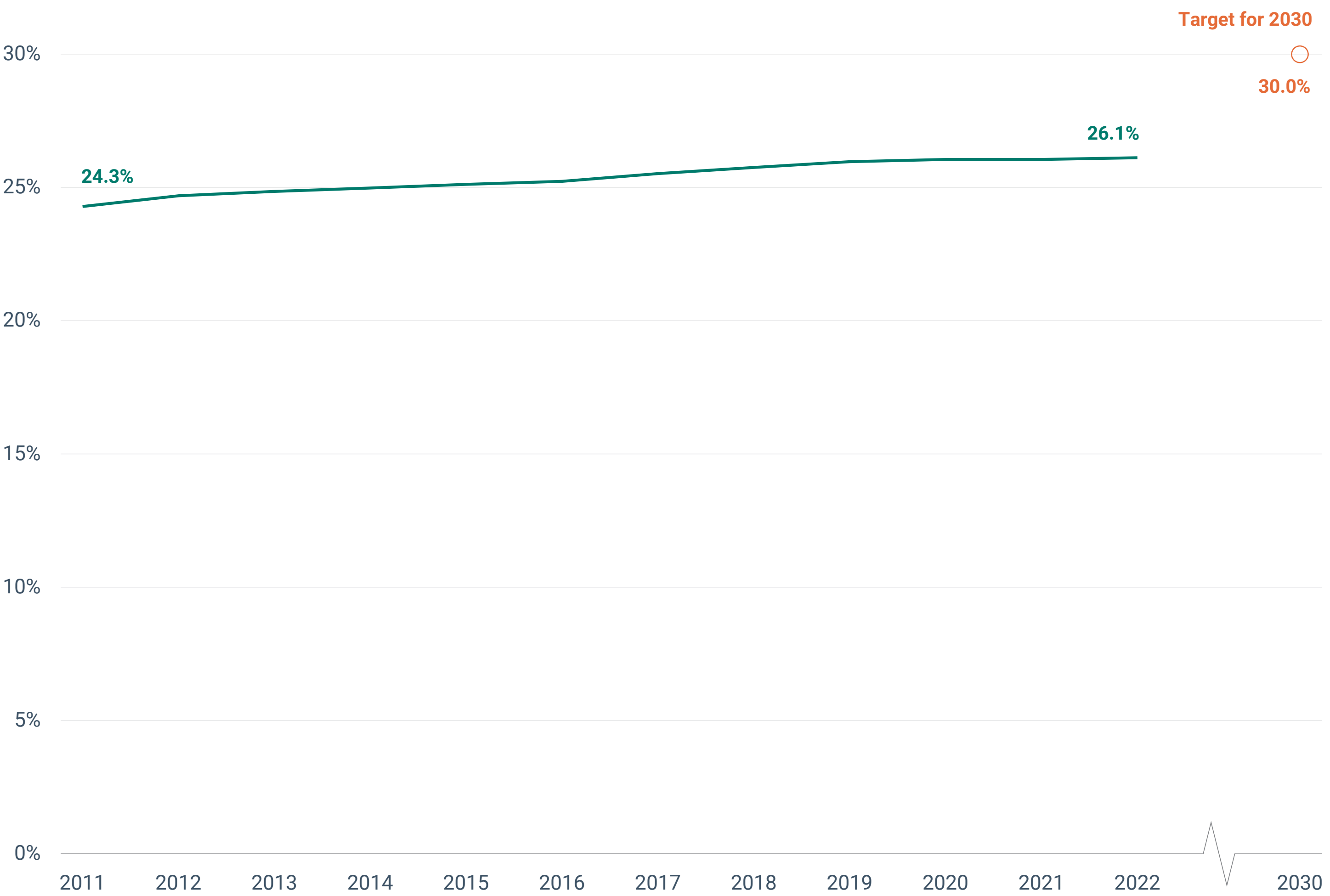
# Terrestrial protected areas in Europe

Published 12 Nov 2024



By the end of 2022, protected areas covered 26.1% of European Union land, with 18.6% of EU land designated as Natura 2000 sites and 7.5% under other complementary national designations. The EU biodiversity strategy for 2030 sets out a target of protecting at least 30% of EU land by 2030, while ensuring that all protected areas are managed effectively. The area reported as protected has steadily increased since 2011, by 1.8 percentage points, yet there are no signs of growth in the last years. It is currently uncertain whether the EU will meet the 30% target, unless rate of designation of protected areas more than doubles by 2030.

## Figure 1. Coverage of protected areas in the EU-27 land area in 2011-2022



Protected areas benefit species, ecosystems, and the environment. They provide significant **economic and societal benefits**, including employment opportunities, contribute to human health and well-being, and have significant cultural value. Historically, protected areas have taken many forms and have been established for different purposes, such as protecting wild game resources, preserving natural beauty and, more recently, safeguarding biodiversity.

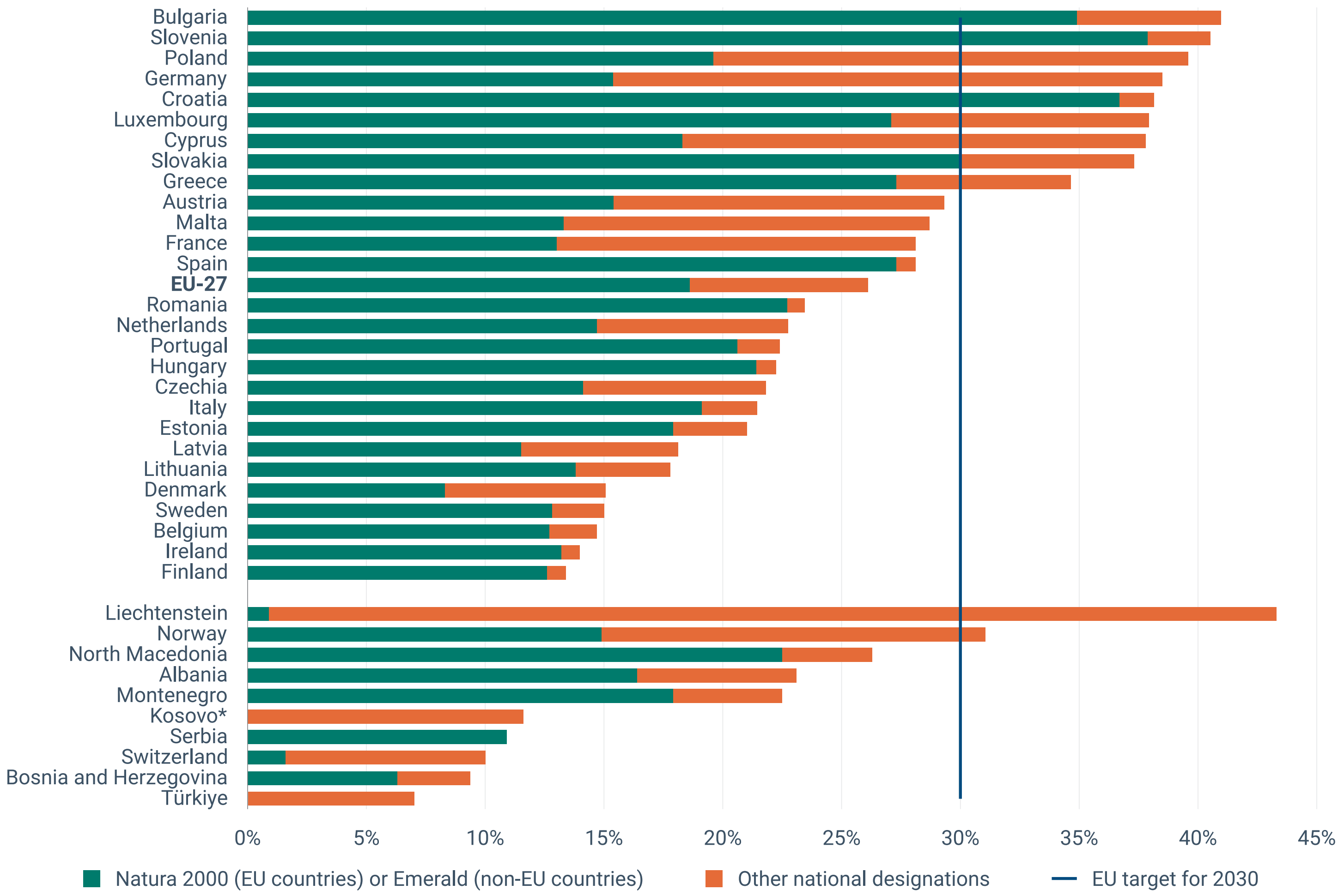
The EU's protected areas are highly diverse, varying in size, aim, and management approach. They are large in number – over 100,000 sites in total – but mostly small in size, with an overall protected surface of 1,079 million km2. This reflects the high **pressure** on land use, arising from agriculture, transport and urban development, and the increasing competition for land for production of renewable energy and biofuels.

Designation of protected areas is an important **policy tool** to halt biodiversity decline. One target of the EU biodiversity strategy for 2030 is to legally protect and effectively manage a minimum of 30% of EU land by 2030. The CBD Kunming-Montreal Global Biodiversity Framework also includes a similar coverage target. Based on Member States reports, 26.1% of EU land was **protected** by the end of 2022, with 18.6% of EU land designated as Natura 2000 sites – areas protected under the EU Birds and Habitats Directives – and 7.5% as other complementary national designations.

While the area reported as protected has steadily increased since 2011 (by 1.8 percentage points), it has not done so in recent years and presently, it is rather uncertain whether the EU will meet the 30% target. For this to occur, the **rate of designation** of protected areas is required to more than double by 2030.

The designation of protected areas is not a guarantee of biodiversity protection, as their management is a decisive factor in achieving conservation aims. However, there is a lack of comprehensive information on how effectively these areas are managed. A well-connected and effectively managed **network of protected areas** is a pre-condition to prevent species and habitats being lost. This requires building an ecologically coherent network that ensures both spatial and functional connectivity within countries and across borders. Member States will need to establish appropriate conservation objectives and measures as well as consistent monitoring for all the existing and future sites to achieve this.

## Figure 2. Terrestrial protected area coverage by country and in the EU-27 by end of 2022




The environmental diversity of Europe's countries and biogeographical regions is matched by the diversity in its protected areas. By the end of 2022, nine Member States had designated **more than 30%** of their land area as protected (Figure 2): Bulgaria, Croatia, Cyprus, Germany, Greece, Luxembourg, Poland, Slovakia and Slovenia. Five EU Member States with 15% or less of protected areas will need to significantly intensify their efforts to reach the target .

While **Natura 2000** is the backbone of the protected areas network in the EU, it is complemented by additional areas designated at national level. The different patterns among Natura 2000 and other national designations reflect the diversity of historical, geographical, administrative, political and cultural circumstances and the management regime. However it is clear that the designation of Natura 2000 sites has significantly increased protected areas in Europe [1].

Protected areas coverage in non-EU EEA member countries and cooperating countries varied hugely by the end of 2022. Many countries will **need to strongly increase** their efforts to reach the target for protected areas adopted as part of the Kunming-Montreal Global Biodiversity Framework.

In addition, Figure 2 shows the contribution of the Emerald network of sites, established under the Bern Convention, to protect species and habitats in those countries.

## Supporting information

**Definition**

The indicator illustrates the changes in the share of terrestrial protected areas in the EU-27 land over time. It also distinguishes between protected areas designated as Natura 2000 sites or Emerald sites and other national designations.

A protected area is a clearly defined geographical space, recognised, dedicated and managed through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values [2].

**Methodology**

The data for the nationally designated protected areas inventory are delivered by the Eionet partnership countries as spatial and tabular information. The inventory began in 1995 under the CORINE programme of the European Commission.

The Natura 2000 network is based on the 1979 Birds Directive and the 1992 Habitats Directive. The European database of Natura 2000 sites consists of a compilation of the data submitted by the Member States of the European Union. This European database is generally updated once a year to take into account any updating of national databases by Member States. However, the release of a new EU-wide database does not necessarily mean that a particular national dataset has recently been updated.

The Emerald network is an ecological network made up of Areas of Special Conservation Interest. The objective of the Emerald Network is the long-term survival of the species and habitats. The Emerald Network consists of the Areas of Special Conservation Interest (ASCI) designated under Recommendation No. 16 (1989) and Resolution No. 3 (1996) of the Standing Committee to the Bern Convention. The Emerald Network aggregated database is updated annually.

Other national designations are nationally designated areas, created in each country under their specific national legislative instruments. These protected areas include a variety of designation types with different protection regimes and regulations. EEA collects information on nationally designated areas from 38 EEA member countries. This information is updated annually and provides an overview of the number of nationally designated areas in each country, their size and designation type.

The same geographical area may be designated several times under different legislation. When producing area statistics on protected areas, nationally designated protected areas and Natura 2000 datasets are overlayed to avoid double counting of overlapping site designations in the datasets. The Reporting guidelines with full details on the methodology are available from: http://cdr.eionet.europa.eu/help/cdda and https://cdr.eionet.europa.eu/help/natura2000/.

**Policy/environmental relevance**

The indicator is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Programme (8$^{th}$ EAP) [3]. It contributes mainly to the monitoring of the 8$^{th}$ EAP biodiversity-related priority objective Article 2.e that shall be met by 2030: ‘protecting, preserving and restoring marine and terrestrial biodiversity and the biodiversity of inland waters inside and outside protected areas by, inter alia, halting and reversing biodiversity loss and improving the state of ecosystems and their functions and the services they provide, and by improving the state of the environment, in particular air, water and soil, as well as by combating desertification and soil degradation’. The European Commission Communication on the 8$^{th}$ EAP monitoring framework specifies that this indicator should monitor progress towards the target to 'legally protect at least 30% of the EU's land area … by 2030'.

The establishment of protected areas is a direct response to concerns over biodiversity loss, so an indicator that measures protected area coverage is a valuable indication of commitment to conserving biodiversity and reducing biodiversity loss at a range of levels.

Comprehensive data on officially designated protected areas are regularly compiled and there is international acceptance of the use of the indicator at the global, regional and national scales.

The EU biodiversity strategy for 2030 contains specific commitments and actions to be delivered by 2030, including establishing a larger EU-wide network of protected areas on land and at sea, building upon existing Natura 2000 areas, with strict protection for areas of very high biodiversity and climate value.

The key commitments for nature protection in the EU biodiversity strategy for 2030 are:

"1. Legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea area and integrate ecological corridors, as part of a true Trans-European Nature Network.

2. Strictly protect at least a third of the EU's protected areas, including all remaining EU primary and old-growth forests.

3. Effectively manage all protected areas, defining clear conservation objectives and measures, and monitoring them appropriately."

Terrestrial protected areas are used in the EU biodiversity dashboard to monitor progress towards the EU Biodiversity Strategy for 2030 and as an EU indicator to monitor progress towards the Sustainable Development Goal 15: "Life on land".

At the global level, new targets for protected areas have been adopted as part of the Kunming-Montreal Global Biodiversity Framework [4], including Target 3 to effectively conserve and manage at least 30% of the world's terrestrial areas.

**Accuracy and uncertainties**

No uncertainty has been specified.

**Data sources and providers**

- Nationally designated areas for public access (vector data) - version 21, Jun. 2023, European Environment Agency (EEA)
- Natura 2000 (vector) - version 2022, European Environment Agency (EEA)
- EuroBoundaryMap 2020 (EBM 2020), Jan. 2020 (copyrights protected) , EuroGeographics
- Emerald Network data (vector) - the Pan-European network of protected sites version 2023, Feb 2024, European Environment Agency (EEA)

## Metadata

**DPSIR**

Response

**Topics**

# Biodiversity   # Nature protection and restoration

**Tags**

# protected areas   # Birds Directive   # 8th EAP   # Habitats Directive   # SEBI007   # Emerald network
# Natura 2000

**Temporal coverage**

2011-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG15: Life on land

**Unit of measure**

Percentage

**Frequency of dissemination**

Once a year

# References and footnotes


1. EEA, 2012. Protected areas in Europe: an overview, 2012, No 5/2012, Publications Office, Luxembourg. ↵
2. Dudley, N., Shadie, P. and Stolton, S., 2013, *Guidelines for applying protected area management categories including IUCN WCPA best practice guidance on recognising protected areas and assigning management categories and governance types*, IUCN, Gland. ↵
3. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union environment action programme to 2030, OJ L 114, 12.4.2022, p. 22-36. ↵
4. CBD, 2022, 'COP 15: final text of Kunming-Montreal global biodiversity framework', *Convention on Biological Diversity* ( https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222) accessed June 28, 2023. ↵

European Environment Agency

# 8th Environment Action Programme

## Designated marine protected areas in Europe's seas

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

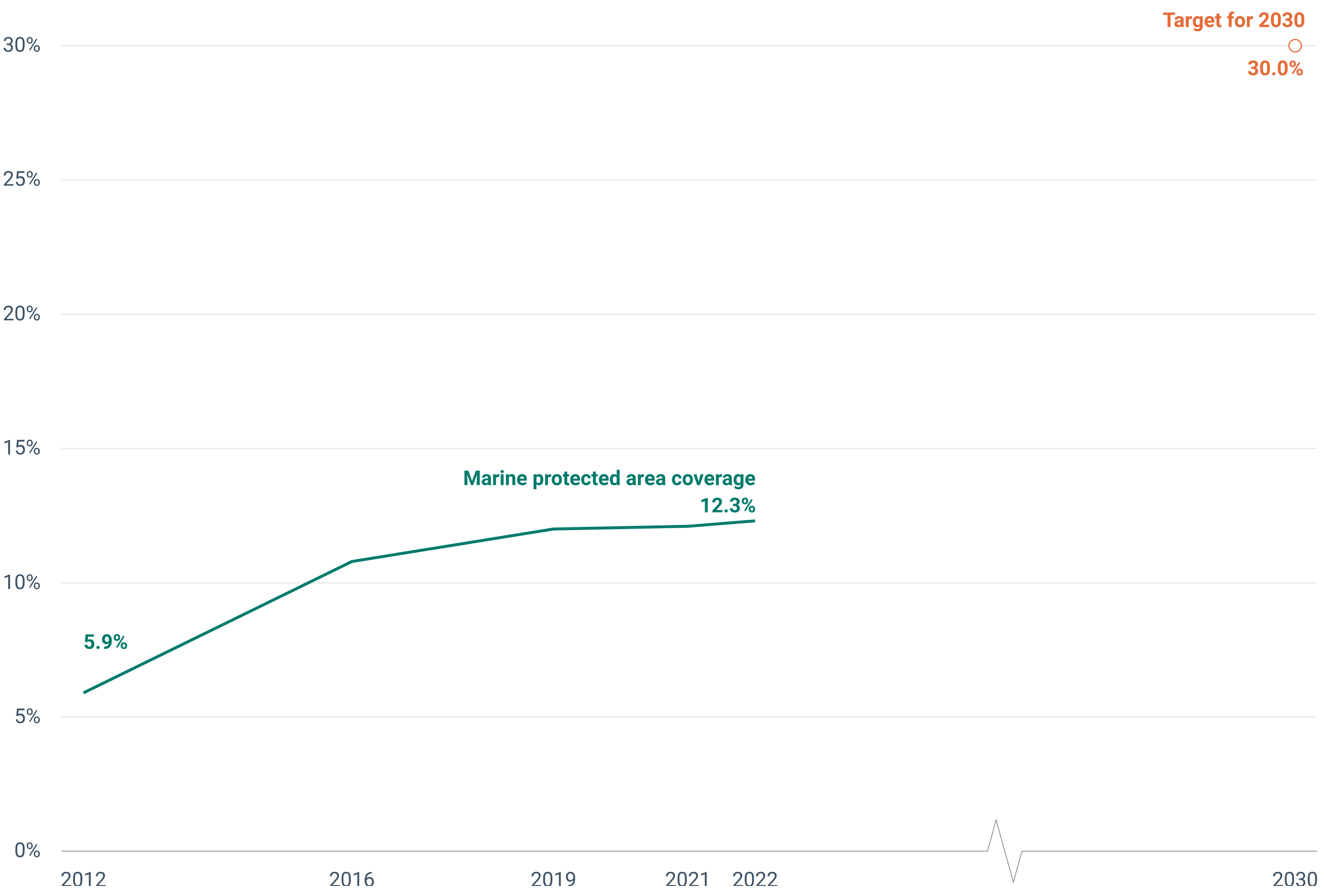
# Marine protected areas in Europe's seas

Published 19 Dec 2024



The European Union has made progress in designating new marine protected areas, both as part of the Natura 2000 network and through complementary national designations. As a result, marine protected area coverage more than doubled, to 12.3%, between 2012 and 2022. However, efforts will need to increase significantly to achieve the EU Biodiversity strategy target of protecting at least 30% of EU seas by 2030, while also ensuring that all protected areas are effectively managed. At present it appears unlikely that the terget will be met.

## Figure 1. Marine protected area coverage in the EU, 2012-2022




The conservation of coastal and marine areas is important for maintaining **biodiversity** and ensuring that ecosystems and their services are fully functional. Marine protected areas (MPAs) play a key role in conserving coastal and marine ecosystems, and provide significant economic and societal benefits supporting local livelihoods.

Designation of protected areas is an essential policy tool to halt biodiversity decline. One target of the EU Biodiversity strategy for 2030 is to legally **protect** and effectively **manage** a minimum of 30% of EU seas by 2030. Target 3 of the CBD's Kunming-Montreal Global Biodiversity Framework also includes a similar coverage target.

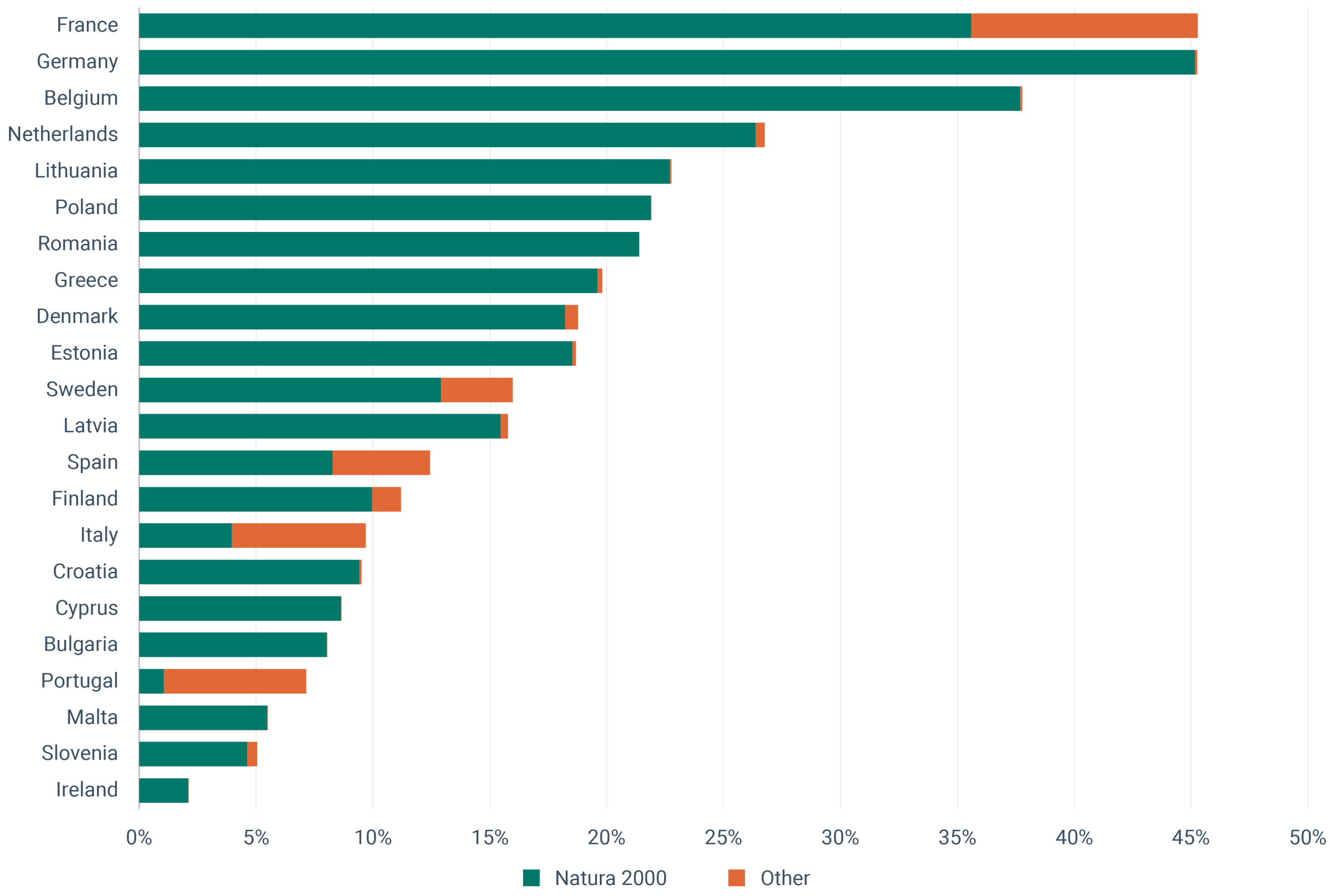
Over the last decade, the total area covered by marine protected areas in the EU has **increased** gradually, from 5.9% in 2012 to 12.3% in 2022. This is the result of both the expansion of the Natura 2000 network (a network of protected areas designated under the EU nature directives) and protected areas established through complementary national designations, as well as protected areas designated under the Regional Seas Conventions (RSC), namely Barcelona Convention, HELCOM & OSPAR.

Although this trend is positive, **further expansion** will be needed to reach the target of legally protecting at least 30% of EU's seas by 2030. The current rate of designation must increase more than threefold compared to the progress made over the last decade.

The EU Biodiversity Strategy for 2030 highlights the importance of building a truly coherent Trans-European network of protected areas through improving their connectivity. It will therefore be particularly important for the designation of new protected areas in EU's seas to ensure that these areas are defined based on sound **scientific analysis** ensuring ecological representativity, coherence and connectivity.

Additionally, improving management effectiveness of individual marine protected areas and of their networks should become a major focus in the coming years. While no comprehensive information is available yet to provide an overview of how effectively managed European MPAs are, it will be essential to develop such indicators in the coming years to track progress in implementing the targets of the EU Biodiversity Strategy for 2030.

## Figure 2. Marine protected area coverage in EU Member States, 2012-2022




By 2022, several EU Member States had made **significant progress** in protecting their marine ecosystems through the designation of MPAs. Germany, Belgium and France have surpassed 30% coverage. Other countries such as the Netherlands, Lithuania, Poland and Romania have expanded their networks of MPAs beyond 20%. Natura 2000 plays a very significant role in the MPAs networks in most countries, with complementary national designations adding to the networks in Sweden, Spain, Finland, Italy and Portugal.

While some progress in designating new MPAs could be observed in most Member States over the last 10 years, it has been slow in many countries. However, such differences also reflect the **variances** between the European marine regions with their diverse ecological conditions. While it is important for Member States to continue working at national level to define new MPAs, it is also crucial to ensure cooperation across European regional seas. This will support the development of a coherent network of MPAs across the EU and to achieve the joint target of protecting at least 30% of seas.

## Supporting information

### Definition

This indicator illustrates the changes in the share of marine protected areas in the EU-27 over time. It also distinguishes between protected areas designated as Natura 2000 sites or Emerald sites, other national designations, and those designated under Regional Sea Conventions.

A protected area is a clearly defined geographical space, recognised, dedicated and managed through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

**Methodology**

## Methodology for data collection

The data for the nationally designated protected areas inventory are delivered by the Eionet partnership countries as spatial and tabular information. The inventory began in 1995 under the CORINE programme of the European Commission.

The Natura 2000 network is based on the 1979 Birds Directive and the 1992 Habitats Directive. The European database of Natura 2000 sites consists of a compilation of the data submitted by the Member States of the European Union. This European database is generally updated once a year to take into account any updating of national databases by Member States.

However, the release of a new EU-wide database does not necessarily mean that a particular national dataset has recently been updated.

The same geographical area may be designated several times under different legislation. When producing area statistics on protected areas, nationally designated protected areas and Natura 2000 datasets are overlayed to avoid double counting of overlapping site designations in the datasets. To streamline the management of the complex spatial vector data from Natura 2000 and National Designated Areas the data were combined into a single dataset. This unified dataset was transferred to the EEA-JEDI data cube as a 10m gridded “dimension”.

The Reporting guidelines with full details on the methodology are available from: http://cdr.eionet.europa.eu/help/cdda and https://cdr.eionet.europa.eu/help/natura2000/

To ensure a comprehensive coverage of EU waters, protected areas designated under the Regional Seas Conventions (RSC), including the Barcelona Convention, HELCOM and OSPAR, were included, using the latest available data from the databases published by these conventions.

## Methodology for indicator calculation

As the terrestrial protected area indicator is already calculated within the JEDI systems, the same methodology was adopted for calculating the marine protected areas indicator. To achieve this, the relevant data was first transferred to a data cube, consolidating all necessary information:

- EEA marine assessment areas (JEDI-link);

- EEA marine water (JEDI-link);

- Protected areas (JEDI-link);

- Regional sea convention protected areas (JEDI-link).

In the next step, the protected area coverage were calculated individually for each country. If multiple countries reported protected areas within the same marine region, these areas were assigned to both countries.

Next, a second statistic was calculated to assess the distribution of protected marine areas within the EEA region. Since individual countries do not need to be considered in this case, no overlaps were accounted for, and the results accurately reflect the percentage of protected areas.

All calculations were performed using Azure Databricks. The corresponding script is available on GitHub:

https://github.com/eea/ETC-DI-databricks/blob/main/D56_PA_protected_area.sql .

**Policy/environmental relevance**

The indicator is a headline indicator for monitoring progress towards the goals of the Eighth Environment Action Programme (8th EAP). It will contribute mainly to monitoring progress towards the 8th EAP biodiversity-related priority objective set out in Article 2(e), to be met by 2030: 'protecting, preserving and restoring marine and terrestrial biodiversity and the biodiversity of inland waters inside and outside protected areas by, inter alia, halting and reversing biodiversity loss and improving the state of ecosystems and their functions and the services they provide, and by improving the state of the environment, in particular air, water and soil, as well as by combating desertification and soil degradation'[1]. The European Commission's communication on 8th EAP monitoring specifies that this indicator should monitor progress towards meeting the target to legally protect at least 30% of the EU's sea area by 2030[2].

The indicator is included in the EU Biodiversity Strategy dashboard. The EU Biodiversity Strategy for 2030 contains specific targets for protected areas to be delivered by 2030, including expanding the current network, in line with the following targets:

· to legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea area and integrate ecological corridors, as part of a true trans-European nature network;

· to strictly protect at least a third of the EU's protected areas, including all remaining EU primary- and old-growth forests;

· to effectively manage all protected areas, defining clear conservation objectives and measures, and monitor them appropriately.

This indicator directly tracks progress towards achieving the 30% target for protecting the EU's seas. The indicator is used by several EU monitoring mechanisms, such as the EU biodiversity dashboard and for the EU's Sustainable Development Goal (SDG) monitoring.

Other relevant EU policy instruments include the EU Marine Strategy Framework Directive (MSFD).

At the global level, targets for protected areas have been adopted as part of the Kunming-Montreal Global Biodiversity Framework, including Target 3 to effectively conserve and manage at least 30% of the world's marine area.

The indicator is also used for monitoring progress towards SDG14 in the European context.

**Accuracy and uncertainties**

## Methodology uncertainty

Due to differences in data resolution, variations in coastline delineations may occur, potentially leading to minor inaccuracies near coastal regions. For instance, small sections of terrestrial protected areas might be mistakenly included in the marine area data.

**Data sources and providers**

- Nationally designated areas for public access (vector data) - May 2024, European Environment Agency (EEA)
- Natura 2000 (vector) - version 2022, European Environment Agency (EEA)
- EEA marine assessment areas - version 3.0, Oct. 2022, European Environment Agency (EEA)

- EEA coastline for analysis (polygon) - version 3.0, March 2017, European Environment Agency (EEA)
- OSPAR Marine Protected Areas Network, OSPAR Commision
- HELCOM MPAs, Helsinki Commission (HELCOM)
- EEA Marine waters for analysis - INTERNAL VERSION, Oct. 2022 (Copyright proyected), European Environment Agency (EEA)
- EEA Marine waters for analysis - INTERNAL VERSION, Oct. 2022 (Copyrights protected), European Environment Agency (EEA)
- Specially Protected Areas of Mediterranean Importance (SPAMIs), Regional Activity Centre for Specially Protected Areas (SPA/RAC)

## Metadata

**DPSIR**

Response

**Topics**

# Biodiversity

**Tags**

# Designated areas # protected areas # 8th EAP # CDDA # Habitats Directive # MAR004 # Natura 2000

**Temporal coverage**

2012-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG14: Life below water

**Unit of measure**

Percentage

**Frequency of dissemination**

Once a year

## References and footnotes


1. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22–36.
↩

2. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives, COM(2022) 357 final.
↩

European Environment Agency

# 8th Environment Action Programme

## Common bird index in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

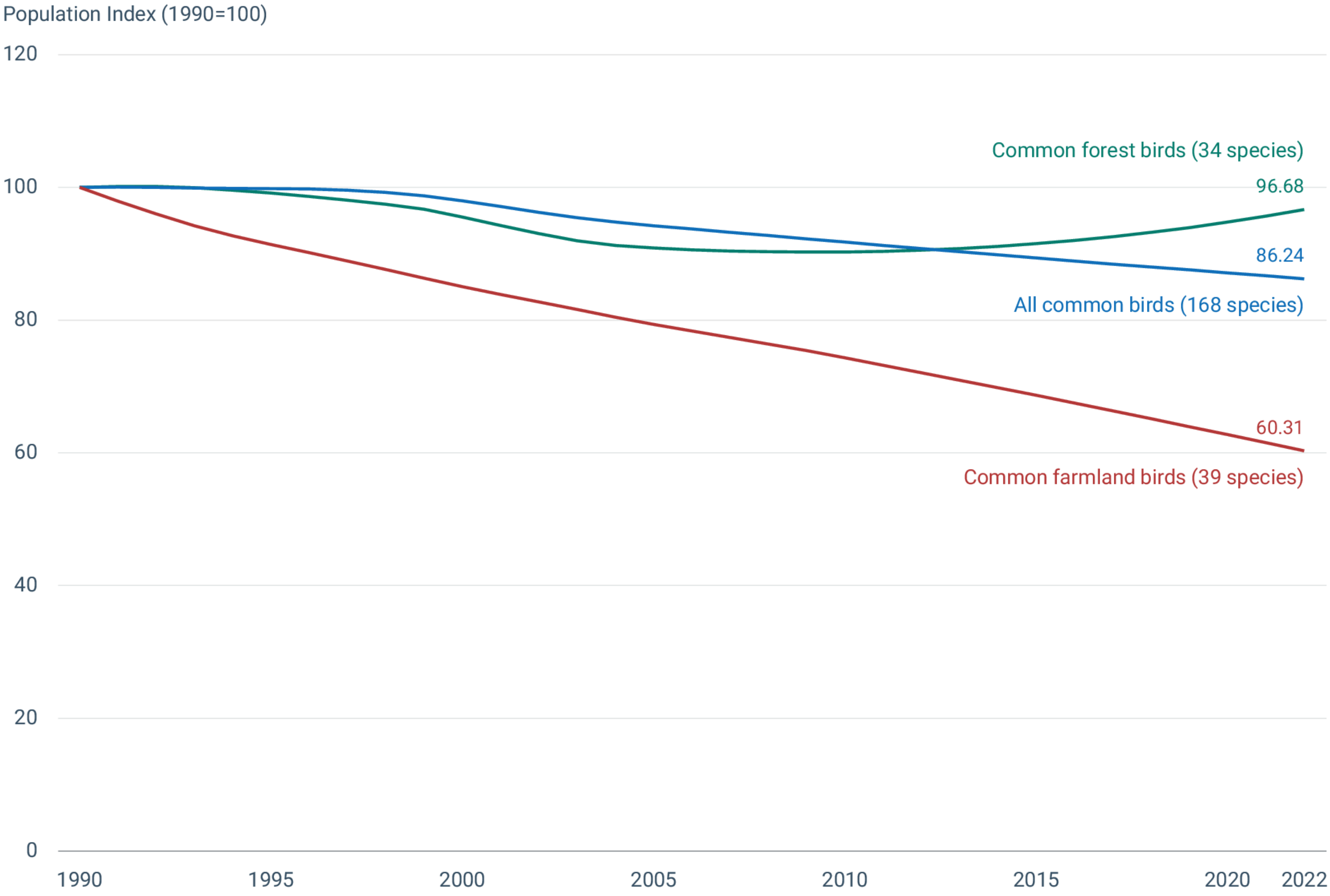
# Common bird index in Europe

Published 11 Sept 2024



Birds are sensitive to environmental pressures and can indicate the health of the environment. Long-term trends show that between 1990 and 2022 the index of 168 common birds decreased by 14% in the EU. The decline was much stronger in common farmland birds, at 40%, while the common forest bird index decreased by 3%. At present, it seems unlikely that the decline in populations of common birds can be reversed by 2030. Member States need to significantly increase the implementation of existing policies and put new conservation and restoration measures in place to ensure their recovery.

## Figure 1. Common bird index in the EU, 1990-2022




Birds are sensitive to environmental pressures. Therefore, their population numbers can serve as an indicator of the health of the environment and help **measure progress** towards the EU’s aim to put biodiversity on the path to recovery by 2030. The status of bird populations has been the subject of long-term monitoring in Europe, much of it via voluntary effort. This is a good example of how the power of **citizen science** can be released through effective targeting and clearly defined monitoring methods [1].

Long-term trends of 168 common birds in the 26 EU Member States with monitoring schemes reveal significant **population declines**. Between 1990 and 2022, the common bird index decreased by 14%, while the common forest bird index decreased by 3%. The decline in common farmland birds was much more pronounced, at 40%. Although this indicator uses 1990 as a baseline, significant decreases had already occurred before this date [2].

These trends demonstrate a major decline in biodiversity in Europe, caused by anthropogenic pressures [3][4][5] . **Agricultural intensification**, in particular pesticides and fertiliser use, is the **main pressure** causing bird population declines [6]. This not only impacts farmland species but also many other common species, especially those whose diet relies on insects and other invertebrates.

There are **other factors** that have adverse effects on the recovery of populations. These include land use change and associated habitat loss and degradation[7][8][9], fragmentation and loss of landscape features [10][11][12][13], intensive forest management [14][15], urbanisation [6], climate change [16][17], increasing competition for land for production of renewable energy and biofuels [18][19], and illegal killing.

It is difficult to forecast how soon biodiversity, as illustrated by the abundance of bird populations, can recover. This recovery is influenced by a complex combination of socio-economic drivers, environmental factors, and policy measures[20]. The measures set out in the Birds and Habitats Directives have helped protect target bird species and their habitats[21][22] . However, the overall decline of bird populations in the EU is mainly driven by large declines in a number of common species [4][5].

The EU regulation on nature restoration paves the way for a broad range of **ecosystems** to be restored. It includes **obligations** to achieve an increasing trend of common farmland and forest bird indices by 2030 and thereafter. This will require Member States to put appropriate restoration measures in place.

The past trend indicates a **steady decline** in the population of **all common birds**, which seems unlikely to be reversed by 2030, as the time needed for species to respond to conservation and restoration actions is unclear. In addition, it is crucial that more effective and ambitious measures to halt biodiversity loss are included in other policies, such as the EU common agricultural policy (CAP) and that CAP Strategic Plans support the implementation and effectiveness of the current and upcoming EU biodiversity and nature legislation [23].

## Supporting information

### Definition

This indicator is a multi-species index measuring changes in population abundance of all common bird species (n=168), as well as those associated with specific habitats: common farmland bird species (n=39) and common forest bird species (n=34). The index for each group is calculated as an EU aggregate, using 1990 as reference year. Each of the three EU bird indices is presented as a smoothed time series and is calculated with 95% confidence limits.

### Methodology

The data for this indicator originate from national monitoring data collected by the Pan-European Common Bird Monitoring Scheme (PECBMS). The PECBMS coordination unit is part of the Czech Society for Ornithology(CSO), based in Prague, Czechia.

Trend information spanning different time periods is derived from annual national breeding bird surveys in 26 EU countries. Skilled survey participants, including volunteers, carry out counting and data collection. Data are collected nationally on an annual basis during the breeding season through common bird monitoring schemes. National bird monitoring data are gathered using several count methods (e.g., standardised point transects/line transects, territory mapping), using a variety of sampling strategies (from free choice of plots to stratified random sampling), and individual plot sizes vary within each country (from 1×1km or 2×2km squares or 2.5-degree grid squares to irregular polygons).

Indicators (multi-species indices) are computed using the MSI-tool (R-script) for calculating multi-species indicators (MSIs) and trends in MSIs. A Monte Carlo method is used to account for sampling error and when not all yearly index numbers for all species are available. The method of calculation is described in [24]. European, EU or regional species indices including standard errors are used as source data.

The PECBMS European species classification (farmland, forest and other common birds) has been developed over time as the indicators have been published and refined. See the PECBMS website for further details on "Species selection and classification".

The current population index of common birds at EU level was produced for the following 168 species:

- **Common farmland birds**: *Alauda arvensis, Alectoris rufa, Anthus campestris, Anthus pratensis, Bubulcus ibis, Burhinus oedicnemus, Calandrella brachydactyla, Ciconia ciconia, Corvus frugilegus, Emberiza calndra, Emberiza cirlus, Emberiza citrinella, Emberiza hortulana, Emberiza malanocephala, Falco tinnunculus, Galerida cristata, Galerida theklae, Hirundo rustica, Lanius collurio, Lanius minor, Lanius senator, Limosa limosa, Linaria cannabina, Melanocorypha calandra, Motacilla flava, Oenanthe hispanica, Passer montanus, Perdix perdix, Petronia petronia, Saxicola rubetra, Saxicola torquatus, Serinus serinus, Streptopelia turtur, Sturnus unicolor, Sturnus vulgaris, Sylvia communis, Tetrax tetrax, Upupa epops and Vanellus vanellus*;
- **Common forest birds**: *Accipiter nisus, Anthus trivialis, Bombycilla garrulous, Bonasa bonasia, Carduelis cintinella, Certhia brachydactyla, Certhia familiaris, Coccothraustes coccothraustes, Columba oenas, Cyanopica cyanus, Dryobates minor, Dryocopus martius, Emberiza rustica, Ficedula albicollis, Ficedula hypoleuca, Garrulus glandarius, Leiopicus medius, Lophophanes cristatus, Nucifraga caryocatactes, Periparus ater, Phoenicurus phoenicurus, Phylloscopus bonelli, Phylloscopus collybita, Phylloscopus sibilatrix, Picus canus, Poecile montanus, Poecile palustris, Pyrrhula pyrrhula, Regulus ignicapilla, Regulus regulus, Sitta europaea, Spinus spinus, Tringa ochropus and Turdus viscivorus;*
- **Other common birds**: *Acanthis flammea, Acrocephalus arundinaceus, Acrocephalus palustris, Acrocephalus schoenobaenus, Acrocephalus scirpaceus, Actitis hypoleucus, Aegithalos caudatus, Alcedo atthis, Anas platyrhynchos, Apus apus, Ardea cinerea, Buteo buteo, Calcarius lapponicus, Cecropis daurica, Cettia cetti, Chloris chloris, Circus aeruginosus, Cisticola juncidis, Clamator glandarius, Columba palumbus, Corvus corax, Corvus corone, Corvus monedula, Cuculus canorus, Cyanecula svecica, Cyanistes caeruleus, Cygnus olor, Delichon urbicum, Dendrocopos major, Dendrocopos syriacus, Egretta garzetta, Emberiza cia, Emberiza schoeniclus, Erithacus rubecula, Fringilla coelebs, Fringilla montifringilla, Fulica atra, Gallinago gallinago, Gallinula chloropus, Grus grus, Haematopus ostralegus, Hippolais icterina, Hippolais polyglotta, Iduna pallida, Jynx torquilla, Larus ridibundus, Locustella fluviatilis, Locustella naevia, Lullula arborea, Luscinia luscinia, Luscinia megarhynchos, Lyrurus tetrix, Merops apiaster, Motacilla alba, Motacilla cinerea, Muscicapa striata, Numenius arquata, Numenius phaeopus, Oenanthe oenanthe, Oriolus oriolus, Parus major, Passer domesticus, Phasianus colchicus, Phoenicurus ochruros, Phylloscopus trochilus, Pica pica, Picus viridis, Pluvialis apricaria, Podiceps cristatus, Prunella modularis, Ptyonoprogne rupestris, Pyrrhocorax pyrrhocorax,*

*Streptopelia decaocto, Sylvia atricapilla, Sylvia borin, Sylvia cantillans, Sylvia curruca, Sylvia hortensis, Sylvia melanocephala, Sylvia nisoria, Sylvia undata, Tachybaptus ruficollis, Tadorna tadorna, Tringa erythropus, Tringa glareola, Tringa nebularia, Tringa totanus, Troglodytes troglodytes, Turdus iliacus, Turdus merula, Turdus philomelos, Turdus pilaris and Turdus torquatus.*

National monitoring schemes and indices can contain a subset of these 168 species, reflecting their varying occurrence in different countries. More information is available at: https://pecbms.info/country/.

**Policy/environmental relevance**

The common bird index is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It mainly contributes to monitoring aspects of the 8th EAP priority objective Article 2.2.e that shall be met by 2030: 'protecting, preserving and restoring marine and terrestrial biodiversity and the biodiversity of inland waters inside and outside protected areas by, inter alia, halting and reversing biodiversity loss and improving the state of ecosystems and their functions and the services they provide, and by improving the state of the environment, in particular air, water and soil, as well as by combating desertification and soil degradation' (EU, 2022). For the purposes of the 8th EAP monitoring framework this indicator assesses specifically whether the EU will 'reverse *by 2030* the decline in populations of common birds', (EC, 2022).

The EU regulation on nature restoration in Articles 11 and 12 includes obligations for Member States to achieve an increasing trend at national level of common farmland and forest bird indices by 2030 and thereafter, as further specified in Annexes V and VI to the regulation.

The common bird index is also used in the EU biodiversity dashboard to monitor progress towards the EU Biodiversity Strategy for 2030 and as an EU indicator to monitor progress towards the Sustainable Development Goal 15: "Life on land".

The EU has been taking action to protect biodiversity for a considerable number of years, for example by adopting the Birds Directive — Council Directive 79/409/EEC (updated by Directive 2009/147/EC) and the Habitats Directive — Council Directive 92/43/EEC.

**Accuracy and uncertainties**

Country coverage (i.e. reflecting the availability of high-quality monitoring data from annually operated common bird monitoring schemes employing generic survey methods and producing reliable national trends): Austria (since 1998), Belgium (Brussels since 1992; Flanders since 2007; Wallonia since 1990), Bulgaria (since 2005), Croatia (since 2015), Cyprus (since 2006), Czechia (since 1982), Denmark (since 1976), Estonia (since 1983), Finland (since 1975), France (since 1989), Germany (since 1989), Greece (since 2007), Hungary (since 1999), Ireland (since 1998), Italy (since 2000), Latvia (since 1995), Lithuania (since 2011), Luxembourg (since 2009), the Netherlands (since 1984), Poland (since 2000), Portugal (since 2004), Romania (since 2007), Slovakia (since 2005), Slovenia (since 2008), Spain (since 1998) and Sweden (since 1975).

**Data sources and providers**

- Common bird index by type of species - EU aggregate, European Bird Census Council, BirdLife International, Royal Society for the Protection of Birds, Czech Society for Ornithology

## Metadata

**DPSIR**

Impact

**Topics**

# Biodiversity # Nature protection and restoration

**Tags**

# biodiversity # common birds # population trends # bird populations # Common bird index # SEBI027 # common farmland and forest birds # conservation # birds # animal and plant population # 8th EAP

**Temporal coverage**

1990-2022

**Geographic coverage**

| | |
|---|---|
| Austria | Belgium |
| Bulgaria | Croatia |
| Cyprus | Czechia |
| Denmark | Estonia |
| Finland | France |
| Germany | Greece |
| Hungary | Ireland |
| Italy | Latvia |
| Lithuania | Luxembourg |
| Netherlands | Poland |
| Portugal | Romania |
| Slovakia | Slovenia |
| Spain | Sweden |

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG15: Life on land

**Unit of measure**

Population index (1990=100)

**Frequency of dissemination**

Once a year

## References and footnotes


1. Brlík, V., Šilarová, E., Škorpilová, J., Alonso, H., Anton, M., Aunins, A., Benkö, Z., Biver, G., Busch, M., Chodkiewicz, T., Chylarecki, P., Coombes, D., De Carli, E., Del Moral, J. C., Derouaux, A., Escandell, V., Eskildsen, D. P., Fontaine, B., Foppen, R. P. B. et al., 2021, 'Long-term and large-scale multispecies dataset tracking population changes of common European breeding birds', *Scientific Data* 8(1), pp. 21 ( https://www.nature.com/articles/s41597-021-00804-2) accessed September 10, 2024. ↵

2. Butchart, S. H. M., Walpole, M., Collen, B., Strien, A. van, Scharlemann, J. P. W., Almond, R. E. A., Baillie, J. E. M., Bomhard, B., Brown, C., Bruno, J., Carpenter, K. E., Carr, G. M., Chanson, J., Chenery, A. M., Csirke, J., Davidson, N. C., Dentener, F., Foster, M., Galli, A. et al., 2010, 'Global biodiversity: indicators of recent declines', *Science* 328(5982), pp. 1164–1168 ( http://www.sciencemag.org/content/328/5982/1164) accessed October 21, 2013. ↵

3. IPBES, 2019, *Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, IPBES secretariat, Bonn, Germany. ↵

4. Burns, F., Eaton, M. A., Burfield, I. J., Klvaňová, A., Šilarová, E., Staneva, A. and Gregory, R. D., 2021, 'Abundance decline in the avifauna of the European Union reveals cross-continental similarities in biodiversity change', *Ecology and Evolution* 11(23), pp. 16647–16660 ( https://onlinelibrary.wiley.com/doi/abs/10.1002/ece3.8282) accessed May 19, 2023. a b

5. Gregory, R. D., Eaton, M. A., Burfield, I. J., Grice, P. V., Howard, C., Klvaňová, A., Noble, D., Šilarová, E., Staneva, A., Stephens, P. A., Willis, S. G., Woodward, I. D. and Burns, F., 2023, 'Drivers of the changing abundance of European birds at two spatial scales', *The Royal Society*. a b

6. Rigal, S., Dakos, V., Alonso, H., Auniņš, A., Benkő, Z., Brotons, L., Chodkiewicz, T., Chylarecki, P., de Carli, E., del Moral, J. C., Domşa, C., Escandell, V., Fontaine, B., Foppen, R., Gregory, R., Harris, S., Herrando, S., Husby, M., Ieronymidou, C. et al., 2023, 'Farmland practices are driving bird population decline across Europe', *Proceedings of the National Academy of Sciences*. a b

7. Donald, P. F., Green, R. E. and Heath, M. F., 2001, 'Agricultural intensification and the collapse of Europe's farmland bird populations', *Proceedings of the Royal Society. B, Biological Sciences* 268(1462), pp. 25–29 ( https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1087596/) accessed January 8, 2019. ↵

8. Musitelli, F., Romano, A., Møller, A. P. and Ambrosini, R., 2016, 'Effects of livestock farming on birds of rural areas in Europe', *Biodiversity and Conservation* 25(4), pp. 615–631 ( https://doi.org/10.1007/s10531-016-1087-9) accessed January 8, 2019. ↵

9. Guerrero, I., Morales, M. B., Oñate, J. J., Geiger, F., Berendse, F., Snoo, G., Eggers, S., Pärt, T., Bengtsson, J., Clement, L. W., Weisser, W. W., Olszewski, A., Ceryngier, P., Hawro, V., Liira, J., Aavik, T., Fischer, C., Flohre, A., Thies, C. et al., 2012, 'Response of ground-nesting farmland birds to agricultural intensification across Europe: Landscape and field level management factors', *Elsevier BV*. ↵

10. Stoate, C., Boatman, N. D., Borralho, R. J., Carvalho, C. R., Snoo, G. R. de and Eden, P., 2001, 'Ecological impacts of arable intensification in Europe', *Journal of Environmental Management* 63(4), pp. 337–365 ( https://www.sciencedirect.com/science/article/pii/S0301479701904736) accessed May 19, 2023. ↵

11. Vickery, J. A., Feber, R. E. and Fuller, R. J., 2009, 'Arable field margins managed for biodiversity conservation: a review of food resource provision for farmland birds', *Agriculture, Ecosystems and Environment* 133(1), pp. 1–13 (http://www.sciencedirect.com/science/article/pii/S0167880909001625) accessed January 8, 2019.

12. Traba, J. and Morales, M. B., 2019, 'The decline of farmland birds in Spain is strongly associated to the loss of fallowland', *Scientific Reports* 9(1), pp. 9473 (https://www.nature.com/articles/s41598-019-45854-0) accessed May 19, 2023.

13. Reif, J. and Vermouzek, Z., 2019, 'Collapse of farmland bird populations in an Eastern European country following its EU accession', *Conservation Letters* 12(1), pp. e12585 (https://onlinelibrary.wiley.com/doi/abs/10.1111/conl.12585) accessed May 19, 2023.

14. Fraixedas, S., Lindén, A. and Lehikoinen, A., 2015, 'Population trends of common breeding forest birds in southern Finland are consistent with trends in forest management and climate change', *Ornis Fennica* 92, pp. 187–203.

15. Virkkala, R., 2016, 'Long-term decline of southern boreal forest birds: consequence of habitat alteration or climate change?', *Biodiversity and Conservation* 25(1), pp. 151–167 (https://doi.org/10.1007/s10531-015-1043-0) accessed March 20, 2019.

16. Stewart, P. S., Voskamp, A., Santini, L., Biber, M. F., Devenish, A. J. M., Hof, C., Willis, S. G. and Tobias, J. A., 2022, 'Global impacts of climate change on avian functional diversity', *Ecology Letters* 25(3), pp. 673–685 (https://onlinelibrary.wiley.com/doi/abs/10.1111/ele.13830) accessed May 19, 2023.

17. Fletcher Jr, R. J., Robertson, B. A., Evans, J., Doran, P. J., Alavalapati, J. R. and Schemske, D. W., 2011, 'Biodiversity conservation in the era of biofuels: risks and opportunities', *Frontiers in Ecology and the Environment* 9(3), pp. 161–168 (https://onlinelibrary.wiley.com/doi/abs/10.1890/090091) accessed May 19, 2023.

18. Gasparatos, A., Doll, C. N. H., Esteban, M., Ahmed, A. and Olang, T. A., 2017, 'Renewable energy and biodiversity: Implications for transitioning to a Green Economy', *Renewable and Sustainable Energy Reviews* 70, pp. 161–184 (http://www.sciencedirect.com/science/article/pii/S1364032116304622) accessed June 1, 2018.

19. Conkling, T. J., Vander Zanden, H. B., Allison, T. D., Diffendorfer, J. E., Dietsch, T. V., Duerr, A. E., Fesnock, A. L., Hernandez, R. R., Loss, S. R., Nelson, D. M., Sanzenbacher, P. M., Yee, J. L. and Katzner, T. E., 2022, 'Vulnerability of avian populations to renewable energy production', *Royal Society Open Science* 9(3), pp. 211558 (https://royalsocietypublishing.org/doi/10.1098/rsos.211558) accessed May 19, 2023.

20. Watts, K., Whytock, R. C., Park, K. J., Fuentes-Montemayor, E., Macgregor, N. A., Duffield, S. and McGowan, P. J. K., 2020, 'Ecological time lags and the journey towards conservation success', *Springer Science and Business Media LLC*.

21. Christina Ieronymidou, Fiona J. Sanderson, Paul F. Donald, Philip A. Stephens, Stephen G. Willis, Richard D. Gregory, Ian J. Burfield, Christine Howard, Robert G. Pople and Alison E. Beresford, 2015, 'Assessing the Performance of EU Nature Legislation in Protecting Target Bird Species in an Era of Climate Change', *Wiley*.

22. EEA, 2020, *State of nature in the EU — Results from reporting under the nature directives 2013-2018*, EEA Report, 10/2020, European Environment Agency.
↩

23. Pe'er, G., Finn, J. A., Díaz, M., Birkenstock, M., Lakner, S., Röder, N., Kazakova, Y., Šumrada, T., Bezák, P., Concepción, E. D., Dänhardt, J., Morales, M. B., Rac, I., Špulerová, J., Schindler, S., Stavrinides, M., Targetti, S., Viaggi, D., Vogiatzakis, I. N. et al., 2022, 'How can the European Common Agricultural Policy help halt biodiversity loss? Recommendations by over 300 experts', *Conservation Letters* (https://onlinelibrary.wiley.com/doi/10.1111/conl.12901) accessed September 16, 2022.
↩

24. Soldaat, L. L., Pannekoek, J. and Verweij, R. J. T., 2017, 'A Monte Carlo method to account for sampling error in multi-species indicators', *Ecological Indicators* 81, pp. 340–347.
↩

European Environment Agency

# 8th Environment Action Programme

## Forest connectivity (forest fragmentation) in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

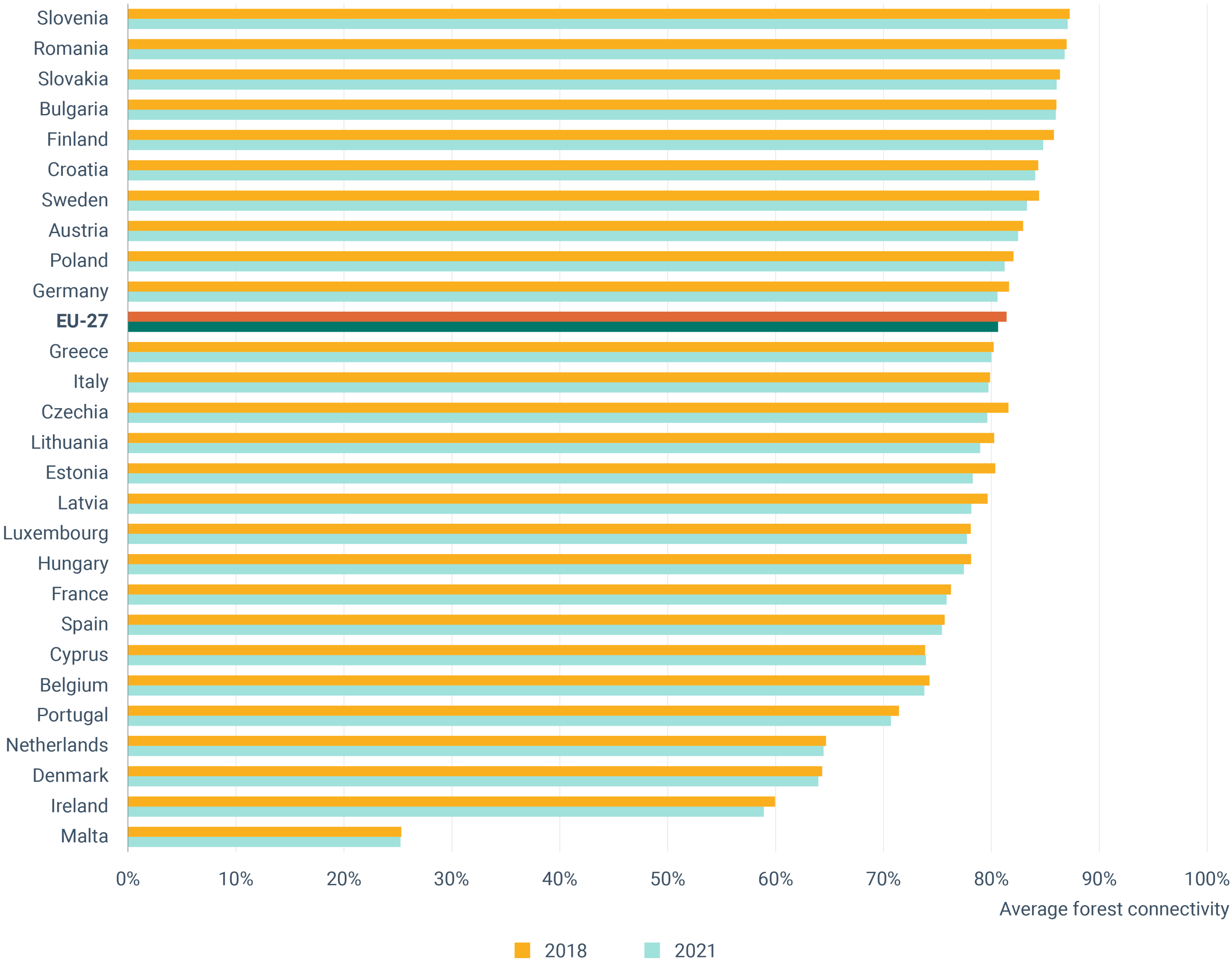
# Forest connectivity in Europe

Published 15 Oct 2024



Increasing forest connectivity is crucial for supporting biodiversity. Connectivity within stocked forest areas is limited by elements fragmenting the tree cover. The European Union's average forest connectivity was 80.6% in 2021, a 0.8% decrease from 2018. The EU has effective policies promoting forest connectivity. However, the effects of these policies will take time to appear as pest and fire outbreaks which intensify with climate change lead to immediate, often temporary, losses in connectivity. Therefore, it is unlikely that forest connectivity will increase by 2030.

## Figure 1. Change in average forest connectivity in EU member states between 2018 and 2021



Forests have significant cultural and economic value and are vital in supporting biodiversity and human well-being. Historically, forests have become fragmented due to conversion to cropland and pastures, urbanisation and infrastructure developments[1][2]. Maintaining forest **connectivity** and avoiding forest fragmentation benefits species that thrive in larger forested areas which enables their dispersal[3][4].

**Policies** are promoting forest connectivity within the EU. The Nature Restoration regulation, the EU forest strategy for 2030, the EU biodiversity strategy for 2030 and the pledge to plant at least three billion additional trees by 2030 all highlight the importance of expanding tree and forest cover to safeguard biodiversity.

This indicator measures the degree of forest coverage within a local, pre-defined neighbourhood area (assessment scale)[5]. It provides a general insight into the environment's **local habitats** without requiring additional knowledge on the type and quality of the forest, or individual species or species groups demands.

The primary information source used for calculation is the High-Resolution Layer Forest Type from Copernicus Land Monitoring Service (CLMS). This layer is derived from satellite imagery (Sentinel-2), which due to the nature of spectral analysis, only maps the stocked areas, and not temporarily unstocked areas (clearcut, burnt or windthrown forests). Therefore, both temporarily and (semi-)permanently unstocked areas are considered as fragmenting the **forest cover**.

The EU's average forest connectivity was 80.6%[6] (Figure 2) in 2021. This indicates that on average, 80.6% of the 10-hectare area surrounding a 100m$^2$ forest grid cell was covered by forest. Forest connectivity **decreased** by 0.8% from 2018 to 2021.

Assessing prospects for improved forest connectivity by 2030 is challenging and past findings show **no significant changes**[7]. Effects of implementing the Nature Restoration regulation, the EU forest and biodiversity strategies - such as promoting afforestation, reforestation, and restoring forest ecosystems - may only become visible after 2030 due to the time lag between actions in the field and increased connectivity. Actions increasing forest fragmentation, such as deforestation, clearcuts and salvage logging, and the effect of major disturbances such as wildfire, windstorms, pests and diseases, can have immediate effects.

## Figure 2. Forest connectivity in the EU Member States in 2018 and 2021

| Country | Average connectivity | | Change in connectivity 2018-2021 | Share of forest by connectivity classes in 2021 | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2018 | 2021 | | Very low | Low | Intermediate | High | Very high |
| Slovenia | 87.2% | 87.1% | -0.2% | 0.1% | 3.1% | 7.2% | 26.6% | 63.0% |
| Romania | 87.0% | 86.8% | -0.2% | 0.3% | 4.4% | 7.5% | 22.5% | 65.3% |
| Slovakia | 86.3% | 86.1% | -0.3% | 0.3% | 4.9% | 7.2% | 24.2% | 63.4% |
| Bulgaria | 86.0% | 86.0% | 0.0% | 0.3% | 5.4% | 7.5% | 22.4% | 64.4% |
| Finland | 85.8% | 84.8% | -1.0% | 0.0% | 2.5% | 7.9% | 36.6% | 53.0% |
| Croatia | 84.3% | 84.0% | -0.3% | 0.3% | 5.8% | 9.3% | 25.6% | 59.0% |
| Sweden | 84.4% | 83.3% | -1.1% | 0.1% | 3.3% | 9.1% | 37.7% | 49.9% |
| Austria | 82.9% | 82.5% | -0.4% | 0.2% | 5.1% | 9.8% | 33.0% | 51.9% |
| Poland | 82.0% | 81.2% | -0.8% | 0.5% | 7.6% | 9.8% | 29.4% | 52.7% |
| Germany | 81.6% | 80.6% | -1.1% | 0.6% | 8.1% | 10.8% | 27.9% | 52.6% |
| **EU-27** | **81.4%** | **80.6%** | **-0.8%** | **0.4%** | **6.9%** | **10.8%** | **32.5%** | **49.5%** |
| Greece | 80.2% | 80.0% | -0.2% | 0.4% | 8.1% | 11.4% | 30.3% | 49.9% |
| Italy | 79.9% | 79.7% | -0.1% | 0.5% | 8.7% | 11.3% | 29.1% | 50.4% |
| Czechia | 81.6% | 79.6% | -2.0% | 0.5% | 8.4% | 11.6% | 29.6% | 49.9% |
| Lithuania | 80.3% | 79.0% | -1.3% | 0.4% | 7.0% | 11.9% | 37.2% | 43.6% |
| Estonia | 80.4% | 78.3% | -2.1% | 0.1% | 5.5% | 13.4% | 41.9% | 39.1% |
| Latvia | 79.6% | 78.1% | -1.5% | 0.2% | 5.9% | 12.8% | 42.6% | 38.5% |
| Luxembourg | 78.1% | 77.7% | -0.4% | 0.5% | 7.5% | 13.4% | 36.4% | 42.2% |
| Hungary | 78.1% | 77.5% | -0.7% | 0.8% | 10.2% | 12.5% | 29.7% | 46.7% |
| France | 76.3% | 75.8% | -0.4% | 0.7% | 11.2% | 13.8% | 31.2% | 43.1% |
| Spain | 75.7% | 75.4% | -0.2% | 0.5% | 10.3% | 14.5% | 35.1% | 39.6% |
| Cyprus | 73.9% | 73.9% | 0.1% | 1.3% | 14.9% | 12.6% | 27.6% | 43.6% |
| Belgium | 74.3% | 73.8% | -0.5% | 1.0% | 12.9% | 14.5% | 31.5% | 40.1% |
| Portugal | 71.4% | 70.7% | -0.7% | 0.6% | 13.8% | 17.7% | 36.8% | 31.1% |
| Netherlands | 64.7% | 64.4% | -0.2% | 2.4% | 22.0% | 17.5% | 29.7% | 28.5% |
| Denmark | 64.3% | 63.9% | -0.4% | 2.1% | 21.0% | 18.9% | 32.7% | 25.2% |
| Ireland | 60.0% | 58.9% | -1.1% | 2.5% | 24.1% | 23.2% | 33.2% | 17.0% |
| Malta | 25.3% | 25.3% | -0.1% | 13.2% | 71.0% | 12.1% | 3.3% | 0.4% |

Forest connectivity in the EU Member States correlates strongly with the presence of large forest areas (displayed by the class ‘very high connectivity’). **Forest strips** may play an important role in maintaining connectivity (classes ‘low’ and ‘intermediate’ connectivity) in Member States with smaller and fewer continuous forest patches.

This indicator is derived from a forest cover mask using a methodology developed by the European Commission’s Joint Research Centre[5]. **Higher connectivity** is found within extended larger tree-covered forest patches with this approach. Therefore, most connectivity estimates at the country level range from 71% to 87%. Based on the country quintiles, an indicator above 84% may be considered very high and an indicator below 71% may be considered very low connectivity.

The **EU average** is highly influenced by areas with large continuous forest coverage, mainly in Slovenia, Romania, Finland and Sweden. Few countries show average connectivity below 70%. Forest connectivity was stable (less than 0.1% change) in four countries, whereas it decreased by more than 1.5% in Estonia, Czechia and Latvia, possibly due to logging, partly related to storms and bark beetle outbreaks.

## Supporting information

### Definition

The forest connectivity indicator quantifies the degree of spatial agglomeration of forest cover. It assesses structural connectivity using EU level forest.

High forest connectivity supports animal movement, plant dispersal, preserves forest microclimate[8], and genetic exchange. Connectivity maps are crucial for biodiversity initiatives, like tree planting, by identifying areas lacking connectivity. However, increased connectivity may also facilitate the spread of invasive species, pests, and diseases[9] and fire[10].

The calculation of the indicator is based on the High-Resolution Forest Type Layer from the Copernicus programme. For this layer, in line with the definition of the Food and Agriculture Organisation of the United Nations[11], forest are “land spanning more than 0.5 hectares with trees higher than five metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It excludes agricultural and urban land”. However, for technical reasons, forest land use not covered by trees is not mapped as forest. Therefore, on the one hand, in the cased of afforestation, there is a delay between the conversion of land use to forestry (at the time of plantation) and the time the forest cover is reported in this indicator (canopy cover reaching the thresholds). This delay is however quite consistent with the new forest reaching characteristics that make it play a role in connectivity. On the other hand, temporarily unstocked forest areas (such as clearcut or burnt areas) are not mapped as forest in this layer, which leads to considering that these areas fragment the forest.

**Methodology**

The methodology used for assessing forest connectivity is called Forest Area Density (FAD). FAD is the ratio of forest area with respect to the local neighbourhood area surrounding a given forest grid cell[5]. Connectivity is scale-dependent, and the scale is chosen by the size of the local neighbourhood for which connectivity is assessed, here 10 hectares. FAD measures the degree of spatial agglomeration of forest land cover and accounts for key fragmentation aspects, such as isolation of small fragments and perforations within compact forest patches[12] . It provides scalable and consistent assessments across large regions, like the EU, but does not account for specific ecological functions or species-specific needs. Unlike species-specific models, which are manifold and highly variable, FAD focuses on general structural connectivity, which is independent of habitat quality or species-specific demands. Efforts are underway to refine FAD by integrating additional data layers to complement the connectivity assessments.

The indicator is derived from the FAO compliant 10-metre resolution forest type products 2018 and 2021 from Copernicus.

The primary result is a spatially explicit map showing the degree of forest connectivity for each 10x10-metre forest grid cell. For the statistics presented in Figure 2, the grid cell values are divided into five categories, where forest connectivity is either very high (90% – 100% FAD), high (60% – <90% FAD), intermediate (40% – <60% FAD), low (10% – <40% FAD), or very low (0% – <10% FAD). The connectivity map can be used to aggregate the grid cell level values to an average indicator value at for any given reporting level, for example, at country or EU-level. This aggregated average value indicates the overall degree of structural connectivity of forest cover in the reporting unit. This is one of the summary statistics available to characterise forest connectivity, which is mainly driven by the presence of large continuous forest patches.

**Policy/environmental relevance**

Forest connectivity is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It mainly contributes to monitoring aspects of the 8th EAP priority objective (Article 2.2.e) that shall be met by 2030: ‘protecting, preserving and restoring marine and terrestrial biodiversity and the biodiversity of inland waters inside and outside protected areas by, inter alia, halting and reversing biodiversity loss and improving the state of ecosystems and their functions and the services they provide, and by improving the state of the environment, in particular air, water and soil, as well as by combating desertification and soil degradation’[13]. For the purposes of the 8th EAP monitoring framework, this indicator assesses whether the EU will 'increase the degree of connectivity in forest ecosystems' by 2030[14]. Ensuring connectivity between and inside habitats is a goal set in the Regulation on Nature Restoration[15] and the EU Biodiversity Strategy for 2030[16]. The 3-Billion-Tree Pledge For 2030[17] indicates that 'afforestation should be carried out at landscape level to strengthen connectivity with natural or semi-natural areas' and therefore lead to increased forest connectivity.

**Accuracy and uncertainties**

Under processing

**Data sources and providers**

- Forest Type 2018 (raster 10 m), Europe, 3-yearly, Oct. 2020, EEA

## Metadata

**DPSIR**

State

**Topics**

# Nature protection and restoration # Forests and forestry # Biodiversity

**Tags**

# biodiversity # Forest fragmentation # 8th EAP # forests # Forest connectivity # SEBI029

**Temporal coverage**

2018
2021

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG15: Life on land

**Unit of measure**

The degree of forest connectivity is measured in a range from 0% to 100%, with 0% meaning no forest connectivity (a single grid cell forest patch without any other forest grid cell in a 10-hectare surrounding neighbourhood), and 100% meaning full connectivity (full continuous forest cover in a 10-hectare surrounding neighbourhood). At reporting unit level, the indicator is calculated as the average value of Forest Area Density (FAD) of all forest grid cells of the reporting unit.

**Frequency of dissemination**

Every 3 years

## References and footnotes


1. Maes, J. and et al., 2020, *Mapping and assessment of ecosystems and their services: an EU wide ecosystem assessment in support of the EU biodiversity strategy*, Publications Office of the European Union, Luxembourg.
↵
2. Rudel, T. K. and et al., 2005, 'Forest transitions: towards a global understanding of land use change', *Global Environmental Change* 15(1), pp. 23–31 (https://www.sciencedirect.com/science/article/pii/S0959378004000809) accessed June 9, 2023.
↵
3. Slattery, Z. and Fenner, R., 2021, 'Spatial Analysis of the Drivers, Characteristics, and Effects of Forest Fragmentation', *Sustainability* 13(6), pp. 3246 (https://www.mdpi.com/2071-1050/13/6/3246) accessed June 12, 2023.
↵
4. Taylor, P. D., 2000, 'Landscape Connectivity', in: Ekbom, B., Irwin, M. E., and Robert, Y. (eds), *Interchanges of Insects between Agricultural and Surrounding Landscapes*, Springer Netherlands, Dordrecht, pp. 109–122.
↵
5. Vogt, P. and et al., 2019, *An approach for pan-European monitoring of forest fragmentation*, Publications Office of the European Union, Luxembourg.
a b c

6. This share differs from the 2023 release due to a change in the underlying data. The method stayed the same. The 2023 release was derived from a 10-metre resolution forest and woody vegetation layer for 2018, combining the FAO compliant 10 metre Forest type product and a generalisation at 10 metres of the 5-metre woody vegetation map product from Copernicus. This 2024 release relies on the Copernicus FAO-compliant 10-metre Forest type product for 2018 and 2021.
↵

7. Forest Europe, 2020, *State of Europe’s forests 2020*, Ministerial Conference on the Protection of Forests in Europe - Forest Europe, Bratislava, Slovakia.

8. Hofmeister, J., Hošek, J., Brabec, M., Střalková, R., Mýlová, P., Bouda, M., Pettit, J. L., Rydval, M. and Svoboda, M., 2019, 'Microclimate edge effect in small fragments of temperate forests in the context of climate change', *Forest Ecology and Management* 448, pp. 48–56 ( https://www.sciencedirect.com/science/article/pii/S0378112719301707) accessed September 26, 2024.

9. Pyšek, P. and et al., 2020, 'Scientists' warning on invasive alien species', *Biological Reviews* 95(6), pp. 1511–1534 ( https://onlinelibrary.wiley.com/doi/abs/10.1111/brv.12627) accessed November 24, 2023.

10. Duane, A. and et al., 2021, 'Forest connectivity percolation thresholds for fire spread under different weather conditions', *Forest Ecology and Management* 498, pp. 119558 ( https://linkinghub.elsevier.com/retrieve/pii/S0378112721006484) accessed June 16, 2023.

11. FAO, 2018, *Terms and Definitions - FRA 2020*, Food and Agriculture Organization of the United Nations, Rome, Italy.

12. Maes, J. and et al., 2023, 'Accounting for forest condition in Europe based on an international statistical standard', *Nature Communications* 14(1), pp. 3723 ( https://www.nature.com/articles/s41467-023-39434-0) accessed November 3, 2023.

13. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030, OJ L.

14. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives. COM(2022) 357 final

15. European Parliament and Council of the European Union, 2024, Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869

16. EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Biodiversity Strategy for 2030 Bringing nature back into our lives

17. EC, 2021, Commission Staff Working Document - The 3 Billion Tree Planting Pledge For 2030 Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. New EU Forest Strategy for 2030. SWD(2021) 651 final

European Environment Agency

# 8th Environment Action Programme

## Energy consumption: primary and final energy consumption in Europe

8TH EAP HEADLINE INDICATOR, 2024

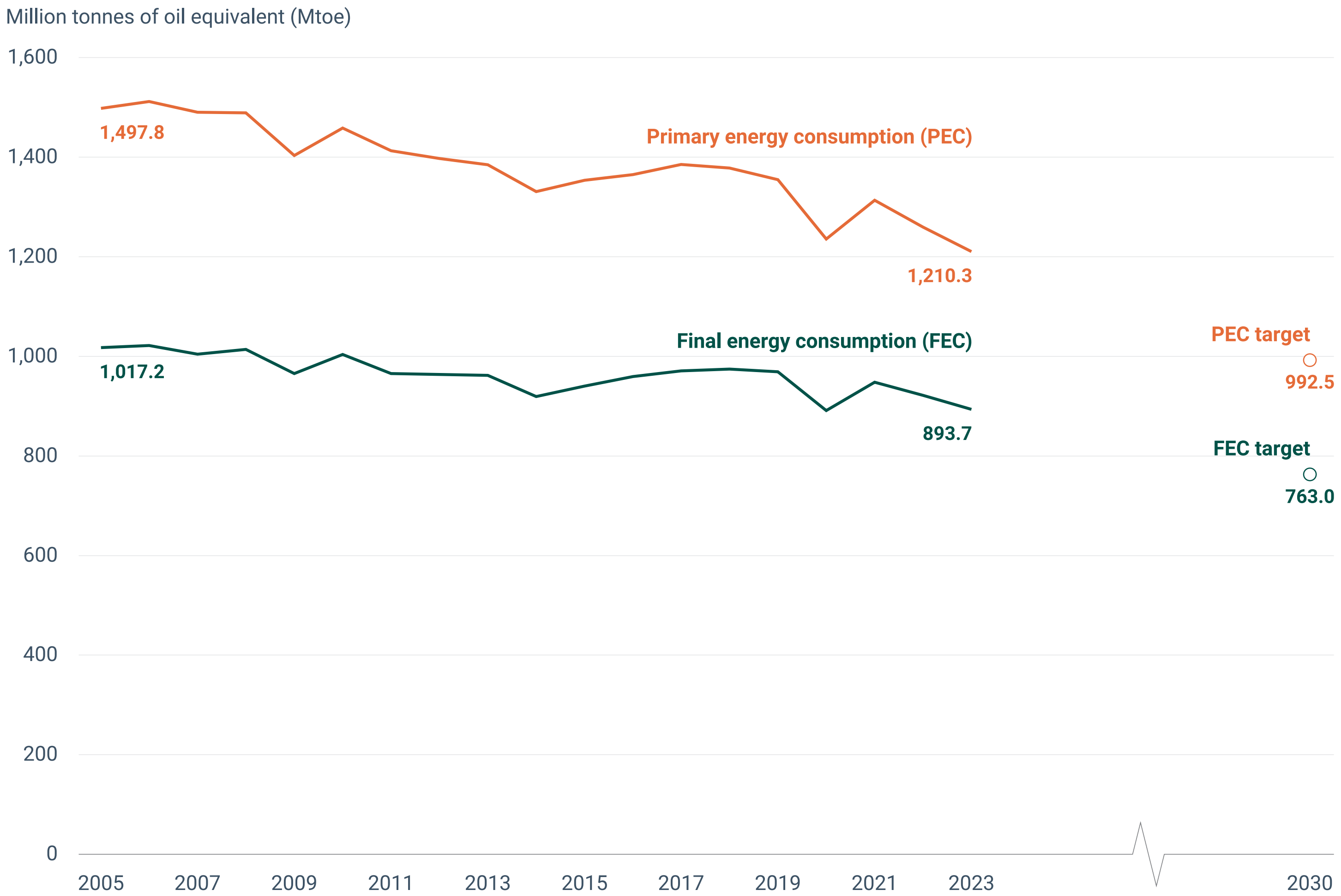
# Primary and final energy consumption in the European Union

Published 31 Jan 2025



The European Union's primary energy consumption (PEC) by end users in 2023 fell by 3.9% compared to 2022 and final energy consumption (FEC) fell by 3.0%. This progress is an improvement compared to historical trends in energy efficiency. The rate of reduction observed in both PEC and FEC over the past three years suggests that the 2030 energy efficiency targets could be achieved, provided that the observed rate of reduction persists through the end of this decade. This also highlights the importance of maintaining decisive action to put the EU on track to meet both the PEC and FEC targets.

## Figure 1. Primary and final energy consumption in the European Union



Reducing energy consumption typically leads to a reduction in **environmental pressures** associated with the production and consumption of energy. It supports the achievement of EU renewable energy and GHG targets, lowers emissions of air pollutants with its associated health benefits, enhances energy security and reduces import energy dependency.

The EU's recast Energy Efficiency Directive sets a **binding target** of 992.5 million tonnes of oil equivalent (Mtoe) for PEC, and an indicative target of 763Mtoe for FEC to be achieved by 2030. PEC represents the total energy demand within a country, including losses. FEC represents the energy used by final consumers.

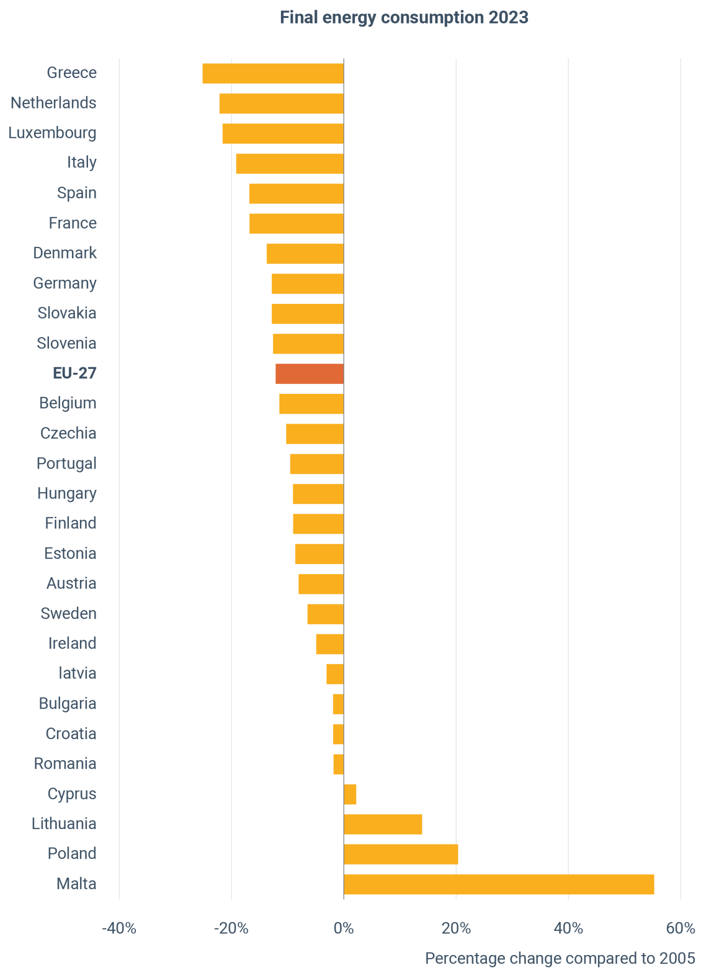
EU-wide PEC levels in 2023 were 1210Mtoe, while EU-wide FEC levels were 894Mtoe. This represents a **decrease** of 3.9% and 3.0% respectively compared to 2022. Despite energy prices faling since their peak in 2022, prices still remained high in 2023, which contributed to an economic incentive to cut back on energy consumption.

Policies to address energy efficiency measures and reduce reliance on fossil fuels, as well as mild winter conditions, also contribute to decreases in both PEC and FEC. The EU took **active measures** to save energy, such as the Council Regulation on coordinated demand reduction measures for gas, where Member States agreed to reduce gas demand by 15% compared to average consumption in the past five years. This collectively led to significant decreases in energy consumption by industry and households.

The full time series of developments show that overall reductions since 2005 in energy efficiency in Europe have been more pronounced for PEC (-19.2%) than for FEC (-12.1%). The replacement of fossil fuels and nuclear energy by **renewables** in electricity generation typically reduces PEC without affecting FEC. The share of renewable energy in the EU has also more than doubled since 2005. Various other factors contributed to the reduction of energy demand, such as energy saving measures, energy transformation improvements, structural changes towards less energy intensive industries and increasingly warmer winters because of climate change.

Compared to average annual reductions of the last 10 years, reaching the ambitious **2030 targets** will require continued introduction of robust measures. Based on this longer-term historical trend, the EU is not yet on track to meet the 2030 targets on energy consumption. Yet recent figures show three consecutive years of promising reductions at a rate that would need to be sustained through the end of this decade for the targets to be met.

## Figure 2. Change in energy consumption of EU Member States between 2005 and 2023





Twenty-five Member States decreased their **PEC** between 2005 and 2023, with Greece as the highest achiever, followed by Italy and Germany. PEC in 2023 for Cyprus remained slightly above their 2005 level (+1.14%), while Poland experienced a more prominent increase in PEC (+5.74%). Poland's significant decrease in coal consumption was overcompensated by an increase in the consumption of gas and liquid fuels.

Twenty-three Member States decreased their **FEC** in the same time frame. Greece showed the greatest decrease in this category again, followed by the Netherlands and Luxembourg. Four Member States saw their FEC increase, with the highest being Malta at 46.08%.

Eighteen Member States decreased their PEC between 2022 and 2023, with Bulgaria and Estonia having the largest relative reductions of 13.98% and 13.53% respectively. Of the nine Member States whose PEC increased, France lead at 3.30%. Nineteen Member States decreased their FEC between 2022 and 2023, with Slovenia and Austria having experienced the greatest drop at 4.14% and 3.85% respectively. Of the eight Member States whose FEC increased, Czechia and Portugal topped the chart with 2.94% and 2.47% respectively.

## Supporting information

### Definition

Final energy consumption (FEC) represents the energy used by final consumers (such as households, transport, industry etc) for all energy uses. It is the energy that reaches the final consumer's door.

Primary energy consumption (PEC) represents the total energy demand within a country, excluding the energy products consumed for purposes other than producing useful energy (non-energy uses, e.g., oil for plastics). For example, the electricity consumed by a household counts towards FEC; the fuel burned to generate that electricity and bring it to the household counts towards PEC.

**Methodology**

**PEC-FEC**

To ensure comparability with energy efficiency targets, this indicator is defined according to Eurostat methodology for final energy consumption (Europe 2020-2030) [FEC2020-2030] and primary energy consumption (Europe 2020-2030) [PEC2020-2030].

Primary energy consumption (Europe 2020-2030) = gross inland consumption (all products total) - gross inland consumption (ambient heat (heat pumps)) - final non-energy consumption (all products total).

Final energy consumption (Europe 2020-2030)= final energy consumption (all products total) - final energy consumption (ambient heat (heat pumps)) + international aviation (all products total) + transformation input blast furnaces (all products total) - transformation output blast furnaces (all products total) + energy sector blast furnaces (solid fossil fuels) + energy sector blast furnaces (manufactured gases) + energy sector blast furnaces (peat and peat products) + energy sector blast furnaces (oil shale and oil sands) + energy sector blast furnaces (oil and petroleum products) + energy sector blast furnaces (Natural gas).

Data set used: 'Complete energy balances nrg_bal_c'

Codes:

- FEC2020-2030 Final energy consumption (Europe 2020-2030)/all products;
- PEC2020-2030 Primary energy consumption (Europe 2020-2030)/all products;
- GIC Gross inland consumption/all products;
- NRG_BF_E Energy sector — blast furnaces — energy use/all products;
- FC_NE Final non-energy consumption/all products;
- FC_TRA_E Final consumption — transport sector — energy use/renewables and biofuels;
- FC_E Final consumption — energy use/ambient heat;
- PPRD Primary production/ambient heat.

Details about this methodology are available from Eurostat at: ENERGY BALANCE GUIDE (Draft 31 January 2019).

The time series for the EU-27 was made by summing the values for each year of the 27 countries that are currently Member States, regardless of whether they were members of the EU in any given year.

**Proxy data**

Values for 2005-2022 are compiled by Eurostat. Approximated figures for 2023 are based on EEA estimates.

**Policy/environmental relevance**

The Energy Efficiency Directive (2012/27/EU) established a set of binding measures to help the EU reach its target of decreasing energy consumption by 20% by 2020, compared with projected levels. This was amended by Directive (EU) 2018/2002, which provides a policy framework for 2030 and beyond. A new amendment was agreed in 2023, which set new targets for 2030.

The composition of the energy mix and the level of consumption provide an indication of the environmental pressures associated with energy consumption. The type and magnitude of the environmental impacts associated with energy consumption, such as resource depletion, greenhouse gas emissions, air pollutant emissions, water pollution and the accumulation of radioactive waste, strongly depend on the types and amounts of fuels consumed, as well as on the abatement technologies applied.

This indicator is a headline indicator for monitoring progress towards achieving the aims of the 8th Environment Action Programme (8th EAP). It contributes mainly to monitoring progress towards energy efficiency aspects of Article 2.f of the 8th EAP which requires: ‘promoting environmental aspects of sustainability and significantly reducing key environmental and climate pressures related to the Union’s production and consumption, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system’ . The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should monitor the achievement by 2030 of the recently agreed 2030 EU targets as detailed in the next paragraph [1].

**Targets**

On 20 September 2023, the EU officially published the recast Energy Efficiency Directive (EU) 2023/1791, which set a target for the reduction of final energy consumption (FEC) of at least 11.7% in 2030, compared with the energy consumption forecasts for 2030 made in 2020. This translates into a mandatory target of 763Mtoe for FEC, and an indicative target of 993Mtoe for primary energy consumption (PEC). Member states will benefit from flexibilities in reaching the target.

For more information, see the European Commission website on the Energy Efficiency Directive and the recent agreement.

**Sources:**

EC, 2022a, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme’s 2030 and 2050 priority objectives, COM/2022/357 final, EUR-Lex - 52022DC0357 - EN - EUR-Lex (europa.eu)

Eurostat, 2023. Complete energy balances (NRG_BAL_C), PEC (2020-2030) and FEC (2020-2030). https://ec.europa.eu/eurostat/databrowser/bookmark/dea184ea-4883-453d-ba24-71e960a4f161?lang=en. Accessed May 2024.

**Accuracy and uncertainties**

## Methodology uncertainty
No uncertainty has been specified.

## Data sets uncertainty
No uncertainty has been specified.

## Rationale uncertainty
No uncertainty has been specified.

**Data sources and providers**

- Simplified Energy Balances: Primary Energy Consumption - Energy Efficiency Directive, Statistical Office of the European Union (EUROSTAT)

- Simplified Energy Balances: Final Energy Consumption - Energy Efficiency Directive, Statistical Office of the European Union (EUROSTAT)

## Metadata

**DPSIR**

Driving forces

**Topics**

# Energy  # Climate change mitigation  # Energy efficiency

**Tags**

# 8th EAP  # ENER016  # Energy  # Energy efficiency  # Targets

**Temporal coverage**

2005-2030

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Efficiency indicator (Type C - Are we improving?)

**UN SDGs**

SDG7: Affordable and clean energy

**Unit of measure**

FIG1: Million tonnes of oil equivalent (Mtoe);

FIG2: Percentage change compared to 2005

**Frequency of dissemination**

Once a year

## References and footnotes


1. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives. COM(2022) 357 final ↩

European Environment Agency

# 8th Environment Action Programme

## Share of energy consumption from renewable sources in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

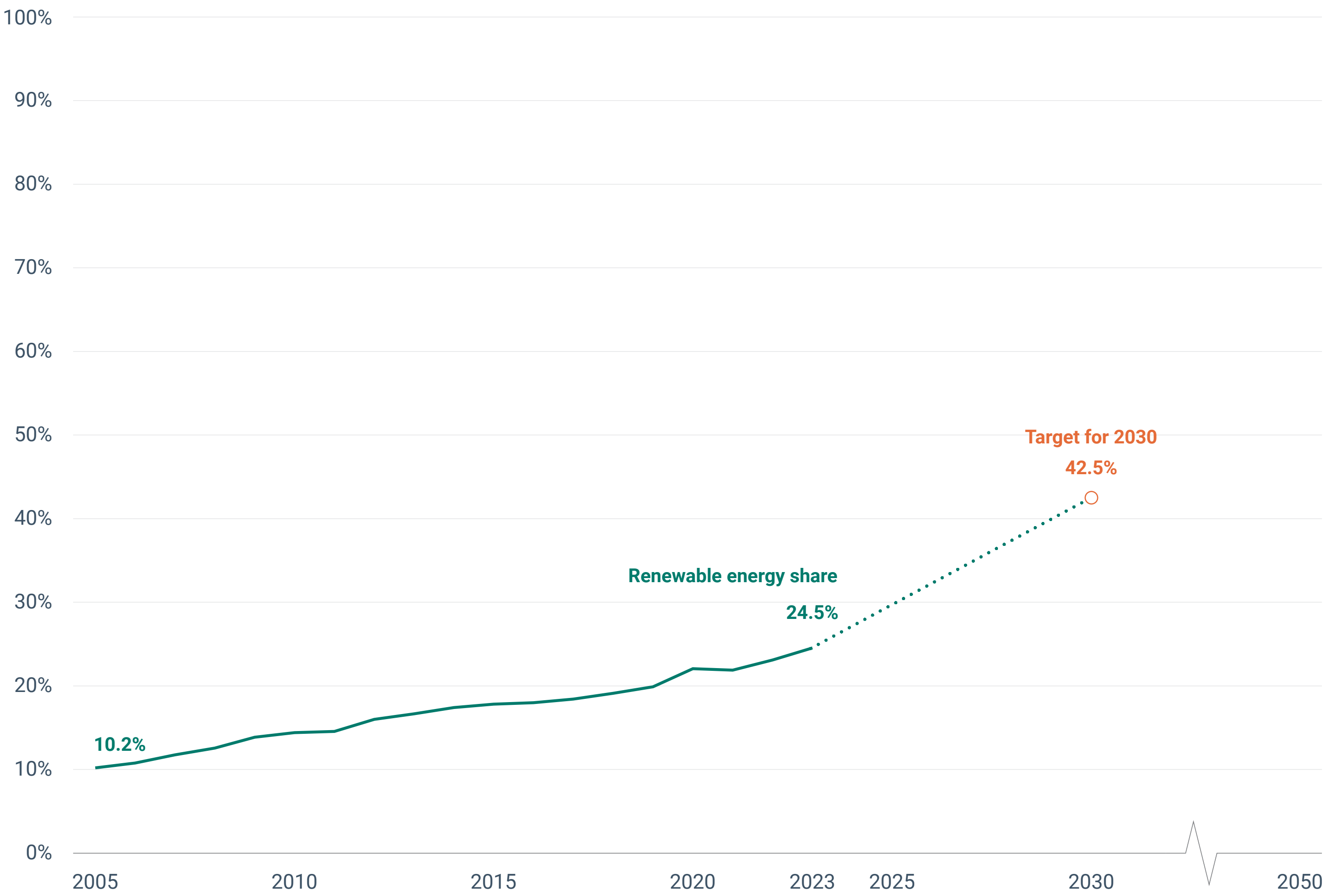
# Share of energy consumption from renewable sources in Europe

Published 16 Jan 2025

Analysis and data > Indicators > Share of energy consumption from ren...

Renewable energy sources represented 24.5% of the European Union's final energy use in 2023. The share is estimated to have increased by one percentage point since 2022, still largely driven by strong growth in renewable electricity supply. The share is also amplified by a small 2023 reduction in non-renewable energy consumption. Meeting the new minimum EU target of 42.5% for 2030 will demand doubling the rates of renewables deployment seen over the past decade and a deeper transformation of the European energy system.

## Figure 1. Progress towards renewable energy source targets for EU-27



Renewable energy sources (RES) have multiple **benefits** for society compared with fossil fuels, such as mitigating climate change, reducing the emission of air pollutants and improving energy security. The revised Renewable Energy Directive increases the binding target from 32% to a minimum 42.5% share of renewables in EU energy consumption, with the aim of achieving 45%. Each Member State will contribute to this common target. Targets were not introduced for individual countries.

At 24.5% in 2023, the share of renewables in the EU increased by one percentage point from 2022. It represents a **historical high** following the adoption of important EU legal frameworks to speed up the clean energy transition. The Fit-for-55 EU policy package and the higher EU ambitions introduced by the RepowerEU plan are especially relevant in response to Russia's invasion of Ukraine.

The 2023 renewable energy share also signals a return to **higher growth rates** of renewables after a dip in 2021 (figure 1). In absolute values, the gross final consumption of renewables grew by almost seven million tonnes oil equivalent (Mtoe) between 2022 and 2023, driven by a substantial increase in solar power generation (by 19.7%) and wind power (by 9.3%).

**Non-renewables** saw a reduction of 3%, mainly linked to lower utilisation of coal for energy supply. This increased the relative share of renewables in the EU gross final energy consumption.

The electricity system continued to lead decarbonisation efforts in 2023, with 45.3% of all EU power generated from renewable sources. It was followed by heating and cooling (26.2%) and transport (10.8%), where renewable energy from heat pumps (+13%) and renewable electricity consumption in road transport (+53%) increased notably, compared with 2022.

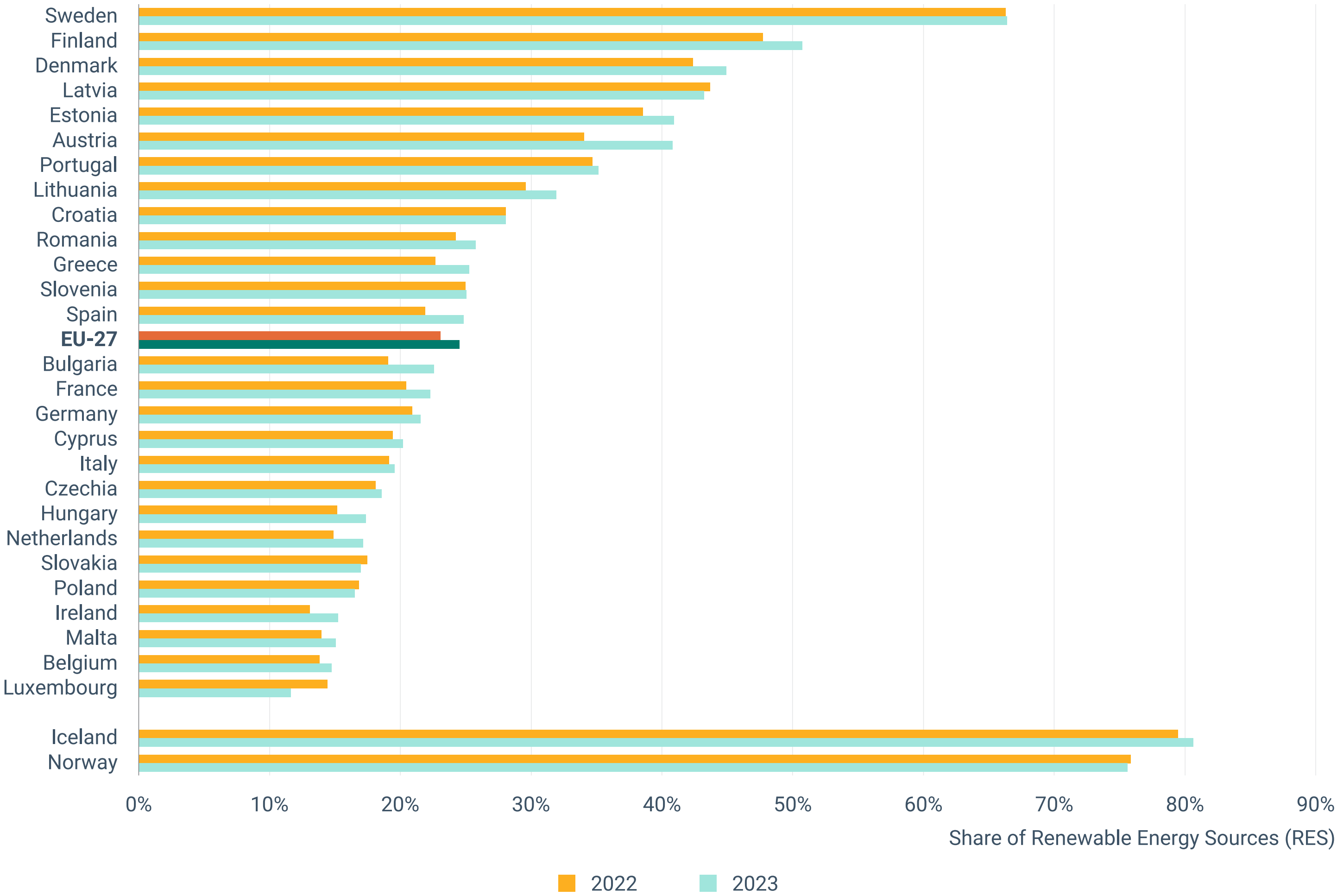
Solid, gaseous and liquid biomass resources together formed the **largest category** in 2023, totalling half of all renewable energy consumption. This may have implications for terrestrial carbon sinks, biodiversity and air pollution if the demand for biomass continues to increase. Solid biomass is most widely used in residential and district heating, electricity generation and industry. Gaseous biomass (biogas) is typically burned to produce heat and power, while liquid biomass fuels (biofuels) are mainly used directly or blended with gasoline and diesel in transport.

Wind (17%), hydro power (13%) and solar photovoltaics (9%) were the other three largest renewable energy sources, followed by heat pumps and liquid biofuels (both with an 8% share of all renewable energy use). Other renewables sources were biogases, renewable waste, geothermal and solar thermal.

Looking at the **longer-term trends**, the RES share more than doubled between 2005 and 2023. This was driven by dedicated policies and support schemes, as well as increased economic competitiveness of renewables. The increase represents a compound annual growth rate (CAGR) of 3.9% over the last decade (or 5.0% since 2005).

Modelling from the IEA and Ember indicate that reaching the **new minimum target** for 2030 of a 42.5% share of renewables might be feasible if fast and decisive action is taken to promote renewables and reduce energy consumption. The trends in the deployment of solar photovoltaics and heat pumps also provides optimism. However, reaching the target will require a challenging CAGR of 8% on the EU renewables share until 2030, which is more than double the observed rate over the past decade. Considering this, the EU is not likely to meet its target, unless it allocates more resources for a deep transformation of the energy system.

## Figure 2. Share of energy from renewable sources, by country




Sweden, Finland and Denmark had the highest RES shares among Member States in 2023 due to strong hydro industries (Sweden and Finland), wind power and wide use of solid biofuels for district heating. By contrast, Luxembourg and Belgium reported the lowest deployment of renewables, of 12% and 15% in 2023.

Over time, Denmark, Sweden and Estonia have experienced the highest growth in RES shares, with more than 20 percentage points increase since 2005. Croatia, Slovenia and Romania, on the contrary, have seen an increase of less than nine percentage points between 2005 and 2023.

On a shorter timescale, 22 EU Member States saw an increase in their renewable energy shares between 2022 and 2023. Austria, Bulgaria and Finland topped the list, having increased their RES share by three percentage points or more in 2023. In contrast, the RES share of Latvia, Slovakia, Luxembourg and Poland decreased, compared to 2022.

In the European Economic Area, Norway and Iceland both have RES shares above 75%. The two countries generate most of their electricity from hydropower while, in Iceland, geothermal energy provides the majority of heating.

## Supporting information

**Definition**

This indicator measures the EU's progress towards achieving its 2020 and 2030 renewable energy targets. Gross final renewable energy consumption is the amount of renewable energy consumed for electricity, heating and cooling, and transport in the 27 EU Member States, and is expressed as a share of gross final energy consumption.

The Renewable Energy Directive (2009/28/EC) defines gross final energy consumption as the energy commodities delivered for energy purposes to final consumers (industry, transport, households, services, agriculture, forestry and fisheries), including the consumption of electricity and heat by the energy branch for electricity and heat production, and including losses of electricity and heat in transmission and distribution.

Figure 1 shows consumption of energy from renewable sources (including only certified biofuels complying with the Renewable Energy Directive (RED) sustainability criteria) as a proportion of gross final energy consumption and the recently adopted 2030 target.

Figure 2 shows the consumption of energy from renewable sources as a proportion of gross final energy consumption by country. It illustrates the progress made by the EU and its Member States in the last year.

For more information, please refer to the EEA's annual Trends and projections in Europe, Eurostat's page on renewable energy statistics, and the Commission's Energy Union reports and Climate Action Progress reports.

**Methodology**

**Eurostat data**

The renewable energy share data used for 2005-2023 were taken directly from the Eurostat SHARES tool. The SHARES tool focuses on the harmonised calculation of the share of energy consumption from renewable sources among the 27 EU Member States. This is done in accordance with the RED guidelines and is based on national energy data reported to Eurostat. The Shares tool detailed results and manual are available online: (https://ec.europa.eu/eurostat/web/energy/database/additional-data).

Electricity generation from hydropower and wind power must be normalised to smooth the effect of weather-related variations. In the case of hydropower, the normalisation is based on the ratio of electricity generation to the installed capacity averaged over 15 years; in the case of wind power, a similar normalisation formula is applied over five years. The Shares tool takes into account all biofuels consumed in transport between 2005 and 2010, and only biofuels certified as being in compliance with the RED sustainability criteria for the years starting from 2011.

With regard to the calculation of the gross final energy consumption for Cyprus and Malta, the derogation in RED was used. This derogation allows these countries to consider the amount of energy consumed in aviation, as a proportion of their gross final energy consumption, to be no more than 4.12%.

The discussion on individual renewable energy sources was based on Eurostat energy balances, since the SHARES tool focus on sectors, rather than individual sources. The comparison is made based on their primary energy supply.

**Proxy data**

Values for 2005-2023 are compiled by Eurostat and reported by Member States. An update of this indicator with EEA estimates for the previous year takes place every autumn.

**Targets**

The 2030 target presented in this indicator was adopted in October 2023 and is defined as a share of renewable energy in the EU's gross final energy consumption of 42.5% by 2030 with an additional "aspirational" 2.5% indicative top up that would allow to reach 45%.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards achieving the aims of the Eighth Environment Action Programme (8th EAP). It contributes mainly to monitoring progress towards sustainable energy aspects of Article 2.f of the 8th EAP which requires: 'promoting environmental aspects of sustainability and significantly reducing key environmental and climate pressures related to the Union's production and consumption, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system' [1]. The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should monitor the achievement by 2030 of the EU target of 42.5% renewable energy share in gross final energy consumption[2].

The RED (2009/28/EC) and its recast directive RED II (2018/2001/EU) establish an overall policy for the production of energy from renewable sources and the promotion of its use in the EU. The RED III was adopted in 2023, introducing stronger measures and a new 2030 target for renewables, aimed at achieving climate neutrality by 2050.

Achieving the 2030 target will depend on the fast implementation of the reinforced policy and legal framework in the Member States, especially via speeding up permitting procedures, better visibility of auctions for renewables and a better integration of the different sectors. Implementation needs to be accompanied by accelerated grid developments in order to absorb more renewables and the full implementation of a guarantee-of-origin system with energy purchase agreements to allow further development of the renewable consumer market. In addition, better and more integrated planning will be required to ensure not only a high efficiency of investment and an accelerated pace of development, but also that the market penetration of these renewable sources takes into account other policy objectives such as environment protection.

The share of renewable energy consumption in final energy consumption is a broad indicator of progress towards reducing the impact of energy consumption on the environment (i.e., through decreased greenhouse gas emissions and air pollutant emissions). At the same time, impacts of increasing renewable energy consumption on landscapes, habitats and ecosystems, namely from construction, the use of water, the use of fertilisers and pesticides for biomass and biofuel crops, and the extraction of heavy metals for photovoltaic cells must also be considered.

Replacing fossil fuels with renewables results in lower carbon emissions. However, total carbon emissions are not necessarily determined by the share of renewable energy in final energy consumption, but by the total amount of energy consumed from fossil sources.

**Accuracy and uncertainties**

## Methodology uncertainty

Officially reported renewable energy data were compiled by Eurostat using annual joint questionnaires, which are shared by Eurostat and the International Energy Agency, following a well-established and harmonised methodology. Methodological information on the annual joint questionnaires and data compilation can be found on Eurostat's web page on metadata on energy statistics.

Values concerning the prevoius year, which normally are published by EEA during the autumn, are approximate (proxies) and have been estimated by the EEA. These proxies were not obtained following the formal collection process for official statistics and are therefore less accurate and reliable than official statistics.

**Notes on uncertainties in the underlying statistics and methodology:**

Biomass and bio-waste, as defined by Eurostat, cover organic, non-fossil material of biological origin, which may be used for heat production or electricity generation. They comprise wood and wood waste, biogas, municipal solid waste (MSW) and biofuels. MSW comprises biodegradable and non-biodegradable wastes produced by different sectors. Non-biodegradable municipal and solid wastes are not considered renewable, but current data availability does not allow the non-biodegradable content of wastes to be identified separately, except in industry. Large data-gaps also exist regarding the energy use of wood, which further adds to the methodological uncertainty.

The electricity produced from hydropower storage systems is not classified as a renewable source of energy in terms of electricity production, but is considered part of the gross electricity consumption of a country. Hydropower and wind power generation are calculated as actual generation and normalised generation. Normalised generation is calculated using the weighted average load factor over the last 15 years for hydropower and the last five years for wind power.

The indicator measures the consumption of energy from renewable sources relative to total energy consumption for a particular country. The share of renewable energy could increase even if actual energy consumption from renewable sources falls. Similarly, the share could fall despite an increase in energy consumption from renewable sources.

Electricity consumption within a national territory includes imports of electricity from neighbouring countries. It excludes electricity produced nationally but exported abroad. In some countries, the contribution of electricity trade to total electricity consumption and the changes observed from year to year need to be looked at carefully when analysing trends in electricity from RESs. Impacts on the (national) environment are also affected, since emissions are taken into account for the country in which the electricity is produced, whereas consumption is taken into account for the country in which the electricity is consumed.

## Data sets uncertainty

No uncertainty has been specified.

## Rationale uncertainty

No uncertainty has been specified.

**Data sources and providers**

- Share of energy from renewable sources [NRG_IND_REN], Statistical Office of the European Union (EUROSTAT)
- Approximated estimates for the share of gross final consumption of renewable energy sources in 2023 (EEA 2023 RES share proxies), European Environment Agency (EEA)

# Metadata

**DPSIR**

Response

**Topics**

# Energy # Renewable energy # Climate change mitigation

**Tags**

# renewable energy # Energy # 8th EAP # ENER028

**Temporal coverage**

2005-2030

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Norway
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Policy-effectiveness indicator (Type D)

**UN SDGs**

SDG7: Affordable and clean energy, SDG13: Climate action

**Unit of measure**

Share of renewable energy in gross final energy consumption (%);

Share of energy from renewable sources (%)

**Frequency of dissemination**

Once a year

## References and footnotes

1. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030, OJ L.
↵

2. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives. COM(2022) 357 final
↵

European Environment Agency

# 8th Environment Action Programme

## Circular material use rate in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

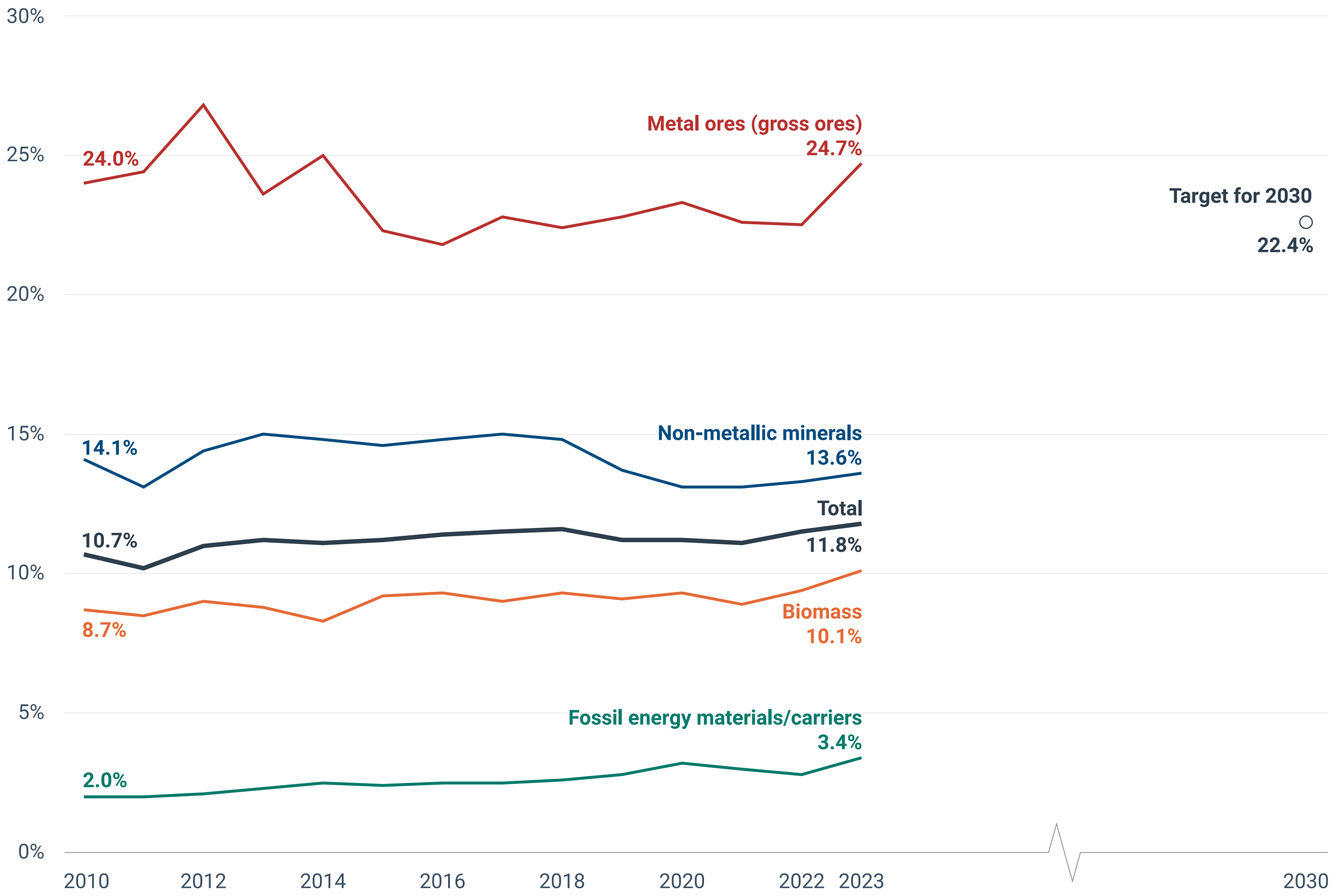
# Circular material use rate in Europe

Published 06 Jan 2025



The European Union aims to double recycled material use, in terms of its share of the economy's total material use, between 2020 and 2030, as set in the 2020 circular economy action plan. Increasing the use of secondary materials would reduce the extraction of primary raw materials and related environmental impacts. Recycled material accounted for 11.8% of material used in 2023, an increase of 1.1 percentage points from 2010. This slow progress, along with projected increased material demand by 2030, implies that the EU is not currently on track to double the circular material use rate by 2030.

## Figure 1. Circular material use rate in the EU and breakdown by material group between 2010 and 2023



The EU's circular economy action plan aims to reduce pressure on natural resources and double its **circular material use rate** (CMUR) in the coming decade[1]. The CMUR measures the circularity of materials in the economy and refers to the share of the total amount of material used in the economy that is accounted for by recycled waste.

Increasing the CMUR (by increasing the amount of recycled waste or decreasing the amount of material used) would reduce the amount of primary material extracted for production and the associated negative impacts on the environment and climate. A reduction in the EU's reliance on primary resources, particularly imported materials, would increase its strategic autonomy. This way, the EU would increase its ability to meet its own needs, without **relying on third countries**.

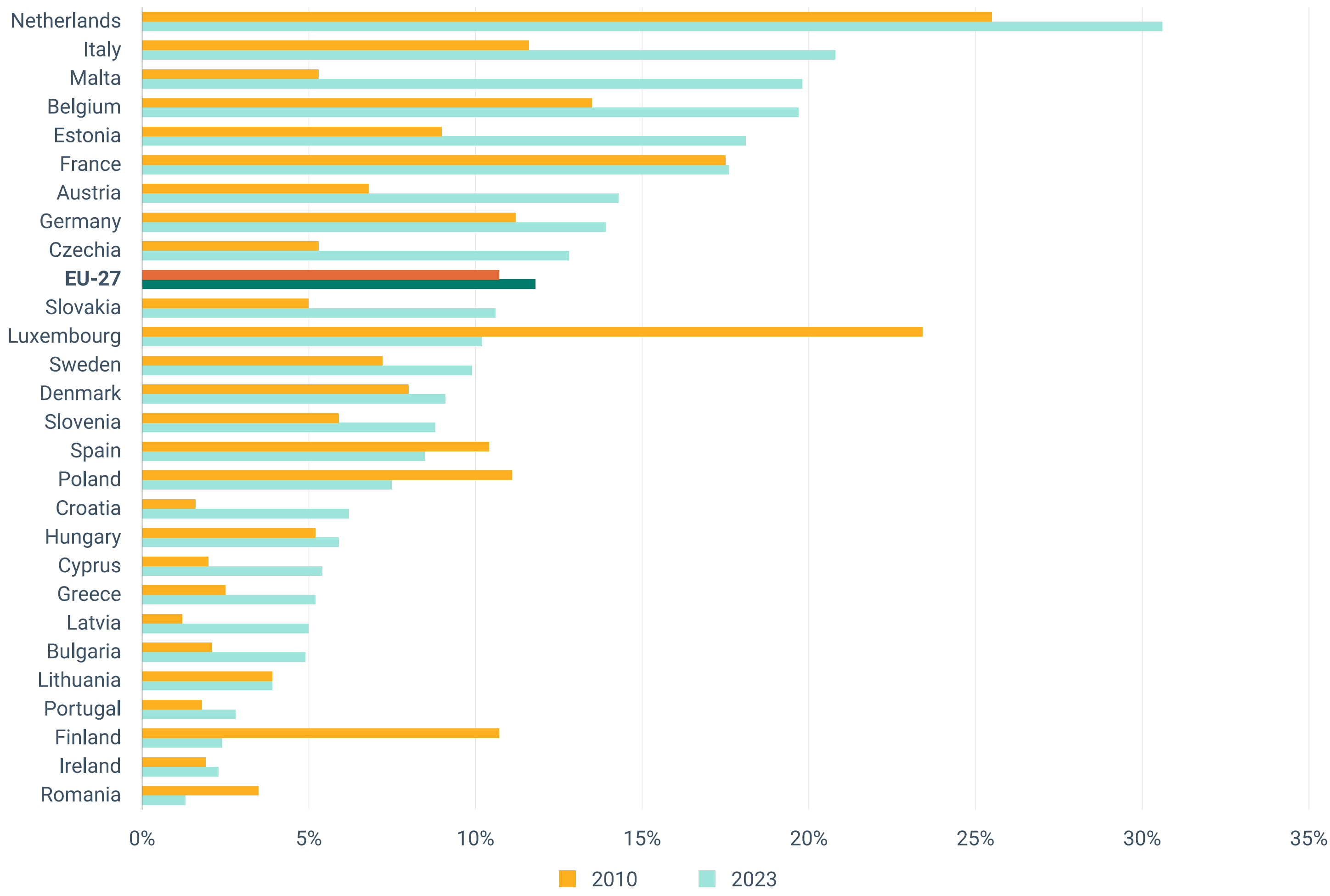
Although the EU's CMUR has increased slightly in the the last 13 years, from 10.7% in 2010 to 11.8% in 2023, it is still considered low, indicating the economy is mostly linear. This trend is mainly due to **increases** in waste recycling efforts, driven by Member States to meet EU recycling targets. Meanwhile, domestic material consumption has remained stable[2].

**Non-metallic minerals** account for more than 50% of total material consumption and their CMUR has decreased since 2010. The CMURs increased for biomass, metals and fossil-based materials between 2010 and 2023. The CMURs for the various material groups differ significantly with almost 25% for metal ores in 2023 and only slightly above 3% for fossil materials. This reflects the different nature of materials and their use. Metals are technically easier and more economical to recycle, feeding back into the economy. Fossil fuels are mostly burned and thus cannot be recycled.

Circular economy strategies aim to retain the value and extend the life of products. They can reduce resource consumption and hence reduce impacts on the environment and climate. Meeting the **target** of doubling the CMUR would mean an increase from 11.8% (2023) to 22.4% by 2030. This requires the CMUR to increase annually with more than 1.5 percentage points, which is twice the increase of the entire past decade. Therefore, the EU is not on track to double the CMUR by 2030, also considering OECD projections of increased future materials demand. The latter is important as increasing recycling alone will not allow the EU to achieve the target.

Increased recycling coupled with reduced material use is required. Reducing the use of heavier material groups like non-metallic minerals and metals has a greater potential for increasing the CMUR. Since material extraction has different **environmental impacts**, measures should also focus on reducing the consumption of fossil energy materials and increasing the sustainability of biomass production in view of reducing environmental pressures.

## Figure 2. Circular material use rate by EU country




Considerable differences in CMURs are observed among countries, ranging from 30.6% (in the Netherlands) to 1.3% (in Romania) in 2023. This reflects significant structural difference in countries' recycling capacities and in their levels of material consumption[2]. In the Netherlands and Italy, more than 20% (one of five tonnes) of material used was recycled material. The CMUR level for the Netherlands is already much higher (by more than seven percentage points) than the EU target for 2030, suggesting that rates are achievable.

Most EU countries (22 out of 27) have increased their CMURs since 2010. The largest absolute CMUR increases (more than five percentage points) were seen in Malta, Italy, Estonia, Austria, Czechia, Belgium and Slovakia. Some countries show impressive relative increases in their CMURs, with Latvia, Croatia and Malta more than tripling their CMURs between 2010 and 2023, although from a very low base. However, significant decreases in CMURs were seen in Finland, Romania, Luxembourg and Poland.

## Supporting information

### Definition

The CMUR measures an economy's circularity. This is defined by the circular use of materials, which is approximated by the amount of waste recycled in domestic recovery plants minus imported waste destined for recovery plus exported waste destined for recovery abroad, divided by the material use. The material use is the sum of domestic material consumption and the aforementioned circular use of materials [3].

**Methodology**

This indicator is directly based on data published by Eurostat and the underpinning methodology can be found in Eurostat (2021)[4].

**Policy/environmental relevance**

The EU's circular economy action plan calls for a doubling of the Union's CMUR in the coming decade[1]. This policy objective aims to increase the EU economy's circularity and thus benefit the environmental and climate. These benefits would mainly stem from the reduced need for natural resource extraction.

This indicator is a headline indicator for monitoring progress towards achieving the aims of the 8th Environment Action Programme[5]. By measuring the use of secondary materials in the economy, it is used to evaluate the sustainability of the industrial sector towards the 8th EAP priority objective for 2030 set out in Article 2.f which requires: 'promoting environmental aspects of sustainability and significantly reducing key environmental and climate pressures related to the Union's production and consumption, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system'. The European Commission Communication on the 8$^{th}$ EAP monitoring framework specifies that this indicator should monitor the 'doubling of the ratio of circular material use by 2030 compared to 2020'. The CMUR is also a performance indicator in the Long-Term Competitiveness Strategy recently adopted by the Commission to set the direction for industry beyond 2030.

**Accuracy and uncertainties**

No uncertainties have been specified.

**Data sources and providers**

- Circular material use rate by material type, Statistical Office of the European Union (EUROSTAT)
- Circular material use rate, Statistical Office of the European Union (EUROSTAT)

## Metadata

**DPSIR**

Impact

**Topics**

# Circular economy # Resource use and materials # Waste and recycling

**Tags**

# 8th EAP # Material use # waste # WST009 # Circular economy

**Temporal coverage**

2010-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Performance indicator (Type B - Does it matter?)

**UN SDGs**

SDG12: Responsible consumption and production

**Unit of measure**

Percentage

**Frequency of dissemination**

Once a year

## References and footnotes


1. EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'A new circular economy action plan for a cleaner and more competitive Europe', COM(2020) 98 final.
a b
2. Eurostat, 2018, *Circular material use rate — calculation method*, Manuals and Guidelines, Publications Office of the European Union, Luxembourg.
a b
3. Eurostat, 2020, 'Circular material use rate', *Product Datasets* (https://ec.europa.eu/eurostat/web/products-datasets/-/cei_srm030) accessed June 30, 2022.
↵
4. Eurostat, 2021, 'Circular economy — material flows', *Statistics Explained* (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Circular_economy_-_material_flows#Circularity_rate_.E2.80.93_methodology) accessed June 30, 2022.

↵

5. EC, 2022, 'Environment action programme to 2030', *European Commission* ( https://environment.ec.europa.eu/strategy/environment-action-programme-2030_en) accessed June 24, 2022.
↵

European Environment Agency

# 8th Environment Action Programme

## Share of buses and trains in inland passenger transport

8TH EAP HEADLINE INDICATOR, 2024

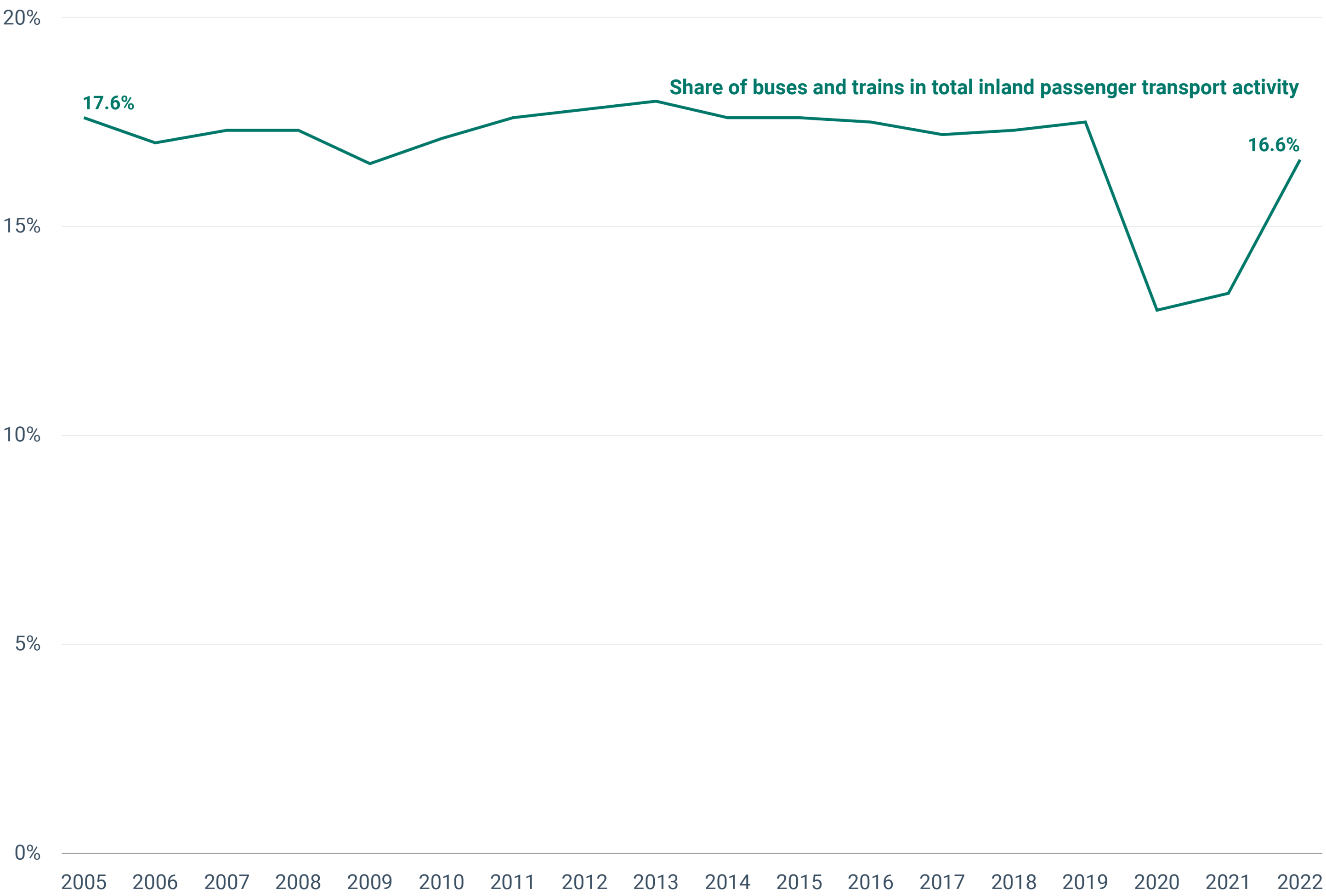
# Share of buses and trains in inland passenger transport in Europe

Published 04 Dec 2024



Promoting sustainable transport modes like public transport can reduce greenhouse gas emissions and other environmental pressures such as air pollution and noise. The European Union's Sustainable and Smart Mobility strategy underlines the importance of public passenger transport in greater transport sustainability. The share of buses and trains in total passenger transport has changed very little since 2005, albeit with fluctuation due to the COVID-19 pandemic. Achieving a modal shift towards public transport will require decisive action and a move in long-standing trends.

## Figure 1. Share of bus and trains in total inland passenger transport activity in the EU-27



In 2020, under the umbrella of the European Green Deal, the European Commission adopted a Sustainable and Smart Mobility strategy aimed at promoting, inter alia, the use of more **sustainable transport modes**. One of the objectives of the strategy is to increase the number of passengers travelling by rail and commuting by public transport, instead of with a personal car. Achieving this objective could reduce greenhouse gas and air pollutant emissions, and other environmental pressures. Changes to the EU's mobility system are vital to realise the green and digital transformation ambitions and become more resilient to future crises.

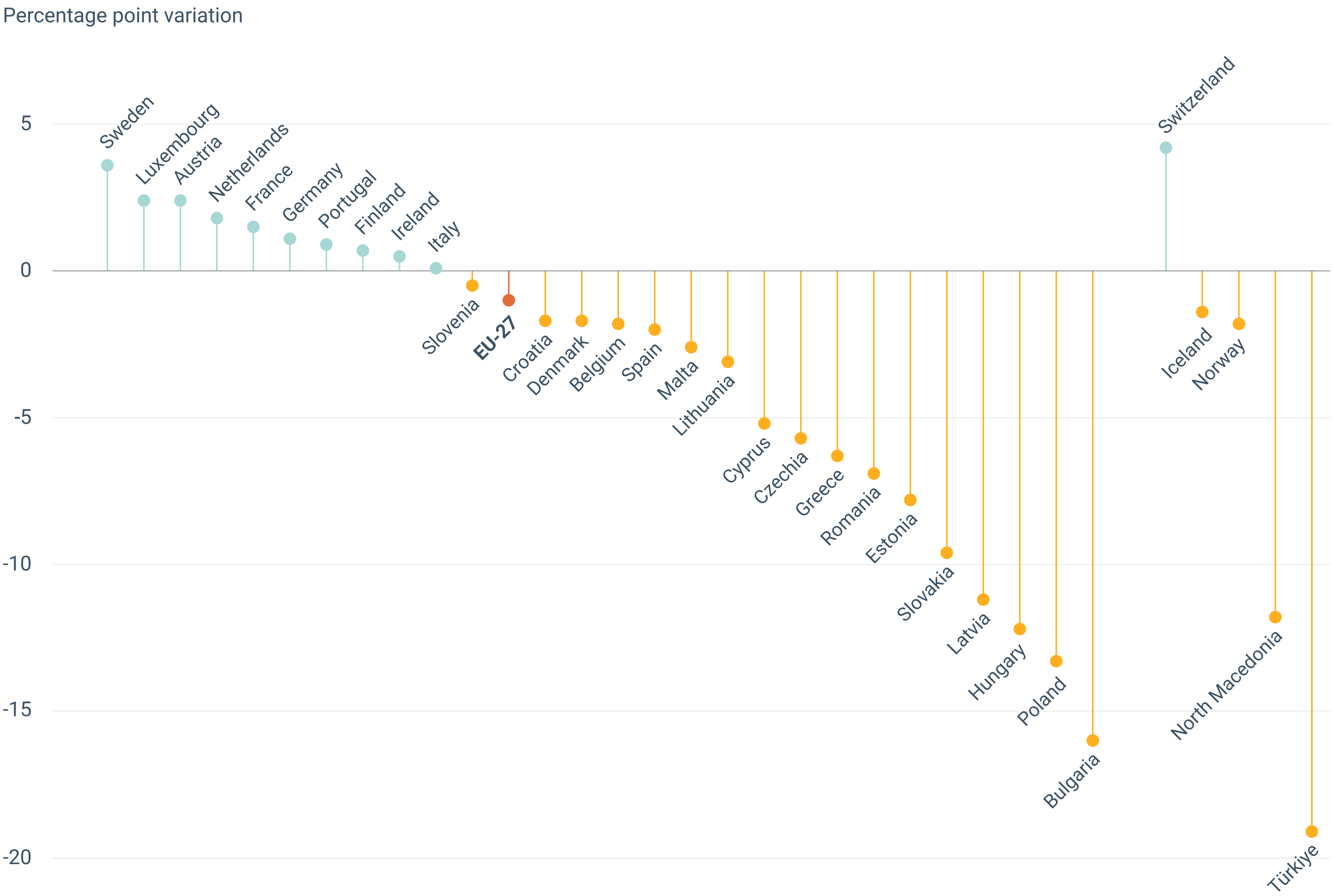
In the period 2005-2019, the share of total passenger transport **demand** met by buses and trains remained relatively constant at around 17%. It fell sharply to 13% in 2020 as a result of COVID-19 pandemic-driven travel restrictions and changed mobility habits[1], then progressively recovered in 2021-2022. The 2022 share almost returned to pre-pandemic levels, at 17%.

At the same time, total inland passenger transport activity increased by 5% in the period between 2005 and 2022, indicating an increase in the use of both private cars and public transportation in absolute terms. Significant efforts to encourage the use of public transport would be needed to achieve a shift towards more sustainable modes. This would require **changes** in the way Europeans commute and travel, and changes in city planning.

The European Commission launched important **initiatives** for the supply side, such as the revised TEN-T regulation (entered into force the 18 July 2024) and rail capacity regulation, which aim to increase the availability of public transport modes. National policies that reduce public transport ticket prices would further contribute to a higher uptake of public transport.

Digitalisation also provides practical tools to internalise the external costs of transport and raise awareness of the pressures exerted by our mobility needs and preferences. The European Commission, is working on **frameworks** to support modal shifts and multimodal trips, as outlined in the EEA's 2022 TERM report. In this context, investments and funding are also required to finance safe, clean and modern infrastructure that ensures access to public transport for all.

## Figure 2. Percentage point variation in the share of bus and trains (collective modes) in total inland passenger transport activity by country




The use of buses and trains in passenger transport activity **differs** vastly across countries, both in terms of share values and time evolution. Between 2005 and 2022, the share of buses and trains in total inland passenger transport increased in 10 EU Member States. Sweden experienced the greatest growth, at 3.6 points of share. However, the share of bus and trains declined by more than five percentage points in 10 countries (Bulgaria, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Poland, Romania and Slovakia).

For all other EEA member and cooperating countries for which data are available, the share ranged from -19 percentage points in Türkiye to 4 percentage points in Switzerland, during the same reference period. Serbia and Montenegro passenger transport data are available only from year 2010[2].

To **fully transition** to a more sustainable mobility system, a combination of approaches is needed, such as a more efficient and attractive public transport system. Active modes like walking and biking are also key to reducing the impacts of mobility in cities. However, these modes are not presented in this indicator, as data are not currently available.

## Supporting information

### Definition

Share of collective modes in total inland passenger transport. Collective modes refer to passenger transport via buses, coaches, and trains. Total inland passenger transport performance includes transport by passenger cars, buses and coaches, and trains. All data are based on movements within national territories, regardless of the vehicle's nationality.

**Methodology**

Figure 1: raw data for the EU-27 share (in %) of collective modes in total inland passenger transport performance were retrieved from Eurostat. Raw data for the increase in total inland passenger transport demand were retrieved from the 2024 version of the EU transport in figures statistical pocketbook published by DG MOVE. EU-27 aggregate data were used. No additional gap filling was applied to the data. Information on data set uncertainties can be found directly in the metadata and explanatory notes provided by Eurostat. Only official Eurostat data sets have been used.

Figure 2: raw data by country of variation (2005-2022) in the share of collective modes in total inland passenger transport performance were retrieved from Eurostat. Data are displayed at country level and are expressed in percentage points. To provide the broadest possible picture of European countries, geographical coverage was extended to the 32 EEA member countries and the Western Balkan cooperating countries when data were available. No additional gap filling was applied to the data. Information on data set uncertainties can be found directly in the metadata and explanatory notes provided by Eurostat. Only official Eurostat data sets have been used.

Additional information on the methodology used for data collection can be found here: Share of buses and trains in inland passenger transport (sdg_09_50) (europa.eu)

**Policy/environmental relevance**

The indicator is part of the indicator set tracking EU Sustainable Development Goals (SDG) and their related 169 targets, which are at the heart of the UN's 2030 Agenda for Sustainable Development. It is used to monitor trends on modal shift to environment-friendly transport modes and the progress towards building resilient infrastructure (SDG 9), promoting inclusive and sustainable industrialisation and fostering innovation and towards on making cities and human settlements inclusive, safe, resilient and sustainable (SDG 11). These targets are embedded in the European Commission's Priorities under the 'European Green Deal', 'A Europe fit for a digital age' and 'An economy that works for people'. The indicator is relevant also in the framework of the Commission 'Sustainable and Smart Mobility strategy' adopted in 2020. This strategy lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises.

The share of buses and trains in inland passenger transport is a headline indicator for monitoring progress towards the 8$^{th}$ Environment Action Programme (8$^{th}$ EAP). It contributes mainly to monitoring mobility aspects of the 8$^{th}$ EAP priority objective Article 2.(2)(f) that shall be met by 2030: *'promoting environmental aspects of sustainability and significantly reducing key environmental and climate pressures related to the Union's production and consumption, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system.'* For the purposes of the 8$^{th}$ EAP monitoring framework this indicator assesses specifically whether the EU will increase the share of buses and trains in inland passenger transport expressed in passenger-kilometres.

**Accuracy and uncertainties**

The accuracy of the is currently limited due to the voluntary collection of road passenger data. As a result, the transport performance data are based on a large variety of statistical sources and some data gaps are filled with estimates. Additional information can be found here: Share of buses and trains in inland passenger transport (sdg_09_50) (europa.eu)

**Data sources and providers**

- Share of buses and trains in inland passenger transport [SDG_09_50], Statistical Office of the European Union (EUROSTAT)
- Statistical pocketbook 2023, European Commission (EC)

## Metadata

**DPSIR**

Pressure

**Topics**

# Transport and mobility  # Urban sustainability

**Tags**

# mobility  # Buses  # modal shift  # 8th EAP  # TERM046  # Passenger transport  # Trains  # Transport

**Temporal coverage**

2005-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG9: Industry, innovation and infrastructure, SDG11: Sustainable cities and communities

**Unit of measure**

Percentage

**Frequency of dissemination**

Once a year

## References and footnotes

1. Lozzi, G. and et al., 2022, *Relaunching transport and tourism in the EU after COVID-19 — Part VI: Public transport*, European Parliament, Directorate-General for Internal Policies of the Union. ↲
2. For additional details on the methodology, see the supporting information. In particular, the limited accuracy of passenger data could impact data comparability between countries and the reported trends. ↲

European Environment Agency

# 8th Environment Action Programme

## Agricultural area under organic farming in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

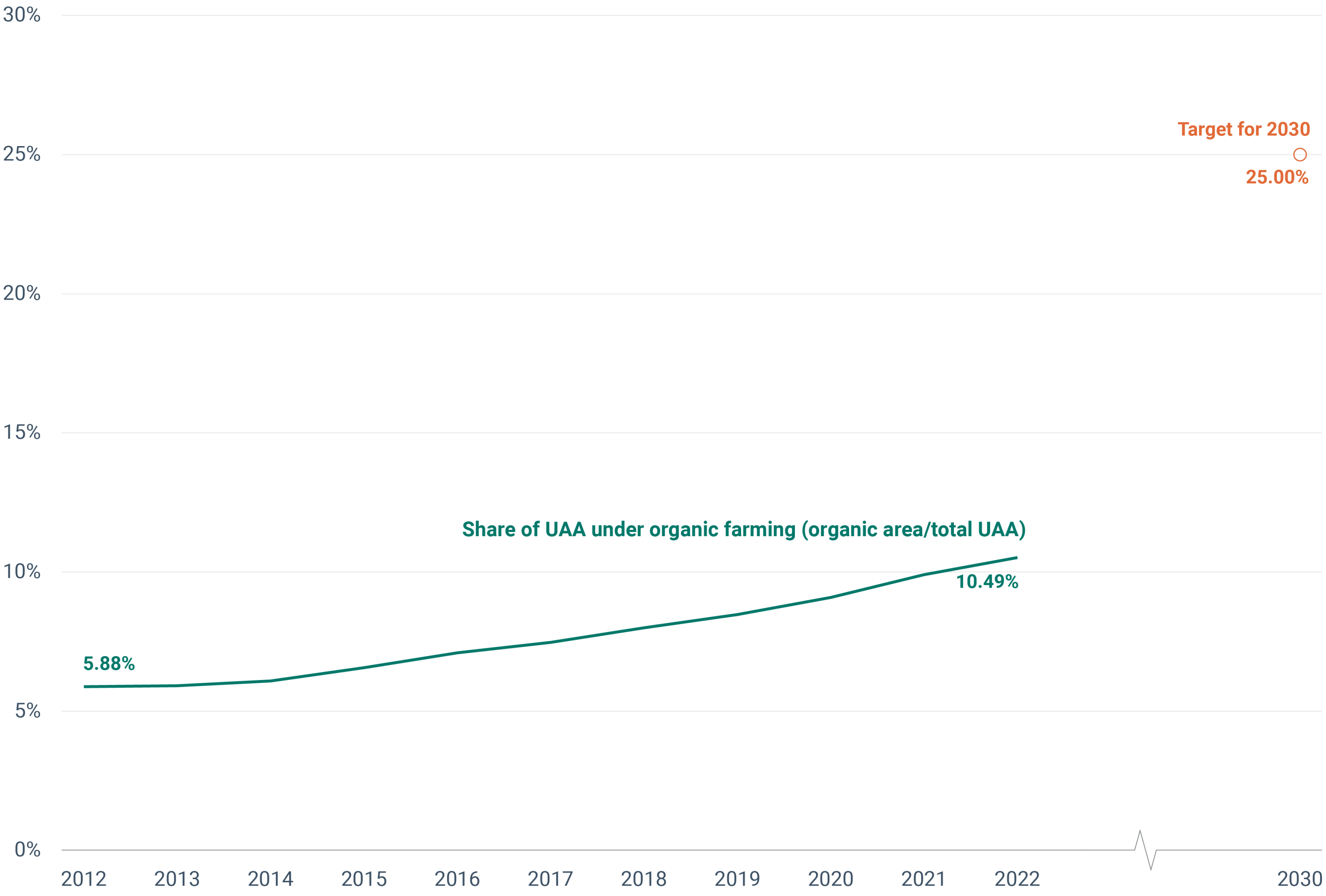
# Agricultural area under organic farming in Europe

Published 19 Nov 2024



The European Green Deal's Farm to Fork strategy sets the target that at least 25% of the European Union's agricultural area should be dedicated to organic farming by 2030. The share of the EU's agricultural land under organic farming increased from 5.9% in 2012 to 10.5% in 2022 as a result of an increasing demand for organic products and policy support. The pace will need to almost double in the remaining years up to 2030 in order to meet the target. Although the current policies are expected to increase the share of organic farming, this alone will not be enough to reach the set target.

## Figure 1. Share of the utilised agricultural area used for organic farming in the EU-27 over the period 2012-2022



Rules for **organic farming** on production and labelling of organic products in the EU are set by Regulation. Organic farming refers to the production of food using natural substances and processes. It avoids or notably reduces the use of synthetic chemicals, applies high standards of animal welfare and excludes the use of genetically modified organisms (GMOs). It has benefits for biodiversity, soil health and water quality.

European Green Deal (EGD) initiatives, particularly the Farm to Fork and EU Biodiversity for 2030 strategies, set the **target** that at least 25% of the EU's utilised agricultural area (UAA) should be organically farmed by 2030. The UAA under organic farming has increased in the EU since 2012 continuously, due to demand for organic products and policy support. It covered an estimated 16.9 million hectares, 10.5% of the EU's UAA, in 2022.

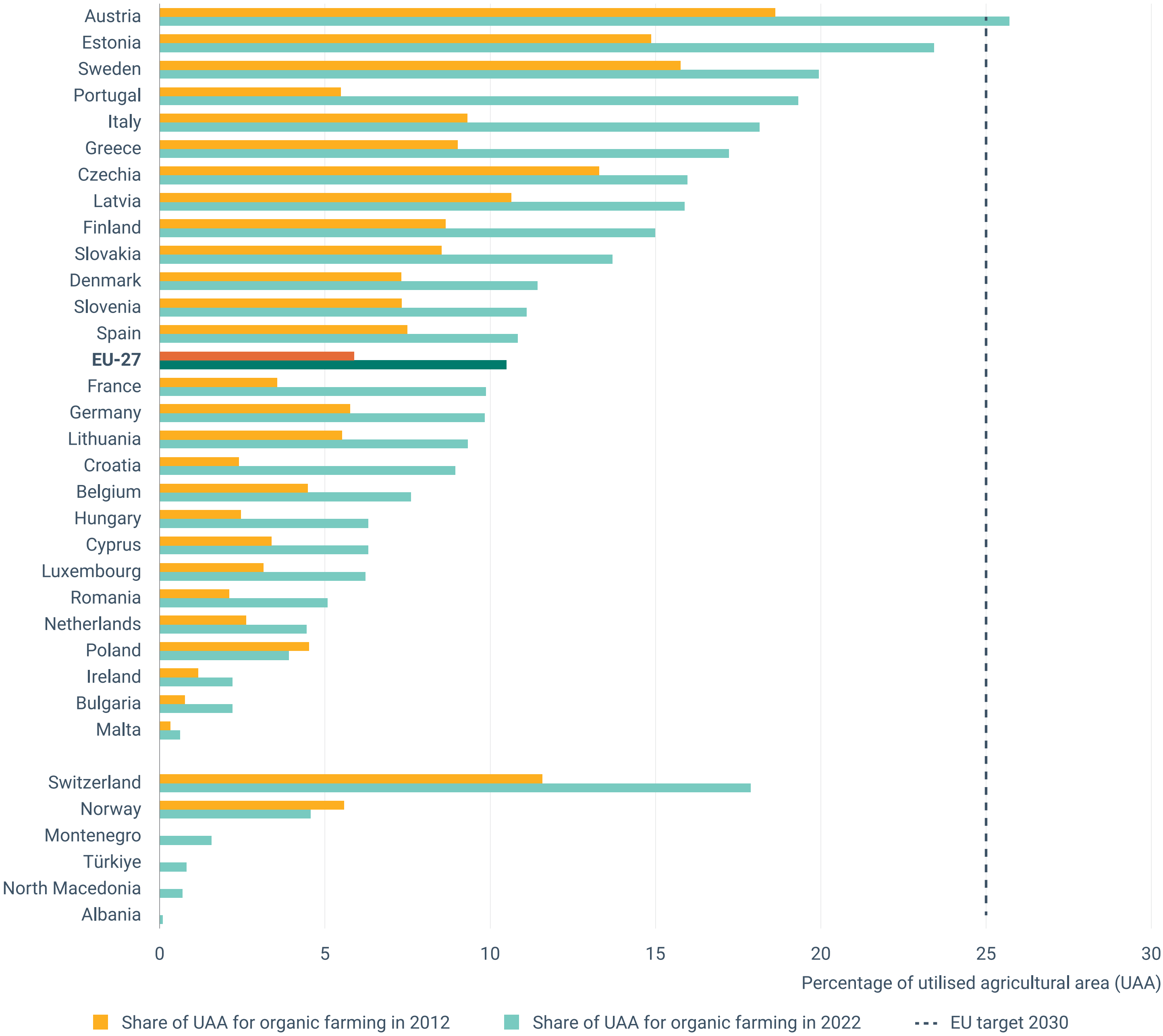
The annual compound **growth rate** between 2012 and 2021 was 6%. Meeting the 25% target by 2030 would require a higher annual compound growth rate of 10.1% for the 2021-2030 period. This would require the conversion of 2.9 million hectares of land per year, and of 23.3 million hectares in total from 2022 to 2030.

Currently, the share of the organic farming area is expected to further increase by 2030. The growth rate was projected to remain stable and lead to a 15% organic farming area share by 2031, assuming a growing demand and continuing policy support[1].

The EGD introduced new initiatives such as the new EU Action Plan for the Development of Organic Production to increase demand and supply of organic products. In this context, the Common Agricultural Policy (CAP) 2023-2027 aims to **provide support** to organic farming. After adoption, national CAP strategic plans of Member States have set their expected targets for areas under organic farming receiving CAP support, including respective financial allocations. It is expected to increase the area of organic farming receiving CAP support to about 10% of the total utilised agricultural area in 2027[2]. However, the Court of Auditors reported gaps in both EU and national policies for the organic sector.

There is high certainty that the objective will **not be met** by 2030. The evolution of the demand for organic products has become more unstable since 2022, and the current policy support alone is not sufficient to reach the target. More strategic and focused measures are required to develop the organic sector and implement the EGD objective. Accelerated development and execution of clear policies with increased ambition levels need to support a fundamental transformation of food production and consumption to hit the target.

## Figure 2. Share of total utilised agricultural area under organic farming by country and in the EU-27, in 2012 and 2022




**Shares** of UAA under organic farming increased between 2012 and 2022 in all EU Member States, except Poland, where the share decreased. Austria and Estonia had more than 20% of their UAA dedicated to organic farming in 2022, the highest shares of all EU Member States. Sweden and Portugal had more than 19% in 2022.

In contrast, five Member States had less than 5% of their UAA dedicated to organic farming. The lowest shares were found in Ireland, Bulgaria and Malta.

For EEA member and cooperating countries where data are available, less than 5% of their UAA were dedicated to organic farming, except Switzerland (with 17.9%). The share of organic farming area increased in Switzerland between 2012 and 2022, and decreased in Norway between 2012 and 2021 (no data for 2022).

## Supporting information

### Definition

This indicator shows the share of the utilised agricultural area (UAA) used for organic farming in the EU. According to the EU definition, the 'total organic area' includes both the 'certified organic farming area' and the 'area under conversion to organic farming', with farms undergoing a conversion process that typically takes 2-3 years, depending on the crop, before being certified as organic.

Organic farming is an integrated agricultural production system. It combines environment- and climate-friendly practices with benefits for biodiversity, the sustainable use of natural resources and the adoption of high animal welfare standards. This is in line with the demand of a growing number of consumers for products produced using natural substances and processes. Organic production thus plays multiple societal roles. It provides for a specific market, responding to consumer demand for organic products, and it delivers publicly available goods that contribute to benefits for environmental and human health, animal welfare and rural development.

The legal framework for organic farming in the EU is defined by Council Regulation 2018/848[3], which came into force on 1 January 2022. Organic agriculture is defined by regulated standards (production rules), certification procedures (compulsory inspection schemes) and a specific labelling scheme in the EU.

**Utilised agricultural area (UAA):** the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens, regardless of the type of tenure or whether or not it is used as a part of common land. It excludes land used for mushroom cultivation; unutilised agricultural land (NUAA); woodland (WA); other land occupied by, for example, buildings, farmyards, tracks or ponds; UAA that is the property of the owner but is leased or rented to someone else; and common land that is not used (NUAA).

See: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Utilised_agricultural_area_(UAA)

**Methodology**

The total organic agricultural area is reported by countries in accordance with Regulation (EU) 2018/848 [3]. The data from non-EU EEA member countries and cooperating countries are transmitted annually to Eurostat on a voluntary basis, based on the European Statistical System Agreement.

The EU's total organic agricultural area is calculated by Eurostat as the sum of the areas reported by the EU Member States. The total organic agricultural area as a share of the UAA is calculated as a percentage by Eurostat. The data set is updated annually by Eurostat, as soon as the underlying data become available and have been validated by Eurostat.

Switzerland provides the percentage of the organic area calculated from the national UAA excluding summer pastures and from the national data on the organic farming area.

## Methodology for gap filling

EU aggregates were calculated from available national data except in a few cases for which national data were not yet available and the data reported for the previous year by a country were taken into account in the calculation of the EU aggregate. Data gaps for Greece and Austria in 2021 were filled by using data from 2020.

## Methodology references

https://ec.europa.eu/eurostat/cache/metadata/en/org_esms.htm

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards achieving objectives of the 8th Environment Action Programme (8th EAP)[4][5]. It mainly contributes to monitoring food system aspects of the 8th EAP priority objective under Article 2(f), to be met by 2030: 'promoting environmental aspects of sustainability and significantly reducing key environmental and climate pressures related to the Union's production and consumption, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system[5].' The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should monitor whether the EU will reach '25% of EU agricultural land organically farmed by 2030'[4].

The indicator is also used for several monitoring frameworks such as for EU monitoring related to the United Nations Sustainable Development Goals.

Organic farming is one of the areas covered by the European Green Deal's Farm to Fork strategy, which sets a target that: 'at least 25% of the EU's agricultural land should be under organic farming by 2030'[6]. To achieve this target and to help the organic farming sector reach its full potential, a comprehensive action plan for organic production in the EU was set out[7]. It includes 23 actions, some of which follow on from the actions successfully undertaken in the period 2014-2020 and some of which are new, complementing existing actions and mobilising different sources of funding.

The three interlinked axes of the action plan reflect the structure of the food supply chain and the European Green Deal's sustainability objectives:

· Axis 1: stimulate demand and ensure consumer trust;

· Axis 2: stimulate conversion and reinforce the entire value chain;

· Axis 3: organics leading by example — increase the contribution of organic farming to environmental sustainability.

As part of the action plan, the regulation laying down the rules related to organic production in the EU has been revised. Since 1 January 2022, Regulation (EU) 2018/848[3] of the European Parliament and of the Council of 30 May 2018 has been the applicable legislative act, also known as the 'basic act'. It lays down rules on organic production and the labelling of organic products, and repeals and replaces Council Regulation (EC) No 834/2007 of 28 June 2007[8]. It aims, among other things, to:

· strengthen the control system to build increased trust in EU organic certification

· make the organic conversion easier for smaller-scale farmers;

· ensure the same standards for imported organic products as for EU organic products;

· increase the range of products that can be marketed as organic.

## Related policy documents

· Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007[3].

· Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an action plan for the development of organic production. COM/2021/141 final[7].

· Stakeholder Consultation — Synopsis report accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an action plan for the development of organic production. SWD/2021/65 final[9].

## Rationale

Organic farming is a farming system that has been explicitly developed to be environmentally sustainable. It is governed by clear, verifiable rules. In the EU, farming is considered organic only if it complies with Regulation (EU) No 2018/848 (Council Regulation (EC) No 834/2007 of 28 June 2007 before Regulation (EU) No 2018/848 entered into force). In line with this legislation, organic farming is differentiated from other approaches to agricultural production by the application of a monitored conversion period (from conventional farming), regulated standards (production rules), certification procedures (compulsory inspection schemes) and a specific labelling scheme. It is thus more suited to identifying environmentally friendly farming practices than other types of farming that also consider environmental aspects.

**Accuracy and uncertainties**

The accuracy of the data varies in the reporting countries. In most countries, a large share of the data comes from the responsible national control body. There are only provisional or estimated values for a few countries.

## Data sets uncertainty

Geographic coverage:

· Data are presented for all EU Member States.

· Non-EU EEA member countries with available data for 2022: Switzerland, Türkiye and for 2012: Norway, Switzerland.

· Non-EU EEA cooperating countries with available data for 2022: Albania, Montenegro, North Macedonia. No data for 2012.

Time coverage: 2012-2022. Data from before 2012 are not used for the indicator assessment, as these data are not comparable with data series from 2012-2022 because of methodological changes in data collection and reporting procedures.

Representativeness of data at the national level:

· The level of representativeness is high.

Comparability:

· The level of comparability is high. An EU-harmonised questionnaire is available for collecting data on organic farming, which guarantees geographical comparability. The actual comparability depends on national practices, left to subsidiarity.

· Length of comparable time series without methodological break is longer than four data points.

## Rationale uncertainty

No uncertainty has been specified.

**Data sources and providers**

- Organic crop area by agricultural production methods and crops (ORG_CROPAR), Statistical Office of the European Union (Eurostat)

# Metadata

**DPSIR**

Pressure

**Topics**

# Agriculture and food # Land use

**Tags**

# Utilised agricultural area # AGRI001 # Organic farming # 8th EAP

**Temporal coverage**

2012-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG15: Life on land

**Unit of measure**

Percentage of total utilised agricultural area (UAA)

**Frequency of dissemination**

Once a year

## References and footnotes

1. Projections about the share of organic farming in 2030 are uncertain due to different reasons such as the evolution of the organic farming market becoming less predictable due to current uncertainty in economic developments. High inflation levels might affect food prices on the short- and medium-term, which might slow down the increase in demand for organic products (EC, 2022b). Support for research and innovation in organic farming is being increased in the EU (EC, 2023), but it is not yet possible to factor in the development and uptake of research & innovation in organic farming practices, which is key to improve their competitiveness and hence uptake.
   ↵
2. Some Member States set organic farming area targets for 2027 some others for 2030. The targets are set only for areas receiving CAP support for organic farming. Areas farmed organically without receiving CAP support are not included. In 2020, 61.6% of organically farmed land received specific organic CAP payment.
   ↵
3. EU, 2018, Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007, OJ L 150, 14.6.2018, p. 1-92., 848
   a b c d
4. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives, COM(2022) 357 final.
   a b
5. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22–36.
   a b
6. EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A farm to fork strategy for a fair, healthy and environmentally-friendly food system, COM(2020) 381 final.
   ↵
7. EC, 2021, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS ON AN ACTION PLAN FOR THE DEVELOPMENT OF ORGANIC PRODUCTION
   a b
8. EU, 2007, Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91, OJ L 189, 20.7.2007, p. 1-23.
   ↵
9. EC, 2021, Stakeholder consultation — synopsis report accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an action plan for the development of organic production, SWD(2021) 65 final.
   ↵

European Environment Agency

# 8th Environment Action Programme

## Share of environmental taxes in total tax revenues


8TH EAP HEADLINE INDICATOR, 2024

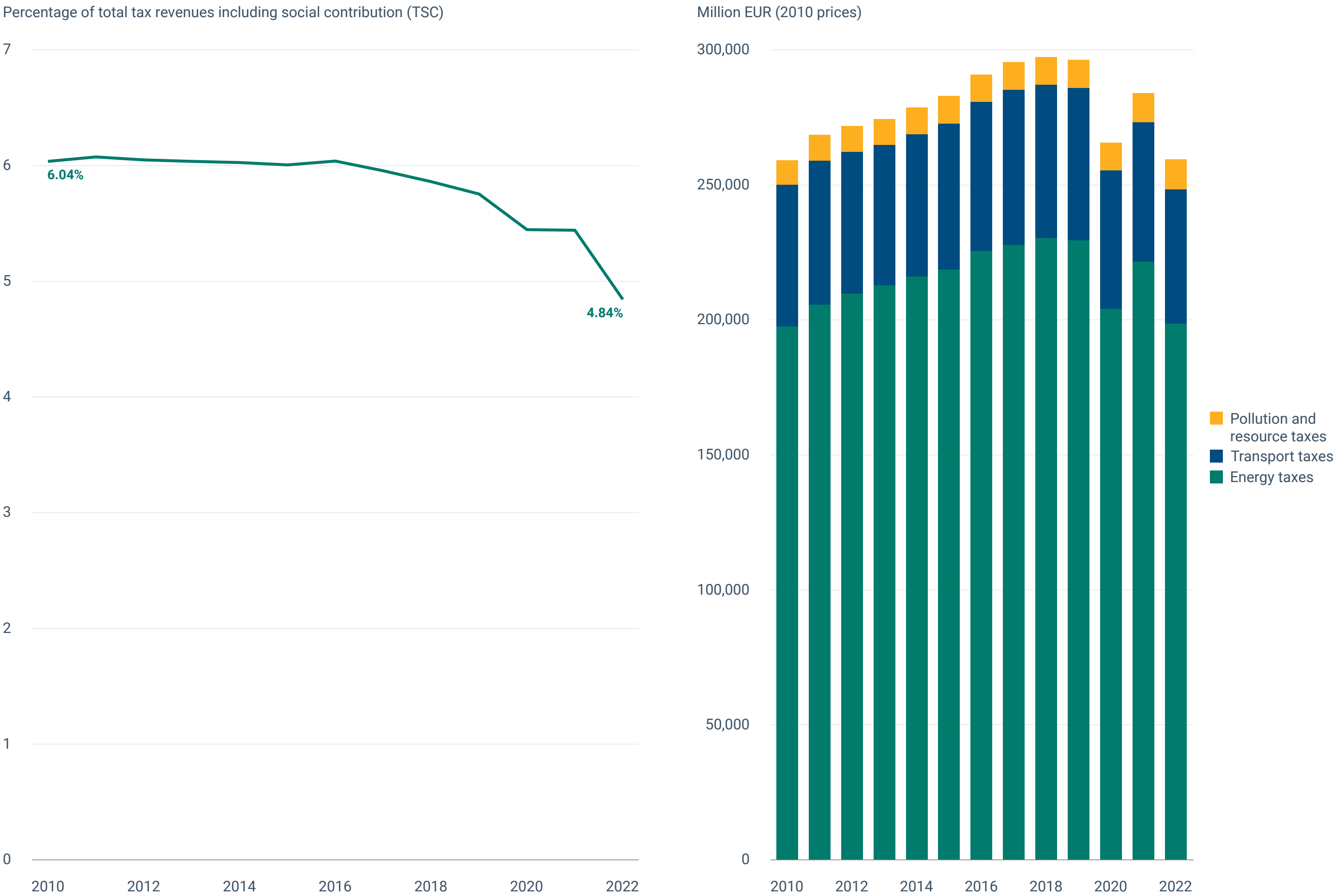
# Share of environmental taxes in total tax revenues in Europe

Published 27 Jan 2025



Despite the essential role of environmental taxation for the transition to a greener economy, the share of environmental taxes in total revenues from taxes and social contributions in the European Union decreased. This share fell from 6.0% in 2010 to 4.8% in 2022. Revenues from carbon pricing are expected to increase from 2027 with the start of the new Emissions Trading System. Whether this is sufficient to halt the persistent decrease in the overall share of environmental taxes is increasingly uncertain. Revenues from energy taxation may decline as future greenhouse gas emissions reductions erode the tax base.

## Figure 1. Environmental tax revenues in the EU-27: in absolute numbers and as a share of total tax revenues including social contribution (TSC), 2010-2022



Environmental taxes encourage producers and consumers to pollute less and use resources more sustainably. Making **polluters pay** is at the core of EU environmental policy [1]. Both the 8th Environment Action Programme and the European Green Deal acknowledge that environmental taxation is crucial for driving the transition to a greener, more sustainable economy.

Despite this, the share of total tax revenue accounted for by environmental taxes **fell** from 6.0% in 2010 to 4.8% in 2022. Driven by restrictions (e.g. on transport) related to the COVID-19 pandemic, environmental tax revenue declined in 2020 and 2022 to EUR317 billion (EUR260 billion in 2010 prices). Many EU Member States reduced excise taxes on petrol and diesel to alleviate the abnormal energy prices caused by the war in Ukraine. Therefore, 2022 was an exceptional year with unprecedented state interventions. Many measures put in place by Governments are temporary and environmental taxation could rebound as these are phased out.

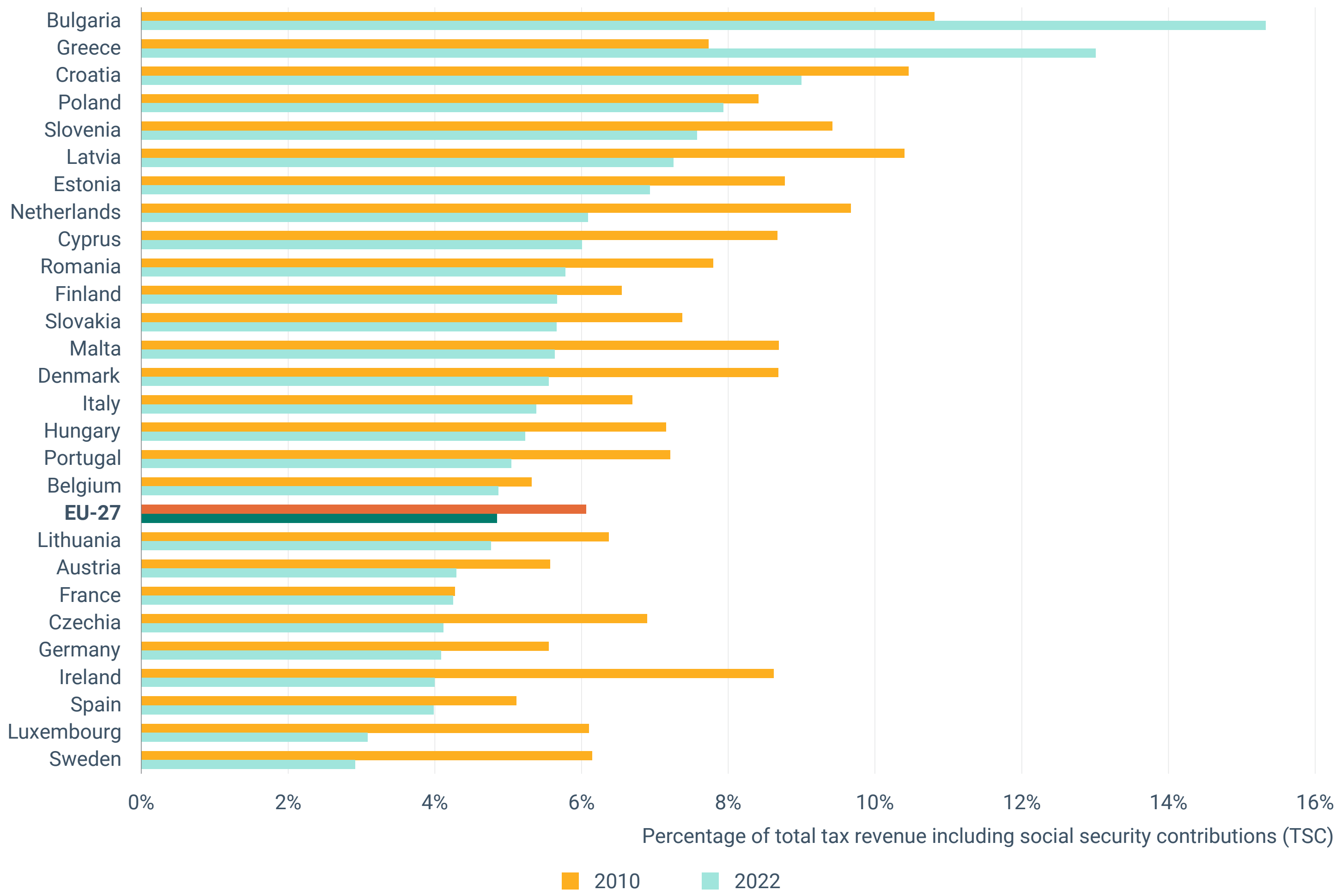
Energy and transport taxes combined accounted for 96% of total environmental tax revenue in 2022. Energy taxes, including carbon pricing revenues from the EU Emissions Trading System (EU ETS)[2], accounted for 77%, transport taxes for 19%, and pollution and resource tax revenues for 4%.

Changes stemming from the Fit for 55 policy package may lead to an increase of EU ETS revenue. Sectors already covered by the EU ETS will have more ambitious greenhouse gas (GHG) emission reduction targets. From 2027 new sectors (road transport, heating of buildings, fuel use in certain industrial sectors) will be included in a new EU ETS.

This suggests that the EU could increase environmental taxes as a share of total tax revenue by 2030, however this is increasingly **uncertain.** Environmental taxes as a share of total taxes have persistently declined and fell sharply in 2022. It is unclear if and to what extent environmental taxes will rebound, or whether the expected revenue from the EU ETS will be sufficient to offset this drop in future.

In the long term, revenue from the EU ETS is also expected to reach a peak and then decline as more stringent GHG emission **reduction requirements** are introduced and drive down emissions. Progress in the EU's transition to a climate neutral and green economy, while positive, will also erode the environmental tax base.

## Figure 2. Revenue from environmental taxes as a share (%) of total tax revenue, including social security contributions, by EU Member State, 2010 and 2022




Trends in the share of **total tax revenue** accounted for by environmental taxes vary across the Member States. Between 2010 and 2022, this share increased in only two Member States (Bulgaria and Greece). The largest increase, from 7.7% to 13%, occurred in Greece. The share declined in the remaining 25 Member States with the largest fall between 2010 and 2022 in Ireland (4.6%) followed by the Netherlands (3.6%). The lowest share was reported for Sweden with 2.9% in 2022.

## Supporting information

### Definition

'An environmental tax is a tax whose tax base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment, and which is defined in the ESA [European System of Accounts] as a tax' [3]. This indicator measures environmental tax revenue as a share of total tax revenue, including social contributions, and is calculated by dividing environmental tax revenue by total tax revenue including social contributions.

### Methodology

This indicator is based directly on data published by Eurostat, and the underpinning methodology can be found in Eurostat [3].

The absolute amount of environmental tax revenue was deflated based on 2010 prices using the Eurostat gross domestic product (GDP) deflator.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting the objectives of the Eighth Environment Action Programme (8th EAP). It contributes mainly to monitoring progress in relation to aspects of Article 3(v), which requires 'making the best use of environmental taxation, market-based instruments and green budgeting and financing tools, including those required to ensure a socially fair transition' [4]. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the 'increase inthe share of environmental taxes in total revenues from taxes and social contributions' [4].

**Accuracy and uncertainties**

**Data sources and providers**

- Environmental taxes by economic activity (NACE Rev. 2)[ENV_AC_TAXIND2], Statistical Office of the European Union (EUROSTAT)
- GDP and main components (output, expenditure and income)(nama_10_gdp), Statistical Office of the European Union (EUROSTAT)
- Environmental tax revenues [env_ac_tax], Statistical Office of the European Union (EUROSTAT)
- Environmental tax statistics, Statistical Office of the European Union (EUROSTAT)

## Metadata

**DPSIR**

Response

**Topics**

# Sustainable finance

**Tags**

# environmental tax # SUFI001 # green economy # budget revenue # public budget # 8th EAP # Tax # total tax # Sustainable finance

**Temporal coverage**

2010-2022

**Geographic coverage**

| | |
|---|---|
| Austria | Belgium |
| Bulgaria | Croatia |
| Cyprus | Czechia |
| Denmark | Estonia |
| Finland | France |

Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

Environmental tax revenue as a percentage of total tax revenue including social contributions, and the absolute amount of environmental tax revenue, in million euros, in 2010 prices.

**Frequency of dissemination**

Once a year

## References and footnotes

1. https://environment.ec.europa.eu/economy-and-finance/ensuring-polluters-pay_en
↲
2. The EU ETS is not a tax, but a market-based environmental measure  designed with the prime objective to reduce carbon emissions and provide a financial incentive to polluters to reduce emissions. The carbon price is not fixed by a government, but determined by the market based on demand and supply fundamentals. Revenue raising is hence not the primary objective of the ETS. However, in Eurostat's statistics on environmental taxation, government revenues from the auctioning of emissions permits, such as those from the EU ETS, are classified as tax receipts in the national accounts. This is why this indicator accounts for them as tax revenues.
↲
3. Eurostat, 2023, 'Environmental tax statistics — detailed analysis', *Eurostat Statistic Explained* ( https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_tax_statistics_-_detailed_analysis ) accessed January 16, 2023.
a b
4. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Fossil fuel subsidies

8TH EAP HEADLINE INDICATOR, 2024

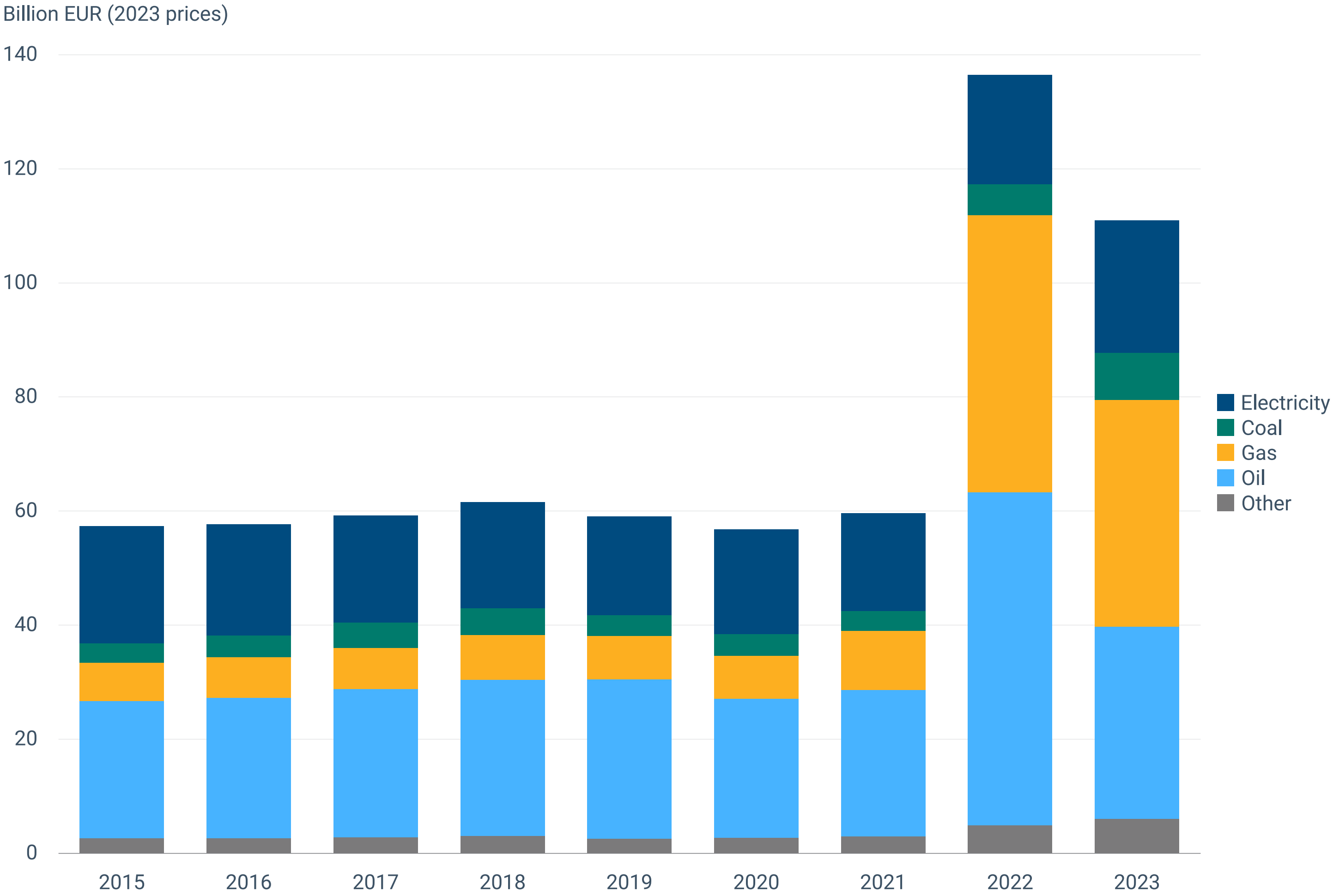
# Fossil fuel subsidies in Europe

Published 29 Jan 2025



The 8th Environment Action Programme calls for fossil fuel subsidies to be phased out without delay. Subsidies were stable from 2015-2021, yet more than doubled in 2022 due to high energy prices post-COVID and Russia's invasion of Ukraine, subsequently falling to EUR 111 billion in 2023. While a significant part of fossil fuel subsidies are due to be phased out by 2030, these are largely crisis measures. The EU is likely not on track to make notable progress by 2030, as most Member States lack concrete plans to phase out the significant fossil fuel subsidies that remain.

## Figure 1. Fossil fuel subsidies by energy vector in EU Member States, 2015 and 2023 (in 2023 prices)



Fossil fuels are non-renewable sources of energy, and their production and use contribute significantly to climate change and pollution. In line with international commitments — such as the G20 Pittsburgh Summit [1] and COP26 Glasgow Climate Pact [2] — and the European Green Deal, the EU's 8th Environment Action Programme (8th EAP) calls for a **phase out** without delay of subsidies for fossil fuels (such as coal, gas and oil). Progress towards this is monitored as part of the European Commission's commitments under the Governance Regulation [3] [4].

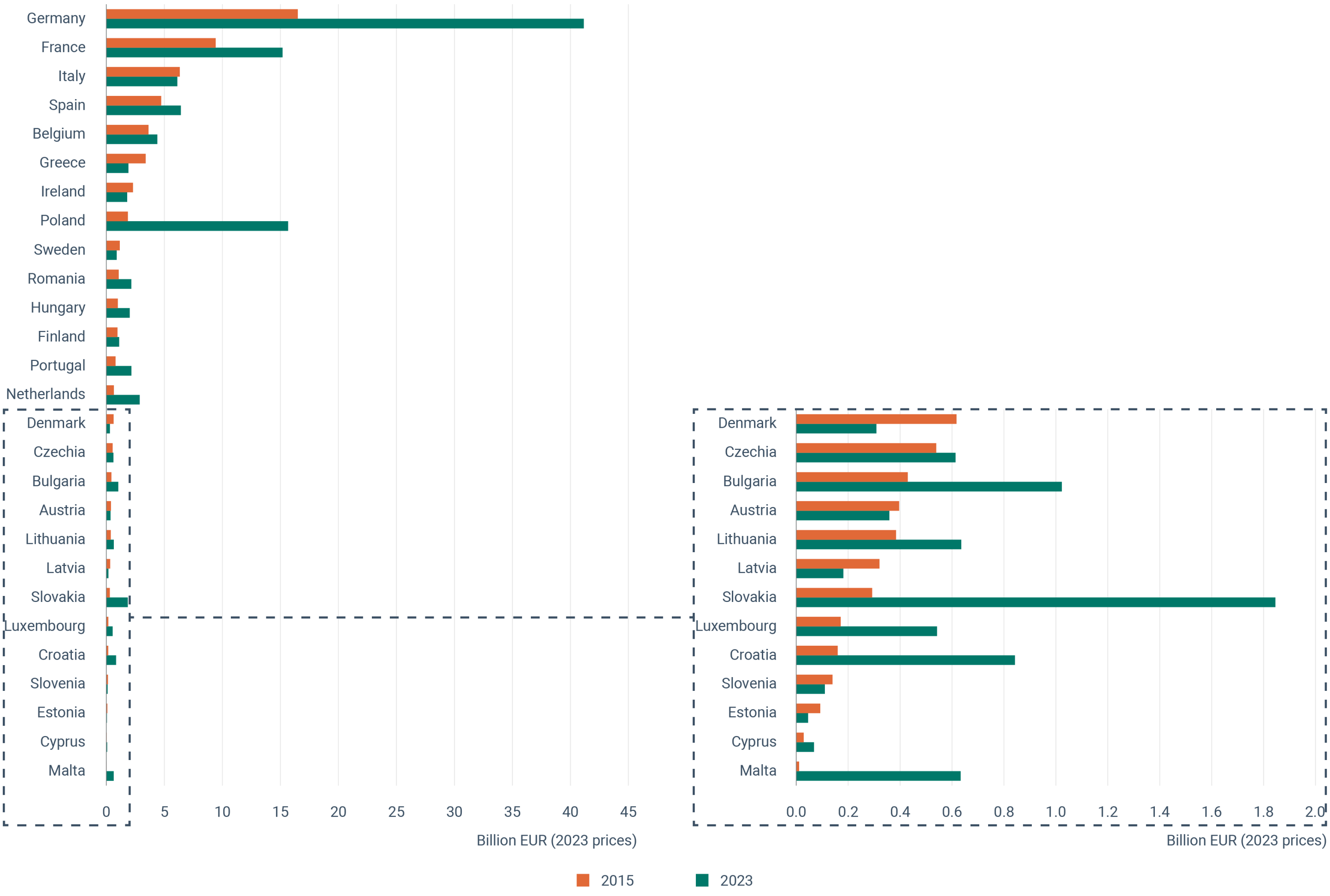
Fossil fuel subsidies remained **stable**, at between EUR 57-62 billion (2023 prices), from 2015 to 2021. A growth of EUR 4 billion occured during 2015-2018, caused by increases in transport and industry sector subsidies. Followed by a decrease of EUR 5 billion from 2018-2021, mostly due to reductions in the energy sector and subsidies for coal and lignite.

The sudden **significant growth** in 2022 fossil fuel subsidies can be attributed to the energy price crisis, intensified by Russia's invasion of Ukraine. EU Member States implemented at least 270 national measures to protect households and industries (forthcoming EC report on energy subsidies). The strong support continued in 2023, although at a lower level (EUR 111bn), as many crisis measures were prolonged despite the large decrease of fossil energy prices (forthcoming EC report).

Member States must include information in their biennial national energy and climate **progress reports** on phasing out energy subsidies, particularly fossil fuels. According to these reports, many countries have ambitions to move away from fossil fuel use, which would naturally phase out fossil fuel subsidies. However, only Denmark has translated this ambition into law. Other Member States have plans to phase out fossil fuel use in the power sector and for heating in buildings (forthcoming EC report).

The recent steep rise in fossil fuel subsidies is likely an **outlier**. In 2023, 43% (EUR 47.7bn) of total fossil fuel subsidies have a planned end-date before 2025, while a further 9% (EUR 10.1bn) have an end-date by 2030. There is no end-date provided for 48% (EUR 53.1bn) of fossil fuel subsidies (forthcoming EC report).

## Figure 2. Fossil fuel subsidies in EU Member States, 2015 and 2023 (in 2023 prices)




Assessing the progress towards phasing out fossil fuel subsidies is difficult in the current political and economic environment. EU Member States responses varied, with most providing generous financial support through fossil fuel subsidies. Fossil fuel subsidies **declined** in 20 EU Member States from 2022 to 2023, yet remained above levels seen in 2021 for most cases. The trend between 2015 and 2023 shows nine EU Member States made progress in phasing out fossil fuel subsidies, with a decrease in real terms over this period.

Notably, more than 60% of all fossil fuel subsidies granted in 2023 were spent in three countries: Germany (EUR 41 billion), Poland (EUR 16 billion), and France (EUR 15 billion).

The extent to which fossil fuel subsidies contribute to national economies also varies considerably across Member States. In 2023, fossil fuel subsidies represented the highest shares of gross domestic product (GDP) in Malta, Poland, and Slovakia (all at or above 1.5%). Countries with the lowest shares were Austria, Denmark, and Estonia (less than 0.2% of GDP).

**Additional figure: Fossil fuel subsidies as a share of national gross domestic products, 2020.**

## Supporting information

### Definition

This indicator is based on the concept developed by the World Trade Organization (WTO) through the Agreement on Subsidies and Countervailing Measures (ASCM), which classifies subsidies and government interventions into four main categories:

1. direct transfers: direct expenditures by governments to recipients, which could be either consumers or producers;
2. tax expenditures: the amounts of tax benefits, or preferences, received by taxpayers and forgone by governments;
3. income or price support mechanisms: various types of economic mechanisms, most of which can be considered cross-subsidies, i.e. involve transferring amounts of money from groups of people/technology/territory to another specific group;
4. RD&D budgets: various types of provisions for financial and/or other preferential mechanisms to support innovation.

For more information on the concept and definition of energy subsidies, see Annex 5 to EC.[5]

**Methodology**

A recurring obstacle preventing the pledge to phase out fossil fuel subsidies from being realised is the lack of a shared definition internationally[6]. This repeatedly stressed barrier is addressed by the Commission under the Regulation on the Governance of the Energy Union and Climate Action[7] through the adoption of 'implementing acts… , including a methodology for the reporting on the phasing out of energy subsidies, in particular for fossil fuels'[8]. As the European Commission published Implementing Regulation (EU) 2022/2299[9] in November 2022, the basis of the current assessment for this indicator is the data-gathering exercise performed by external consultants for the European Commission and published in the Commission report on energy subsidies in the EU [10]accompanying the 2023 State of the Energy Union report. The methodology behind the data collection and validation process is discussed in detail in Annex 5.1 to EC[5].

The data were deflated to 2022 prices as published in EC[10][5].

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting the objectives of the 8th EAP. It contributes mainly to monitoring progress in relation to aspects of Article 3(h), which requires, inter alia, 'phasing out environmentally harmful subsidies, in particular fossil fuel subsidies, at Union, national, regional and local level, without delay… by... (ii) setting a deadline for the phasing out of fossil fuel subsidies consistent with the ambition of limiting global warming to 1,5°C' [11]. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the reduction in 'environmentally harmful subsidies, in particular fossil fuel subsidies, with a view to phasing them out without delay' [12].

**Accuracy and uncertainties**

**Data sources and providers**

- Energy subsidies (Forthcoming DG ENER study on energy subsidies in the European Union) (direct link to the datasets is not available), DG ENER, European Commission
- Energy subsidies (Forthcoming DG ENER study on energy subsidies in the European Union) (direct link to the datasets is not available), DG ENER, European Commission

## Metadata

**DPSIR**

Response

**Topics**

# Sustainable finance

**Tags**

# SUFI002 # 8th EAP # subsidies # Fossil fuel

**Temporal coverage**

2015-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

Absolute subsidy amounts are measured in billion euros (EUR) and the contributions of fossil fuel subsidies to GDPs are given as percentages (%).

**Frequency of dissemination**

Once a year

## References and footnotes


1. OECD, 2009, *Leaders' statement: the Pittsburgh Summit — September 24-25 2009*, Organisation for Economic Co-operation and Development.
↩
2. UK Government, 2022, *COP26: the Glasgow Climate Pact*, United Nations Climate Change Conference UK 2022.
↩
3. EC, 2023, Report from the Commission to the European Parliament and the Council '2023 report on energy subsidies in the EU' (COM(2023) 651 final of 24 October 2023).
↩
4. EC, 2023, Study on energy subsidies and other government interventions in the European Union — 2023 edition, Final Report, Directorate-General for Energy (https://op.europa.eu/en/publication-detail/-/publication/32d284d1-747f-11ee-99ba-01aa75ed71a1/language-en ) doi: 10.2833/571674
↩
5. EC, 2022, *Study on energy subsidies and other government interventions in the European Union — 2022 edition*, Final Report, Directorate-General for Energy.
a b c
6. OECD and IEA, 2021, *Update on recent progress in reform of inefficient fossil-fuel subsidies that encourage wasteful consumption 2021*, Contribution by the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) to G20 Environment, Climate and Energy Ministers, in consultation with the Organization of Petroleum Exporting Countries (OPEC), Climate and Energy Joint Ministerial Meeting, Naples, 23 July 2021.
↩
7. EU, 2018, Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, OJ L 328, 21.12.2018, p. 1-77.
↩
8. EU, 2021, Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1-17.
↩
9. EU, 2022, Commission Implementing Regulation (EU) 2022/2299 of 15 November 2022 laying down rules for the application of Regulation (EU) 2018/1999 of the European Parliament and of the Council as regards the structure, format, technical details and process for the integrated national energy and climate progress reports, OJ L 306, 25.11.2022. p. 1-98.
↩
10. EC, 2022, Report from the Commission to the European Parliament and the Council '2022 report on energy subsidies in the EU', COM(2022) 642 final of 15 November 2022.
a b
11. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22-36.
↩
12. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Environmental protection expenditure

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

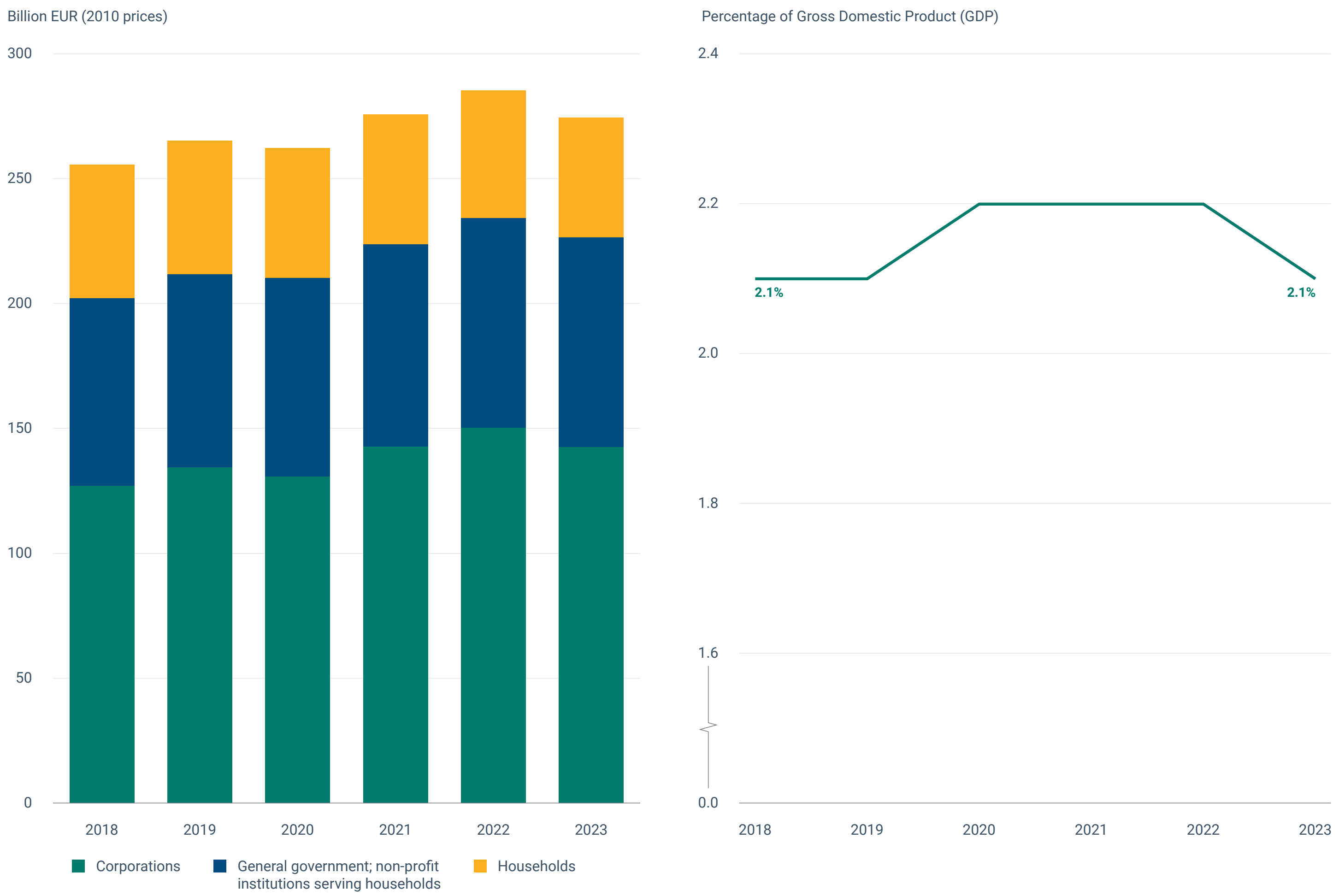
# Environmental protection expenditure

Published 29 Oct 2024



Increasing environment- and climate-related expenditure can help meet the objectives of the European Green Deal. Environmental protection expenditure (EPE) mainly includes expenditure related to the abatement of air, water, soil and noise pollution, the protection of biodiversity, the management of wastewater and waste, and environmental research and development. Expenditure increased between 2018 and 2023 from EUR 280 billion to EUR 357 billion in the European Union. After adjusting for inflation this represents an increase of 7%. It is very likely to increase in the coming years, as additional funds will be made available.

## Figure 1. Environmental protection expenditure by institutional sector in the period 2018-2023, EU-27



Building on the European Green Deal policy objectives [1], the Eighth Environment Action Programme (8th EAP) aims to accelerate the **green transition** [2]. Increasing environmental protection expenditure (EPE) in the Member States and green expenditure directly related to environmental protection, such as expenditure on renewables, energy and resource efficiency, and the circular economy transition can help achieve this.

EPE covers the **protection** of ambient air, soil and water; wastewater and waste management; noise abatement; biodiversity protection; protection against radiation; and environmental research and development (R&D). EPE only partly captures expenditure related to the climate-related expenditure[3][4]and the circular economy[5][6], and includes both operating expenditure and investments.

In real terms, growing by 7% during 2018-2023 and reaching an estimated EUR 275 billion in 2010 prices (EUR 357 billion in current prices) by 2023. Most EPE is spent by **corporations** and increased in real terms by 12% from 2018 to 2023. Over the same period, the EPE of general governments and non-profit institutions increased by 12% but EPE by households decreased by 11%. Most EPE was spent on waste management and wastewater treatment activities in this period [7]. Since 2018, the share of overall EPE in gross domestic product (GDP) has remained relatively stable, at around 2%, but declined from 2.2% in 2022 to 2.1% in 2023.

It is very likely that EPE will increase in the coming years, as **additional resources** have been made available. The EU's 2021-2027 budget has earmarked additional funding for climate- and biodiversity-related activities [8]. Grants and loans for climate-related activities are available through the 2021-2026 EU Recovery and Resilience Facility (RRF) [8]. The RRF was created to mitigate the social and economic impacts of the COVID-19 pandemic and supports the EU's aim to achieve a twin digital and green transition.

To achieve EU's objectives on environmental protection by 2030 [9], the additional investment needed for the period 2021-2030 are estimated at EUR 77 billion per year. It is **uncertain** if investments will increase at a fast enough rate to bridge the gap between current investment and total investment needed by 2030. For instance, environmental protection investments account for only a small share of total EPE, amounting to 19% in 2023, and increased from EUR 47 billion in 2018 to EUR 51 billion (both in 2010 prices) in 2023[10]. InvestEU and sustainable finance actions are expected to trigger additional private capital flows in Member States for sustainable investment, which would help to fill the investment gap.

## Figure 2. Expenditure on environmental protection by EU Member State, 2018 and 2021, (% of GDP)


EPE **increased** from 2.1% to 2.2% of GDP between 2018 and 2021 at the EU level. EPE to GDP ratios varied across the Member States. In Austria, Belgium and Czechia, EPE accounted for more than 3% of GDP, while in Ireland and Luxembourg it accounted for less than 1%.

In 17 of the 27 EU Member States, this share increased during the period 2018-2021, with the biggest increases in Poland and Austria (0.5 percentage point). In contrast, the share **fell** in four EU Member States, with the biggest reduction in Estonia (0.4 percentage point) and remained constant in the other six EU Member States.

## Supporting information

### Definition

'Environmental Protection Expenditure Accounts (EPEA) measure the economic resources devoted to prevention, reduction, and elimination of pollution and any other degradation of the environment. They cover the spending by resident units of a country (i.e. by its households, corporations and government) on environmental protection (EP) services, e.g. pollution abatement (air, water, soil and noise), waste and wastewater management, protection of biodiversity as well as related research and development, education and training activities' [7].

The scope of EPEA is defined according to the Classification of Environmental Protection Activities and Expenditure (CEPA 2000). CEPA 2000 is a recognised international standard included in the family of international economic and social classifications.

For further information, see Eurostat (2017).

**Methodology**

This indicator is directly based on data published by Eurostat and the underpinning methodology can be found in Eurostat [11][7]. EU-level data are based on Eurostat estimates.

The EUR values were deflated to 2010 prices using the Eurostat GDP deflator.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting one of the targets of the 8th EAP. It contributes mainly to monitoring progress in relation to aspects of the 8th EAP's aim to accelerate the green transition (Article 1) and Article 3(u), which requires 'mobilising resources and ensuring sufficient sustainable investments from public and private sources… consistent with the Union's sustainable finance policy agenda' [2]. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the 'increase [in] spending by households, corporations and governments on preventing, reducing and eliminating pollution and other environmental degradation' [12].

**Accuracy and uncertainties**

**Data sources and providers**

- National expenditure on environmental protection by institutional sector [env_ac_epneis1__custom_10844239], Eurostat (ESTAT)
- GDP and main components (output, expenditure and income) [NAMA_10_GDP__custom_3489075], Eurostat (ESTAT)
- National expenditure on environmental protection by institutional sector [env_ac_epneis1__custom_12233389], Eurostat (ESTAT)

## Metadata

**DPSIR**

Response

**Topics**

# Sustainable finance

**Tags**

# GDP   # SUFI003   # climate   # 8th EAP   # Environmental protection expenditure   # environment   # expenditure   # environmental protection investment   # Sustainable finance

**Temporal coverage**

2018-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

EPE is measured in billion euros (EUR in 2010 prices) and as a share of GDP (%)

**Frequency of dissemination**

Once a year

## References and footnotes

1. EC, 2019, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions 'The European Green Deal', COM (2019) 640 final of 11 December 2019.
↲
2. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union environment action programme to 2030, OJ L 114, 12.4.2022, p. 22-36.
a b
3. It does not capture expenditure on the production of renewable energies, energy efficiency in general or climate adaptation. However, it now includes expenditure on clean transport (vehicles and charging systems) as directly contributing to reducing air pollution. See CEPA and EPEA explanatory notes (Eurostat, 2020).
↲
4. https://ec.europa.eu/eurostat/documents/1798247/12177560/CEPA+and+CReMA+explanatory+notes+-+technical+note.pdf/b3517fb9-1cb3-7cd9-85bd-4e3a3807e28a?t=1609863934103

↵

5. Information on circular economy private investments in Member States is available in a data set published by Eurostat, under the circular economy indicators on competitiveness and innovation (see data set ‘Private investment and gross value added related to circular economy sectors’
↵

6. https://ec.europa.eu/eurostat/web/products-datasets/-/cei_cie010
↵

7. Environmental protection expenditure accounts, 2023b, ( https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_protection_expenditure_accounts) accessed August 28, 2023.
a b c

8. EC, 2021, *The EU’s 2021-2027 long-term budget and NextGenerationEU — facts and figures*, Publications Office of the European Union, Luxembourg.
a b

9. EC, 2020, Commission staff working document ‘Identifying Europe’s recovery needs’ accompanying the document Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions ‘Europe’s moment: repair and prepare for the next generation’, SWD(2020) 98 final of 27 May 2020.
↵

10. EEA own calculations based on Eurostat data taken from Environmental protection expenditure accounts, 2024, Statistics Explained – data extracted in June 2024 (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_protection_expenditure_accounts) accessed September 9, 2024
↵

11. Eurostat, 2023, 'National expenditure on environmental protection by institutional sector', *Eurostat Data Browser* ( https://ec.europa.eu/eurostat/databrowser/view/env_ac_epneis/default/table?lang=en) accessed March 24, 2023.
↵

12. EC, 2022, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions ‘REPowerEU plan’, COM (2022) 230 final of 18 May 2022
↵

European Environment Agency

# 8th Environment Action Programme

## Green bonds

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

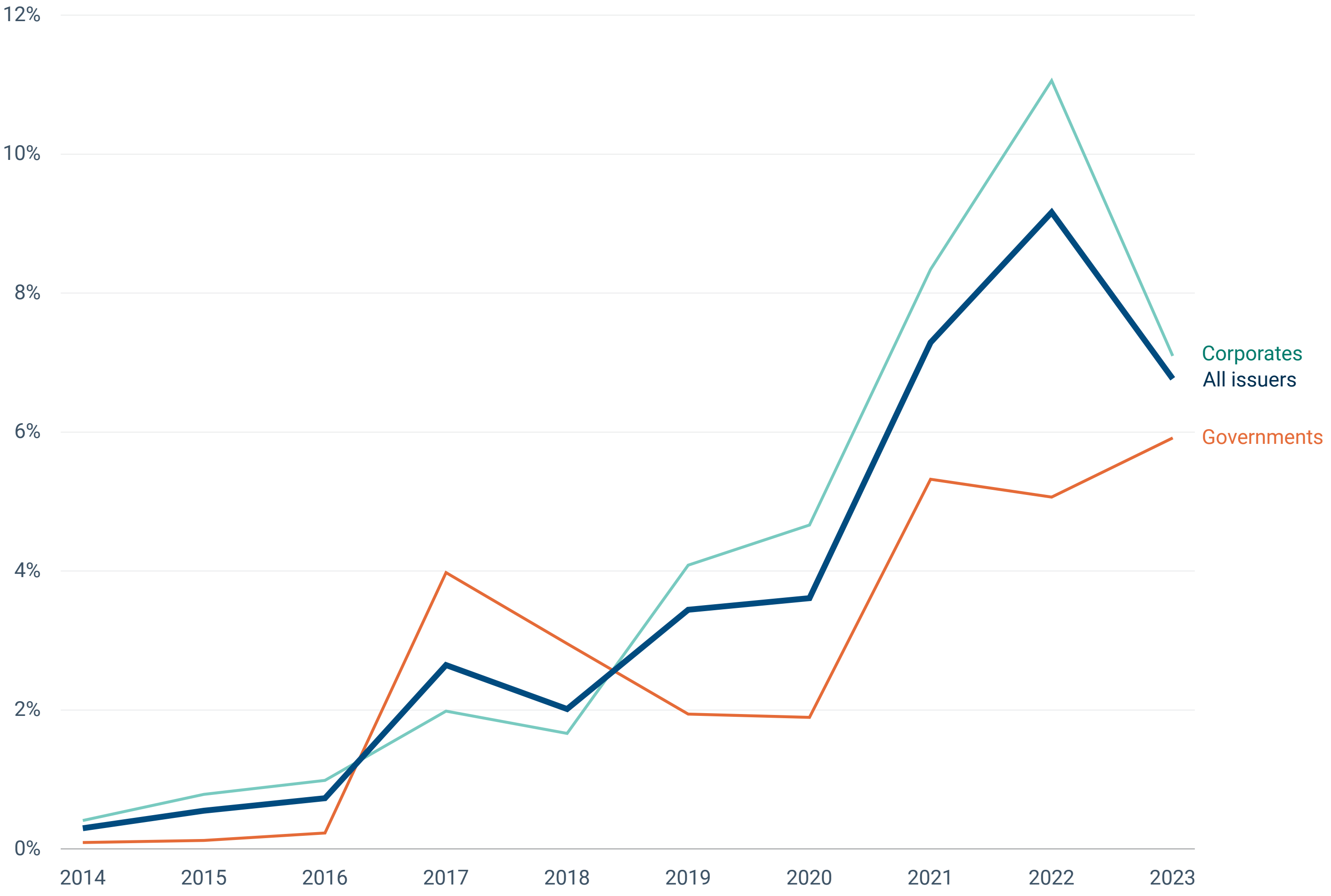
# Green bonds in Europe

Published 04 Nov 2024



Bonds used to finance activities that address climate change and environmental issues - green bonds - provide a means to increase green investment. Green bonds account for only 0.3% of all bonds issued by corporations and governments in the European Union in 2014. This rose to 9.2% in 2022, then fell to 6.8% in 2023. Trends reflect growing interest in offering financial products that support sustainability and demand among investors to finance environmentally sustainable projects. Issuances of green bonds are likely to increase given the ambitious environment and climate goals of the European Green Deal.

## Figure 1. Green bonds as a percentage of total bonds issued by corporations, by governments, and by both corporations and governments in the EU-27, 2014-2023



The European Green Deal emphasises the need to **direct capital flows** to green investments. One way to achieve this is by issuing green bonds, which, supported by the EU Sustainable Finance Framework, raise finance for projects, assets and specific business activities that help achieve environmental and climate objectives.

Green bond **issuance** increased significantly in the EU between 2014 and 2023, from 0.3% to 6.8% of total bonds issued. This indicates an increasing demand to finance sustainable investments, driven in part by the European Green Deal and the need to fund the transition to a low-carbon, green economy.

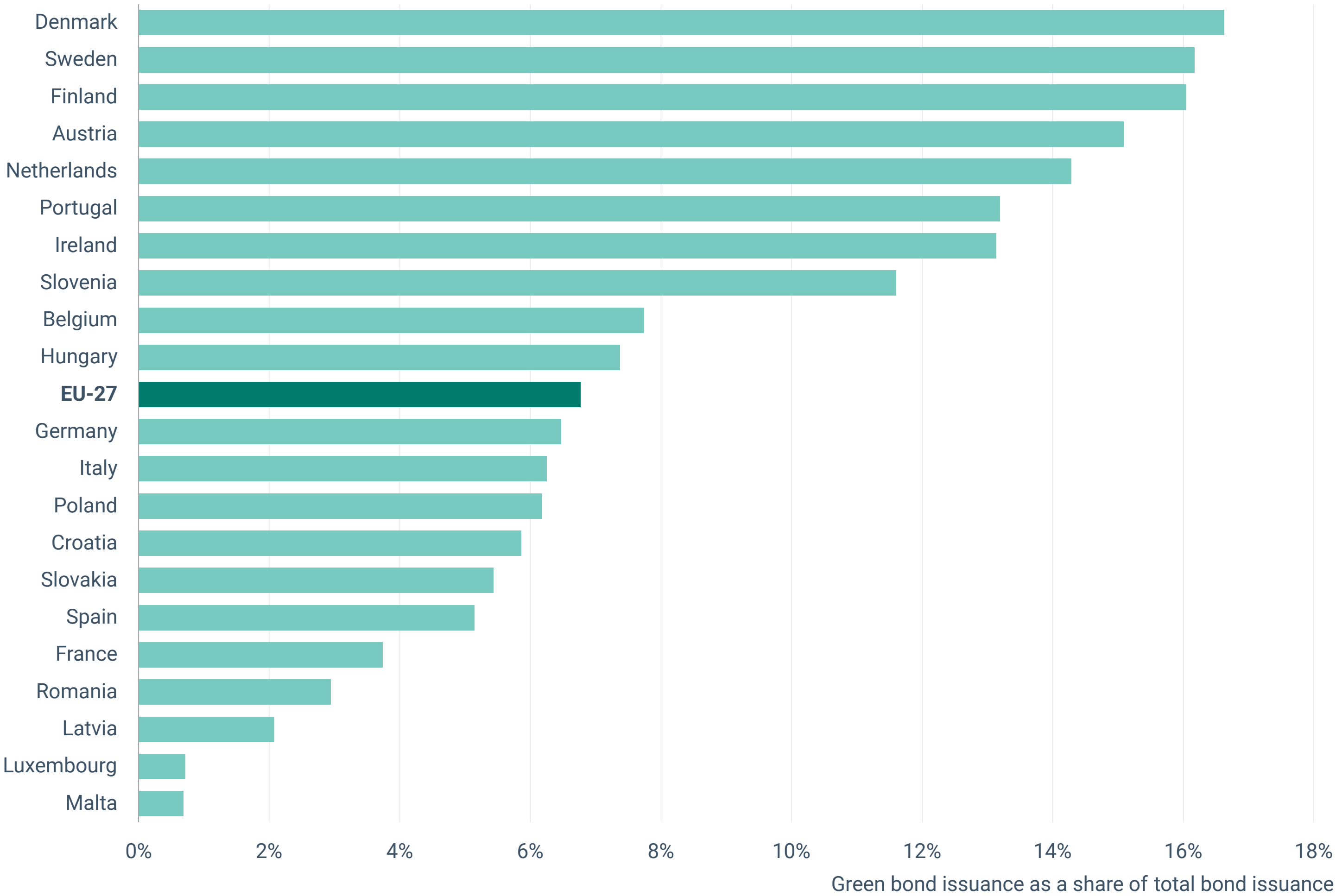
Green bonds can be issued by various types of entities. The rates at which these entities have increased green bond issuance vary. In recent years, green bond issuance by **corporations** increased rapidly, from 4.7% of total corporate bonds issued in 2020 to a high of 11.1% in 2022, before falling to 7.1% in 2023. The share of green bonds issued by **governments** (sovereign bonds) increased from 1.9% in 2020 to 5.9% in 2023. In 2023, corporations accounted for 76% percent of the total value of corporate and government green bonds issued in the EU, reaching €197.3 billion [1].

The volume of green bonds issued by some **supranational entities** also fell in 2023. The European Investment Bank issued €13.15bn of Climate Awareness Bonds in 2023, down from €13.73bn in 2022 and the European Commission issued €12.46bn NextGenerationEU Green Bonds in 2023, down from €24.44bn in 2022. This drop does not reflect a trend as both supranationals are following a multianual plan[2].

The recent dip in the green bond market may be due to short-term economic conditions. Rising interest rates increased borrowing costs in 2021, making it less attractive for green projects with high upfront investments to secure financing via bonds[3].This led to a **reduction** in green bond issuance, causing the green segment of the primary bond market to shrink and hindering its overall growth in 2023.

Interest rates are beginning to fall across Europe and the **demand** for green bonds is expected to pick up again driven by the ambitious environmental and climate objectives of the European Green Deal. Conditions for sustainable finance are also improving. The European green bond standard, which entered into force in December 2023, and the EU taxonomy for sustainable activities aim to boost sustainable investment. These developments indicate green bonds are likely to account for a growing share of total bonds in future.

## Figure 2. Shares of green bonds issued by corporations and by governments in 2023, by EU Member State




Green bond issuance as a share of total bond issuance varies across the EU Member States. In 2023, the share of green bonds was **highest** in Denmark, Sweden and Finland, for which green bonds represented more than 16% of bonds issuance. In contrast, six Member States did not issue any green bonds in 2023, namely Bulgaria, Czechia, Estonia, Greece, Cyprus, and Lithuania.

The speed at which national green bond markets develop and mature depends on many variables, including policy and regulatory factors, market conditions and financing trends. Further growth in the issuance of green bonds across the EU faces a range of **challenges**, including fragmented capital markets in Europe, insufficient pipelines of standardised green projects ready for green bond funding, and a lack of domestic investors [4].

Differences in investment needs and a lack of commonly accepted green bond standards and definitions add to the challenges and lead to green bond markets of different scales across the EU. The European green bond standard[5] aims to overcome some of these barriers and boost the share of green bonds in domestic (i.e., national) markets.

## Supporting information

**Definition**

**Bonds**

Bonds are loans provided by an investor to a borrower that are widely used to fund activities. The borrower agrees to pay back the loan with interest at a specified future date. Bonds can be used to finance a wide range of projects, and the proceeds are not necessarily earmarked for any particular purpose.

**Green bonds**

Green bonds are types of bonds that are issued specifically to finance green projects, i.e. the proceeds from green bonds are earmarked for green projects. The use of proceeds is typically guided by a set of criteria or green bond frameworks.

**Green bond frameworks and standards**

This indicator only includes those green bonds that are either aligned with the four core components of the International Capital Market Association (ICMA) green bond principles or are certified by the Climate Bond Initiative (CBI), i.e. follow the climate bond standard or are CBI aligned (i.e. unlabelled (conventional) bonds issued by a climate-aligned issuer or self-labelled green bonds that do not need to be aligned with ICMA principles or certified by the CBI).

**EU Green Bond Standard**

The EU Green Bond Standard establishes a new and clear gold standard for green bonds. Eighty-five percent of the bond's proceeds must be aligned with the EU Taxonomy technical screening criteria. The standard will be accessible to all issuers, including non-EU issuers, on a voluntary basis. It is scheduled to be available for use on 21 December 2024.

**Types of green bond issuers**

Green bonds can be differentiated by the entity that issues them. For instance, corporate green bonds are issued by a corporate entity, such as a company or financial corporation. Sovereign green bonds are issued by a national government. Supranational green bonds are issued by an international body such as the EU, which started to issue green bonds in 2021 under the NextGenerationEU Green Bonds programme, or by international financial institutions (IFIs) such as the European Investment Bank, the lending arm of the EU. Data providers also differentiate green bonds issued by subnational entities such as municipalities or agencies from other types of green bond. Green bonds issued by agencies are usually securitised by a government-sponsored enterprise or a government department.

**NextGenerationEU**

The NextGenerationEU instrument was established to support the EU's recovery from the economic impacts of the COVID-19 pandemic. In the coming years, the European Commission intends to fund up to EUR 250 billion (or 30%) of its NextGenerationEU plan by issuing green bonds [6].

**EU taxonomy for sustainable activities**

The EU taxonomy for sustainable activities is a classification system that defines sustainable activities, e.g. activities for climate change mitigation and adaptation [7].

**Methodology**

This indicator is calculated based on data on the issuance of green bonds by companies, including financial institutions, and governments in the EU. Green bonds issued from supranational entitities, from agencies and sub-national entities are not included. It shows green bond issuance as a percentage of all bonds issued and by type of green bond issuer. Data on corporate and government bonds were provided by the European Securities and Markets Authority (ESMA) in May 2024. As the groups of issuers were compiled by ESMA and Refinitive Eikon, minor double-counting at margins cannot be excluded, despite the utmost care.

Green bond indicators such as this may contain discrepancies, as they rely on data provided by various commercial data providers, which report on issuances at different dates and rely on different green bond standards or frameworks. Moreover, numbers from the same data provider can vary depending on the date of data download and the currency exchange rate used.

It is important to note that the indicator does not provide information on the environmental impact, or the sustainability of the projects financed by green bonds. In addition, the indicator does not capture the varying 'greenness' levels of the projects financed by different bonds or the contribution of financed projects to achieving the Paris Agreement goals, which are increasingly important factors for investors and regulators. Finally, fixed-income instruments cover only parts of the financial system, and this green bond indicator therefore only partially reflects trends in financing green assets. Those trends might be different for different environmental objectives depending on the financial preferences and the 'investability' of the projects and activities funded.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting targets of the Eighth Environment Action Programme (8th EAP). It contributes mainly to monitoring in relation to aspects of 8th EAP Article 3(u), which requires 'mobilising resources and ensuring sufficient sustainable investments from public and private sources… consistent with the Union's sustainable finance policy agenda'. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the 'increase [in] the issuance of green bonds to boost public and private financing for green investments' [8].

**Accuracy and uncertainties**

**Data sources and providers**

- Share of bonds issued as green bonds (copyright-protected and direct link to the dataset is not available), European Securities and Markets Authority (ESMA), based on data produced by Refinitiv

## Metadata

**DPSIR**

Response

**Topics**

# Sustainable finance

**Tags**

# green bond issuances # European Green Deal # SUFI004 # sustainable finance # 8th EAP

**Temporal coverage**

2014-2023

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

Green bond issuance is measured as a share (%) of total bond issuance.

**Frequency of dissemination**

Once a year

## References and footnotes

1. EEA calculations based on data provided by ESMA. Data for the European Economic Area is published in ESMA's 2024 report: TRV Risk Monitor ESMA Report on Trends, Risks and Vulnerabilities No. 1. ↲
2. For instance, the European Commission has announced that it will fund up to 30% of the NextGenerationEU scheme (i.e. EUR 250 million) via green bonds. ↲
3. ECB, 2023, 'Monetary policy tightening and the green transition', ( https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp230110~21c89bef1b.en.html) accessed September 5, 2024.

4. OECD, 2017, 'Mobilising Bond Markets for a Low-Carbon Transition', *OECD* ( https://www.oecd.org/en/publications/2017/04/mobilising-bond-markets-for-a-low-carbon-transition_g1g77998.html) accessed September 5, 2024.

5. Regulation (EU) 2023/2631 of the European Parliament and of the Council of 22 November 2023 on European Green Bonds and optional disclosures for bonds marketed as environmentally sustainable and for sustainability-linked bonds (Text with EEA relevance), 2023,

6. EC, 2023, 'NextGenerationEU green bonds', ( https://commission.europa.eu/strategy-and-policy/eu-budget/eu-borrower-investor-relations/nextgenerationeu-green-bonds_en) accessed April 17, 2023.

7. EU, 2020, Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, OJ L 198, 22.6.2020, p. 13-43.

8. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme’s 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Eco-innovation index

8TH EAP HEADLINE INDICATOR, 2024

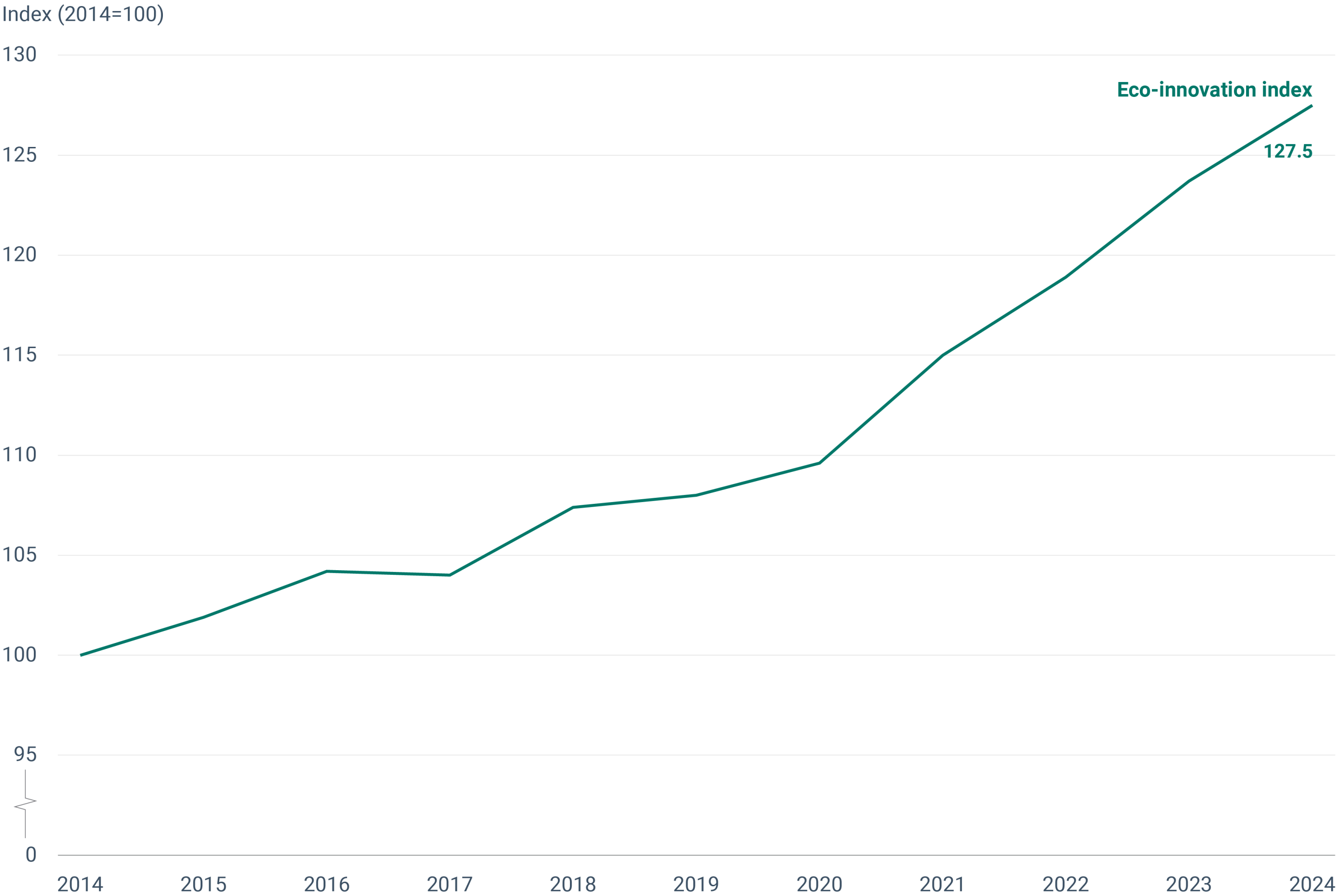
# Eco-innovation index in Europe

Published 11 Dec 2024



Eco-innovation, which is crucial for achieving the European Green Deal objective of transitioning to a carbon-neutral and sustainable economy, has increased in the European Union. The European Commission's eco-innovation index increased by 27.5% from 2014 to 2024, mainly driven by improvements in resource efficiency. This steady increase in recent years is expected to continue, as the European Green Deal has set ambitious environment- and climate-related objectives. Its associated initiatives are very likely to create favourable conditions for more eco-innovation.

## Figure 1. Eco-innovation index, EU-27, 2014-2024 (EU-27=100 in 2014)




Eco-innovation refers to any innovation that **reduces impacts** on the environment, increases resilience to environmental pressures or uses natural resources more efficiently[1]. Eco-innovation is essential for achieving the objectives of the European Green Deal, such as the transition to a climate-neutral, circular economy.

The European Commission's eco-innovation index [2] is a composite indicator based on **five dimensions**:

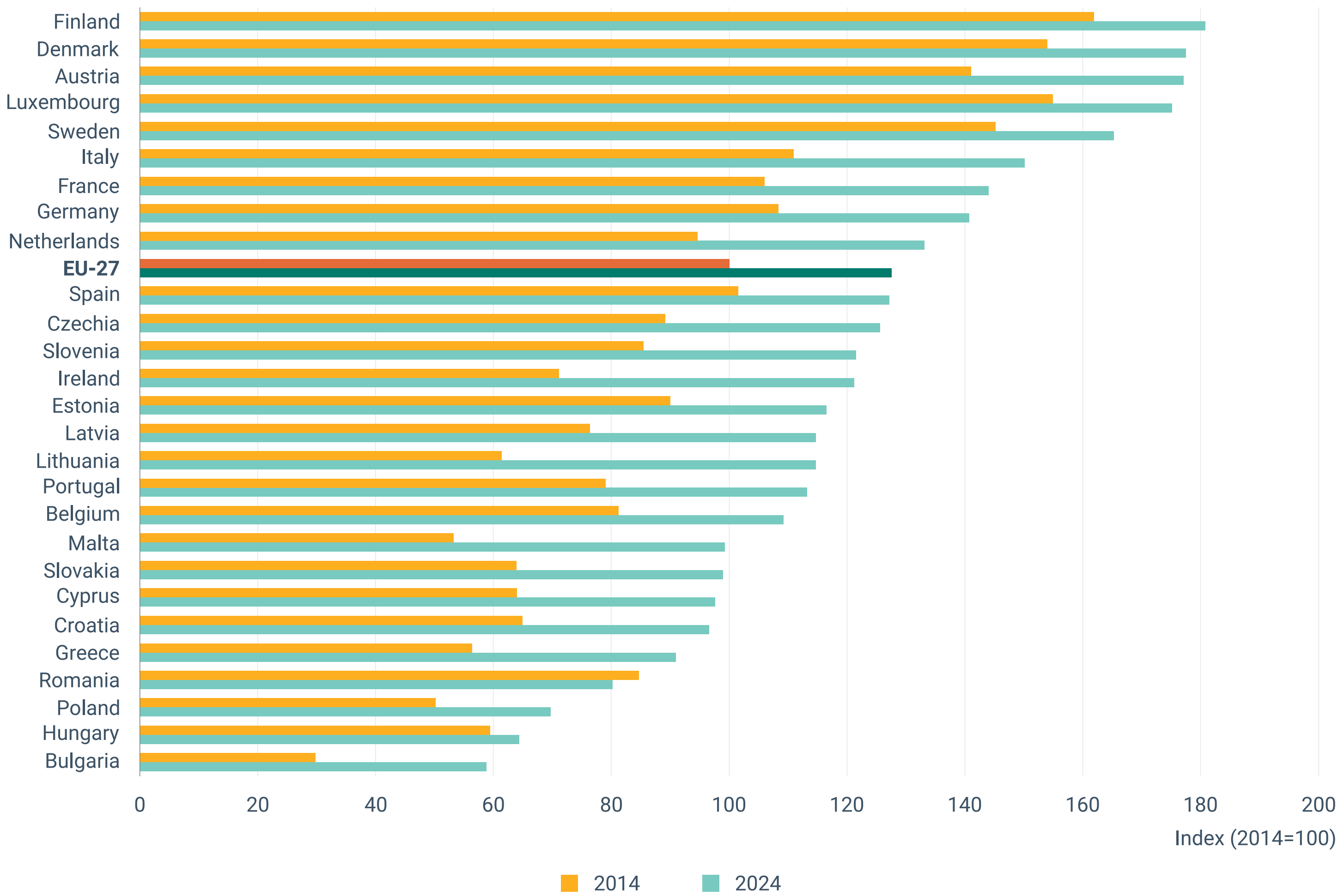
1. eco-innovation inputs;
2. eco-innovation activities;
3. eco-innovation outputs;
4. resource efficiency outcomes, and;
5. socio-economic outcomes.

Performance in each of these dimensions is measured using relevant indicators, which are published by, for instance, Eurostat, the European Environment Agency and the Organisation for Economic Co-operation and Development (OECD).

The EU's performance between 2014 and 2024 **improved** markedly, as shown by the by steady 27.5% increase in the eco-innovation index score. Increases were seen in all of the five themes, however the increasing eco-innovation index score can mostly be attributed to improvements in resource efficiency outcomes. This theme increased by 62% during the period, particularly in greenhouse gas (GHG) emission productivity (i.e. decreases in GHG emissions generated per unit of gross domestic product (GDP)). At the indicator level, the greatest improvement was seen in the number of eco-innovation publications, while the worst performance was in eco-innovation related patents.

The steady increase in the eco-innovation index score between 2014 and 2024 is expected to continue in the future. This is because the improvements in resource efficiency and other contributing indicators are likely to continue due to the highly ambitious environment- and climate-related objectives of the European Green Deal and its associated initiatives[3].

## Figure 2. Eco-innovation index by EU Member State, 2014-2024 (relative to EU-27=100 in 2014)




The Nordic countries, Luxembourg and Austria were the **best performers** of eco-innovation from all individual EU Member States in 2014 and 2024[4]. Apart from Finland, all of these countries performed well in resource efficiency outcomes. Finland and Austria scored particularly highly on socio-economic outcomes.

Index scores improved between 2014 and 2024 for all Member States except Romania. Eighteen Member States achieved increases of above the EU-27 average. Lithuania achieved the **largest growth**, followed by Ireland and Malta. Lithuania's improvement is largely driven by strong growth in eco-innovation related academic publications, water productivity (GDP/total freshwater abstraction), the number of ISO 14001 certificates, and indicators included in socio-economic outcomes.

Some countries showed substantial progress over the period, reflecting concerted efforts to foster eco-innovation activities. For example, Greece experienced a steady improvement in its eco-innovation, increasing from 56 in 2014 to 91 in 2024. However, there remains a gap between the top performers and those still in need of further progress. The top-performing member state, Finland, scored three times higher than the lowest-performing member state, Bulgaria.

## Supporting information

### Definition

'Eco-innovation is any innovation that make progress towards a more green and sustainable economy by reducing environmental pressures, increasing resilience or using natural resources more efficiently' [5].

The eco-innovation index is based on the eco-innovation scoreboard, which has 12 indicators in five thematic areas[3]:

1. 'Eco-innovation inputs, which includes financial and human capital investment in eco-innovative activities;
2. Eco-innovation activities, which defines the extent to which companies in a given country are active in eco-innovation;
3. Eco-innovation outputs, which measures the output of eco-innovation activities concerning the number of patents and academic literature;
4. Resource efficiency outcomes, which pinpoint a country's efficiency of resources and GHG emission intensity;
5. Socio-economic outcomes, which aims to measure the positive societal as well as economic outcomes of eco-innovation'.

**Methodology**

Eco-innovation index scores are currently calculated on the basis of 12 indicators belonging to the following five thematic areas:

1. Eco-innovation inputs: governments' environmental and energy R&D appropriations and outlays (governments' environmental and energy R&D appropriations and outlays as a proportion of GDP); total R&D personnel and researchers (total R&D personnel and researchers as a proportion of total employment).
2. Eco-innovation activities: number of ISO 14001 certificates (number of ISO 14001 certificates/population in millions).
3. Eco-innovation outputs: eco-innovation-related patents (number of patent applications filed under the Patent Cooperation Treaty (PCT) in the fields of environment-related technologies, climate change adaptation technologies and sustainable ocean economy inventions/population in millions); eco-innovation-related academic publications (number of publications with any the following list of English keywords in the title and/or abstract: eco-innovation, energy efficient/efficiency, material efficient/efficiency, resource efficient/efficiency, energy productivity, material productivity, resource productivity)population in millions;
4. Resource efficiency outcomes: material productivity (GDP/domestic material consumption (DMC)); water productivity (GDP/total fresh water abstraction); energy productivity (GDP/gross available energy for a given year); GHG emission productivity (GDP/GHGs ($CO_2$, $N_2O$ in $CO_2$ equivalent, $CH_4$ in $CO_2$ equivalent, hydrofluorocarbons (HFCs) in $CO_2$ equivalent, perfluorocarbons (PFCs) in $CO_2$ equivalent, $SF_6$ in $CO_2$ equivalent, $NF_3$ in $CO_2$ equivalent)).
5. Socio-economic outcomes: exports of environmental goods and service sector (export of goods and services in the field of environmental protection and resource management activities/total exports); employment in environmental protection and resource management activities (employment in environmental protection and resource management activities/total employment); value added in environmental protection and resource management activities (value added in the environmental goods and service sector/GDP).

**Policy/environmental relevance**

The Eighth Environment Action Programme (8th EAP) should, among other things, accelerate the transition to a green economy in the context of a well-being economy through, inter alia, 'continuous… innovation' (EU, 2022). This indicator is a headline indicator for monitoring progress towards meeting one of the 8th EAP and contributes mainly to monitoring progress in relation to aspects of Article 3(w), which requires 'strengthening the environmental knowledge base… and its uptake…, including through… innovation' (EU, 2022). The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the increase in 'eco-innovation as a driver for the green transition' [6].

**Accuracy and uncertainties**

**Data sources and providers**

- Eco-innovation index, Research and Innovation (DG)

## Metadata

**DPSIR**

Response

**Topics**

# Sustainability solutions

**Tags**

# impacts # 8th EAP # Transition # Eco-innovation # environment # resource efficiency # SUSO001 # environmental pressures

**Temporal coverage**

2014-2024

**Geographic coverage**

| | |
|---|---|
| Austria | Belgium |
| Bulgaria | Croatia |
| Cyprus | Czechia |
| Denmark | Estonia |
| Finland | France |
| Germany | Greece |
| Hungary | Ireland |
| Italy | Latvia |
| Lithuania | Luxembourg |
| Malta | Netherlands |
| Poland | Portugal |
| Romania | Slovakia |
| Slovenia | Spain |
| Sweden | |

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG11: Sustainable cities and communities

**Unit of measure**

This is a composite indicator and therefore no units are used.

**Frequency of dissemination**

Once a year

## References and footnotes


1. EC, 2011, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions ‘Innovation for a sustainable future — the eco-innovation action plan (Eco-AP)’, COM(2011) 899 final of 15 December 2011. ↵
2. Al-Ajlani, H., Cvijanović, V., Es-Sadki, N. and Müller, N., 2022, *EU eco-innovation index 2022 — policy brief*, European Commission. ↵
3. Mohamedaly, Al-Ajlani, H., Kuuliala, V., McKinnon, D. and Johansen, M., 2022, *Eco-innovation for circular industrial transformation — a report on the best practices, drivers, and challenges in key sectors*, European Commission. a b
4. The progress made by EU Member States over time is presented relative to an eco-innovation score for the EU-27 in 2014 of 100. ↵
5. EC, 2022, *Eco-index 2022 — indicators and methodology*, European Commission. ↵
6. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme’s 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022. ↵

European Environment Agency

# 8th Environment Action Programme

## Land take: net land take in cities and commuting zones in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

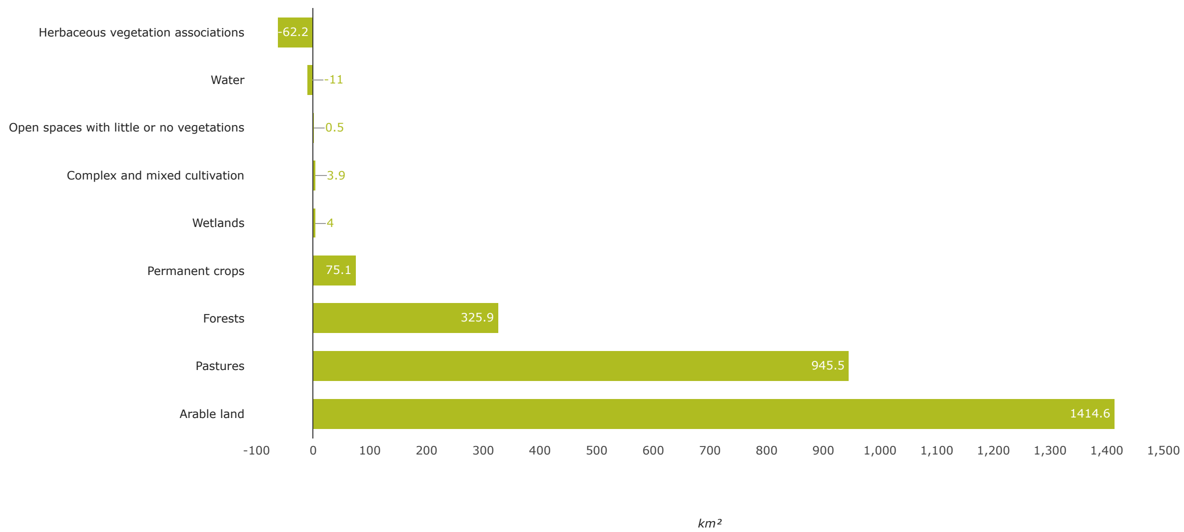
# Net land take in cities and commuting zones in Europe

Published 23 Mar 2023



Land conversion to artificial surfaces impairs the ecological functions of land and makes ecosystems less resilient. In Europe, this conversion takes place primarily in cities and commuting zones. Between 2012 and 2018, the net land take in the EU in these zones was 450 $km^2$ annually. The land that was taken was mostly croplands and pastures, followed by forests. For the EU to reach its aim of 'no-net-land take by 2050' there needs to be significant reductions in the net land take over the years and this seems, at present, uncertain and challenging. It is unclear how the main drivers of land take will change and whether reconverting artificial surfaces to land will increase sufficiently in the future while current projections indicate a likely expansion of built up areas in the coming years.

## Figure 1. Net land take in cities and commuting zones by land cover category, 2012-2018, EU-27




| Land cover category | Net land take (km2) | Net land take (km2)_Text |
|---|---|---|
| Arable land | 1414.6 | 1414.6 |
| Pastures | 945.5 | 945.5 |
| Forests | 325.9 | 325.9 |
| Permanent crops | 75.1 | 75.1 |
| Wetlands | 4 | 4 |
| Complex and mixed cultivation | 3.9 | 3.9 |
| Open spaces with little or no vegetations | 0.5 | 0.5 |
| Water | -11 | -11 |
| Herbaceous vegetation associations | -62.2 | -62.2 |

Land take entails the conversion of land to artificial surfaces, which impairs the valuable ecological functions of lands. This leads to less resilient ecosystems, decreased potential for carbon storage and biodiversity maintenance, increased surface run-off during floods and increased effects of heatwaves in cities. It also results in reduced quality of life via the diminished ecological land functions as well as via the direct loss of natural areas for relaxation, regeneration and outdoor activities.

The EU's biodiversity strategy for 2030 [1] addresses land take as one of the major threats to biodiversity, whereas the soil strategy for 2030 [2] sets the aim of 'no net land take by 2050'. The European Commission proposed a nature restoration law [3], which includes, among others: no net loss of green urban spaces by 2030, a 5% increase by 2050, a minimum of 10% tree canopy cover in every European city, town and suburb, and net gain of green space that is integrated to buildings and infrastructure.

Land take mostly (but not exclusively) occurs in cities and their commuting zones — these are also known as functional urban areas (FUAs). Over the 2012-2018 period, the majority (78%) of the net land take happened in commuting zones. The net land take in FUAs during 2012-2018 amounted to 2,696km$^2$ or 450km$^2$ annually.

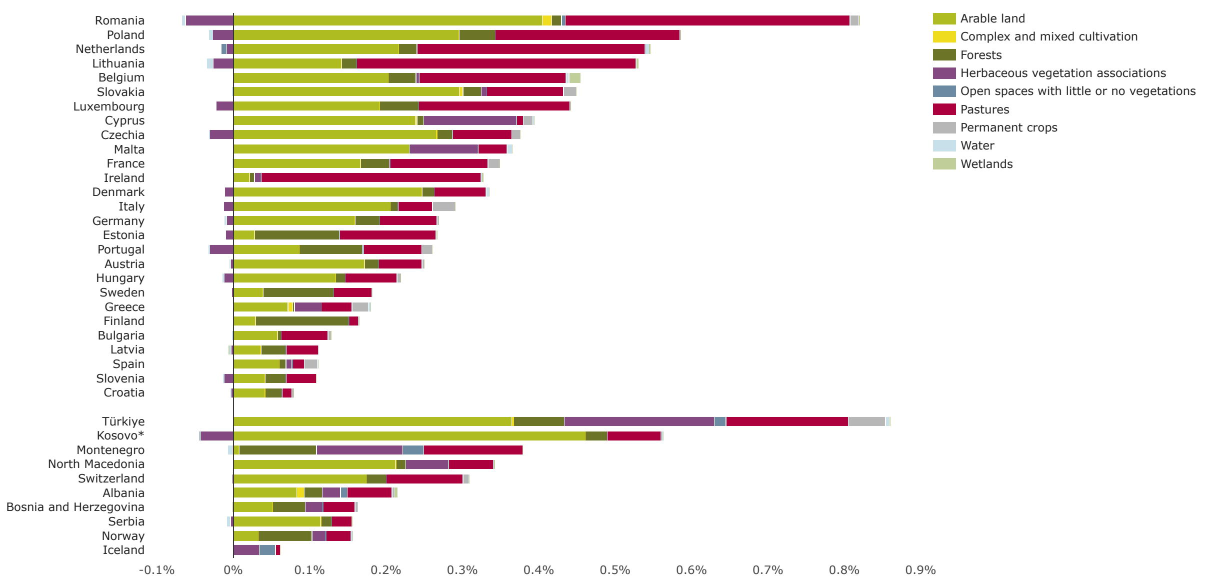
Most land take in FUAs took place in arable lands — a loss of 1,415km² or 47% of all land take. Loss in arable land can impact food security, carbon sequestration and the maintaining of biodiversity. The second largest land take took place in pastures — a loss of 945km² or 36% of all land take. Pastures are among Europe's most important biodiversity hotspots[4] and carbon sinks[5], so being under such pressure is a cause for concern. The area of forests loss (326km$^2$) was about one quarter of the area of arable lands lost. Forests present significant carbon stocks accumulated through growth of trees and an increase in soil carbon, and are important for habitat provision, flood protection and climate regulation. For the same reasons, although wetlands represent a very small area of FUA territory (2.5%) any loss — and there has been a total loss of 6km$^2$ in 2012-2018 — is cause for concern.

Assuming a linear evolution in land take, for the EU to meet its aim of reducing its net land take to zero by 2050 would require that from 2019 onwards the EU reduces its net land take by 14km$^2$ annually. This would mean that by 2030 the EU needs to reduce annual net land take to 282km$^2$.

Major drivers of land take include population growth, the need for transport infrastructure, cultural preferences and economic growth[6]. It is unclear how these drivers will evolve in the coming years and therefore it is uncertain whether the EU would be reducing its net land take by 2030 sufficiently to stay on track with meeting its 2050 no net land take goal. The recently adopted (2021) Soil Strategy for 2030 sets a series of actions and their implementation could contribute to reducing land take. However, according to a European Commission study[7]built-up areas are likely to expand by more than 3%, reaching 7% of the EU territory by 2030.

Discouraging diffuse urban expansion while promoting compact city planning and the re-naturalisation of land instead would be an important means to reduce the land take rate in the future and reach the 2050 no net land take goal[6].

## Figure 2. Net land take by land cover and country, 2012-2018, EEA-38 (in % of the total FUA surface in the country)



| Countries | Arable land | Complex and mixed cultivation | Forests | Herbaceous vegetation associations | Open spaces with little or no vegetations | Pastures | Permanent crops | Water | Wet |
|---|---|---|---|---|---|---|---|---|---|
| Romania | 0.404 | 0.013 | 0.013 | -0.062 | 0.004 | 0.373 | 0.012 | -0.005 | 0.00 |
| Poland | 0.296 | 0 | 0.047 | -0.027 | 0 | 0.242 | 0.001 | -0.006 | 0 |
| Netherlands | 0.217 | 0 | 0.023 | -0.009 | -0.007 | 0.298 | 0.001 | 0.005 | 0.00 |
| Lithuania | 0.142 | 0 | 0.02 | -0.026 | 0 | 0.365 | 0 | -0.009 | 0.00 |
| Belgium | 0.203 | 0 | 0.036 | 0.004 | 0 | 0.193 | 0 | 0.004 | 0.01 |
| Slovakia | 0.296 | 0.004 | 0.024 | 0.008 | 0 | 0.1 | 0.018 | -0.002 | 0 |
| Luxembourg | 0.191 | 0 | 0.052 | -0.022 | 0 | 0.198 | 0.001 | 0 | 0 |
| Cyprus | 0.238 | 0.003 | 0.008 | 0.121 | 0 | 0.009 | 0.013 | 0.002 | 0 |
| Czechia | 0.265 | 0.002 | 0.02 | -0.031 | 0 | 0.077 | 0.011 | -0.001 | 0 |
| Malta | 0.23 | 0 | 0 | 0.091 | 0 | 0.037 | 0 | 0.008 | 0 |
| France | 0.166 | 0 | 0.038 | 0.002 | 0 | 0.127 | 0.016 | -0.001 | 0 |
| Ireland | 0.022 | 0 | 0.006 | 0.008 | 0 | 0.288 | 0 | 0.001 | 0.00 |
| Denmark | 0.247 | 0 | 0.016 | -0.011 | 0 | 0.068 | 0 | 0.005 | 0 |
| Italy | 0.206 | 0 | 0.01 | -0.013 | 0 | 0.044 | 0.031 | 0 | 0 |
| Germany | 0.159 | 0 | 0.032 | -0.009 | 0 | 0.076 | 0.002 | -0.003 | 0 |
| Estonia | 0.028 | 0 | 0.111 | -0.01 | 0 | 0.127 | 0 | 0 | 0.00 |
| Portugal | 0.086 | 0 | 0.083 | -0.031 | 0.001 | 0.077 | 0.013 | -0.002 | 0 |
| Austria | 0.171 | 0 | 0.019 | -0.004 | 0 | 0.057 | 0.003 | -0.001 | 0 |
| Hungary | 0.134 | 0 | 0.012 | -0.012 | 0 | 0.068 | 0.005 | -0.003 | 0 |
| Sweden | 0.039 | 0 | 0.093 | -0.002 | 0 | 0.049 | 0 | 0.001 | 0 |
| Greece | 0.072 | 0.006 | 0.002 | 0.035 | 0 | 0.04 | 0.021 | 0.004 | 0 |
| Finland | 0.029 | 0 | 0.122 | 0.001 | 0 | 0.012 | 0 | 0.001 | 0 |
| Bulgaria | 0.058 | 0 | 0.005 | 0 | 0 | 0.061 | 0.003 | -0.002 | 0.00 |
| Latvia | 0.035 | 0.001 | 0.033 | -0.003 | 0 | 0.042 | 0 | -0.002 | -0.0( |
| Spain | 0.06 | 0 | 0.009 | 0.008 | 0.001 | 0.015 | 0.017 | 0.001 | 0 |
| Slovenia | 0.041 | 0 | 0.028 | -0.012 | 0 | 0.04 | 0 | -0.002 | 0 |
| Croatia | 0.041 | 0.001 | 0.022 | -0.003 | 0 | 0.012 | 0.003 | -0.001 | 0 |
| | | | | | | | | | |
| Türkiye | 0.364 | 0.003 | 0.066 | 0.197 | 0.015 | 0.16 | 0.049 | 0.005 | 0.00 |
| Kosovo* | 0.461 | 0 | 0.029 | -0.043 | -0.001 | 0.069 | 0.002 | 0.002 | 0 |
| Montenegro | 0.008 | 0 | 0.101 | 0.113 | 0.027 | 0.13 | -0.001 | -0.007 | 0 |
| North Macedonia | 0.212 | 0.001 | 0.013 | 0.056 | 0 | 0.058 | 0.001 | 0 | 0.00 |

| Countries | Arable land | Complex and mixed cultivation | Forests | Herbaceous vegetation associations | Open spaces with little or no vegetations | Pastures | Permanent crops | Water | Wet |
|---|---|---|---|---|---|---|---|---|---|
| Switzerland | 0.174 | 0 | 0.027 | -0.001 | 0 | 0.099 | 0.008 | 0.001 | 0 |
| Albania | 0.083 | 0.01 | 0.023 | 0.024 | 0.009 | 0.059 | 0.002 | 0.001 | 0.00 |
| Bosnia and Herzegovina | 0.051 | 0.001 | 0.042 | 0.022 | 0.002 | 0.041 | 0.004 | 0 | -0.0 |
| Serbia | 0.114 | 0.001 | 0.014 | -0.004 | 0 | 0.026 | 0 | -0.005 | 0.00 |
| Norway | 0.033 | 0 | 0.07 | 0.017 | 0.002 | 0.032 | 0 | 0.002 | 0 |
| Iceland | 0 | 0 | 0 | 0.034 | 0.021 | 0.007 | 0 | 0 | 0 |

None of the EU countries have re-naturalised more land than that converted to urban areas (Figure 2). There are positive signs in a few countries, however: in Czechia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal and Romania, the re-naturalisation of former urbanised areas appears.

At the national level, compared to their 2012 FUA area, net land take in the EU was highest in FUAs in Romania, Poland and the Netherlands (an increase of between 0.5% and 1%). Croatia, Latvia, Slovenia and Spain increased their urbanised areas the least (below 0.1% increase in FUAs).

EU net land take in arable lands was highest in Denmark, Austria and Italy (>65% of all land take), followed by Czechia, Germany, Hungary, Malta, and Slovakia (around 60% of all land take) (Figure 2).

In most countries, land take did not impact forests, except for Estonia, Finland and Sweden (circa 40% of land take), however this accounted for less than $50km^2$ of forest loss. In Ireland and Lithuania, more than 70% of all land take impacted pastures, although in absolute terms, the impacted areas were smaller than $50km^2$.

Land take in pastures were highest in Ireland, Lithuania, the Netherlands and Romania, where artificial surfaces increased by circa 0.5% of the FUA area. Wetland loss due to land take was very little as a percentage of the FUA territory. The highest value was observed in Belgium, with $1.6km^2$ of net wetland loss.

## Supporting information

**Definition**

The land take indicator addresses the change in the areas of agricultural, forest and other semi-natural land taken for urban and other artificial land development. Land take includes areas sealed by construction and urban infrastructure, urban green areas, and sport and leisure facilities.

The main drivers of land take are grouped as processes resulting in the extension of:

• housing, services and recreation;

• industrial and commercial sites;

• transport networks and infrastructure;

• mines, quarries and waste dump sites;

• construction sites.

**Note:** the land take changes relate to the extension of urban areas and may also include parcels that were not sealed (e.g. urban green areas, and sport and leisure facilities). This is, in particular, the case for discontinuous urban fabric, which is considered as a whole. Similarly, monitoring the indicator with satellite images leads to the exclusion of some linear transport infrastructure, which are too narrow to be observed directly.

**Methodology**

## Methodology for indicator calculation

The indicator is currently calculated from the Urban Atlas dataset of the Copernicus Land Monitoring Service for the years 2012 and 2018. Changes from agriculture, forest and semi-natural/natural land, wetlands or water to urban areas are grouped and expressed in $km^2$ of converted area.

Net land take is calculated taking into account the 'reverse land take process', i.e. when urban areas are converted to semi-natural land. This can happen as, for example, land cover changes from a mineral extraction site to forest. Net land take is hence the result of land take minus reverse land take, expressed in $km^2$ area.

## Methodology for gap filling

Not applicable.

**Policy/environmental relevance**

## Justification for indicator selection

Land is a finite resource and the way it is used is one of the principal drivers of environmental change and has a significant impact on quality of life and ecosystems. In Europe, the proportion of total land use occupied by production (agriculture, forestry, etc.) is one of the highest on the planet and conflicting land use demands require decisions to be made that involve hard trade-offs. Land use in Europe is driven by a number of factors, such as the increasing demand for living space per person, and the link between economic activity, increased mobility and the growth of transport infrastructure, which usually result in land take. Urbanisation rates vary substantially, with coastal and mountain areas being among the most affected regions in Europe as a result of the increasing demand for recreation and leisure.

Land take occurs mostly in peri-urban areas, where the demand for new infrastructure is high and soil quality, for historical reasons of human settlement, is good. The increase in the area of artificial surfaces often impairs or disrupts valuable ecological functions of soils, such as biomass provision, soil biodiversity and soil carbon pool, or water infiltration potential causing flooding. This has negative impacts on climate change, as it decreases the potential for carbon storage and sequestration, and increases surface run-off during flood [8][9]. Land occupied by artificial surfaces and dense infrastructure connects human settlements and fragments landscapes. It is also a significant source of water, soil and air pollution. In addition, lower population densities — a result of urban sprawl — require more energy for transport and heating or cooling. The consequences of urban lifestyles, such as air pollution, noise, greenhouse gas emissions and impacts on ecosystem services, are felt within urban areas and in regions far beyond them.

**Policy context and targets**

## Context description

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It contributes mainly to monitoring aspects of the 8th EAP Article 2.1. that requires that 'by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced. A healthy environment underpins the well-being of all people and is an environment in which biodiversity is conserved, ecosystems thrive, and nature is protected and restored, leading to increased resilience to climate change, weather- and climate-related disasters and other environmental risks. The Union sets the pace for ensuring the prosperity of present and future generations globally, guided by intergenerational responsibility'[10]. The European Commission 8th EAP monitoring Communication specifies that this indicator should monitor whether the EU is on track to meet the 'no land take by 2050' target[11].

In May 2020, the European Commission adopted a biodiversity strategy to 2030, related to protecting and restoring nature. The strategy states that the 'biodiversity crisis and the climate crisis are intrinsically linked. Climate change accelerates the destruction of the natural world through droughts, flooding and wildfires, while the loss and unsustainable use of nature are in turn key drivers of climate change'. Therefore, both the EU biodiversity strategy and the soil strategy for 2030 include the no net land take target by 2050. The soil strategy also addresses land recycling and promotes the circular use of land over greenfield development to limit the acute pressure from soil sealing and land take. The soil strategy further suggests that member states include 'land take hierarchy' in their urban greening plans to 'give priority to reusing and recycling land and to quality urban soils at national, regional and local level, through appropriate regulatory initiatives and by phasing out financial incentives that would go against this hierarchy, such as local fiscal benefits for converting agricultural or natural land into built environment.' In June 2022, the European Commission adopted the proposal for a nature restoration law that aims to put all natural and seminatural ecosystems on the path to recovery by 2030. The proposed law includes specific targets on green urban spaces and peatlands.

'No net land take' is also addressed in the land degradation neutrality (LDN) target of the United Nations Convention to Combat Desertification (UNCCD), which aims to maintain the amount and quality of land resources. LDN is promoted by target 15.3 of the UN Sustainable Development Goals (SDGs), which, by 2030, strives to combat desertification and to restore degraded land and soil. Land and soil are also linked to goals that address poverty reduction (SDG 1), health and well-being through reduced pollution (SDG 3), access to clean water and sanitation (SDG 6), the environmental impact of urban sprawl (SDG 11) and climate change (SDG 13). The EU biodiversity strategy to 2020 [1] calls for the restoration of at least 15% of degraded ecosystems in the EU and the expansion of the use of green infrastructure, e.g. to help overcome land fragmentation.

Policy decisions that shape land use need to consider trade-offs among many sectoral interests, including industry, transport, energy, mining, agriculture and forestry. These trade-offs are eventually implemented through spatial planning and land management in the Member States. Although the subsidiarity principle assigns land and urban planning responsibilities to the national and regional government levels, most EU policies have a direct or indirect effect on urban development. In particular, the effective implementation of the Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) Directives[12][13] has shown that they can improve the consideration of environmental aspects in planning projects, plans and programmes, contribute to more systematic and transparent planning, and improve participation and consultation. The far-reaching consequences of EU and other policies for spatial impacts are, however, only partially perceived and understood. Tackling these challenges needs the completion of a comprehensive knowledge base and better awareness of the complexity of the problems. Initiatives aimed at achieving such an integrated approach, as requested in the Community strategic guidelines on cohesion 2007-2013[14] imply compliance with the precautionary principle, the efficient use of natural resources and the minimisation of waste and pollution, and must be vigorously pursued and, in particular, implemented.

### Targets

While many EU and national policies address land and soil to some extent, legally binding targets, incentives and measures are largely missing at the EU level. Nevertheless, the 8th Environmental Action Program and the soil and biodiversity strategies to 2030 all address and aim at no-net land take by 2030.

The European Commission adopted the proposal for a nature restoration law and intends to adopt the proposal for a soil health law in 2023, including related targets on healthy soil.

**Accuracy and uncertainties**

### Methodology uncertainty

The methodology is straightforward as it is based on calculating observed area changes as long as the definition of land take is followed.

### Data set uncertainty

Even though the Urban Atlas dataset represents every 10m$^2$ grid cell in Functional Urban Areas, very large-scale sealed surfaces or land use processes converting semi-natural land to artificial surfaces will be underestimated. These processes are not captured by the dataset and hence the absolute land take value could be higher. There is however no indication on an EU level as to the degree of this underestimation.

### Rationale uncertainty

Newly urbanised areas (land uptake) may also comprise non-artificial surfaces (private gardens or public green areas). Thus, they may vary in environmental condition and provision of habitats or ecosystem services.

**Data sources and providers**

- Copernicus Land Monitoring Service - Urban Atlas, European Environment Agency (EEA)

## Metadata

**DPSIR**

Pressure

**Topics**

**# Land use**

**Tags**

# Communting zones # 8th EAP # LSI001 # Artifical surfaces # Fnctional urban areas

**Temporal coverage**

2012-2018

**Geographic coverage**

Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG15: Life on land

**Unit of measure**

km² and percentage

**Frequency of dissemination**

Once a year

## References and footnotes


1. EC, 2020, Communication from the commission to the European parliament, the Council, the European economic and social committee and the committee of the regions. EU Biodiversity Strategy for 2030 - Bringing nature back into our lives
a b
2. EC, 2021, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions 'EU Soil Strategy for 2030 - Reaping the benefits of healthy soils for people, food, nature and climate', COM(2021)699.
↵
3. Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on nature restoration, 2022,
↵
4. SOER, 2020, 'The European environment — state and outlook 2020 — European Environment Agency', ( https://www.eea.europa.eu/soer/publications/soer-2020) accessed September 16, 2022.
↵
5. IPBES, 2018, *The IPBES assessment report on land degradation and restoration*, Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn.

↵

6. European Environment Agency, 2021, 'Land take and land degradation in functional urban areas', ( https://www.eea.europa.eu/publications/land-take-and-land-degradation) accessed November 14, 2022.
a b

7. EU, 2019, 'Main land-use patterns in the EU within 2015-2030', ( https://joint-research-centre.ec.europa.eu/publications/main-land-use-patterns-eu-within-2015-2030_en) accessed January 5, 2023.
↵

8. IPCC, 2014, *Climate change 2014: Impacts, adaptation and vulnerability — Part B: Regional aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Barros, V.R., Field, C. B., Dokken, D. J., et al. (eds)., Cambridge University Press, Cambridge.
↵

9. IPCC, 2011, *Renewable energy sources and climate change mitigation: Summary for policymakers and technical summary*, Special Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK.
↵

10. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030
↵

11. EC, 2022, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives
↵

12. EU, 2001, Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197, 21.7.2001, p. 30-37.
↵

13. EU, 2003, Directive 2003/35/EC of the European Parliament and of the Council providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC
↵

14. EC, 2005, Communication from the Commission: Cohesion policy in support of growth and jobs — Community strategic guidelines, 2007-2013, COM(2005) 0299.
↵

European Environment Agency

# 8th Environment Action Programme

## Water scarcity conditions in Europe (Water exploitation index plus)

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

# Water scarcity conditions in Europe

Published 17 Jan 2025

Analysis and data > Indicators > Water scarcity conditions in Europe

Water scarcity affected 34% of the European Union territory during at least one season in 2022. Despite water abstraction declining by 19% in the EU between 2000 and 2022, there has been no overall reduction in the area affected by water scarcity conditions. In fact, the situation has intensified since 2010. This, compounded with the fact that climate change is expected to further increase the frequency, intensity and impacts of drought events, makes it somewhat unlikely that water scarcity will reduce by 2030. Additional effort is required to ensure sustainable water use.

## Figure 1. Area and population affected during at least one quarter of the year by water scarcity conditions in the EU, measured by the water exploitation index plus

Freshwater resources are essential for human health, nature and the functioning of economies and societies. However, across the EU, these **resources are threatened** by multiple pressures. To address this, the Water framework directive requires Member States to promote the sustainable use and the long-term protection of available water resources [1].

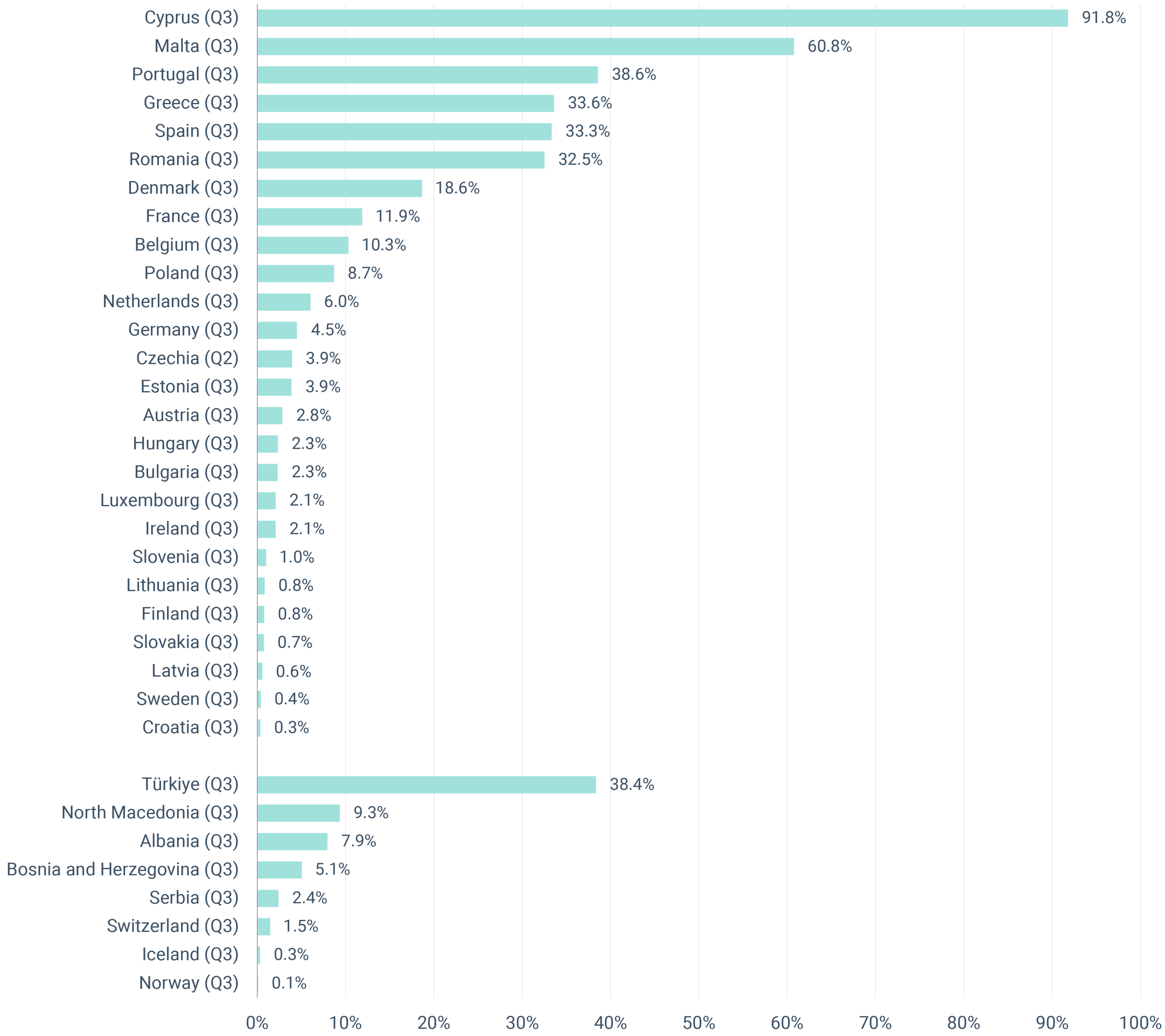
The Water exploitation index plus (WEI+) measures **water consumption** as a percentage of renewable freshwater resources at river basin or subunit levels, across each quarter of the year. This detailed approach reveals local water scarcity conditions that broader annual WEI estimates at European or country levels may not reveal. WEI+ values above 20% indicate that water resources are under stress and therefore water scarcity conditions prevail, while values above 40% signal water stress is severe, and the level of freshwater use may be unsustainable[2][3].

Figure 1 shows the percentage of EU territory and population affected in at least one of the four quarters of the year by water scarcity conditions (Seasonal WEI+ above 20%). On average, about 30% of the EU territory and 34% of the population are **affected** each year. In 2022, water scarcity conditions affected 34% of the population and 40% of the EU land area.

Water scarcity is prevalent in southern Europe, with around 30% of the population in areas with permanent water stress and up to 70% in areas with seasonal summer stress. Agriculture, public water supply, and tourism place significant pressure on freshwater resources in this region. However, water **scarcity** extends beyond southern Europe, affecting various river basins across the EU, where urban population density and water abstraction for public supply, energy, and industry are significant factors. Over the last decade, droughts have also increased in frequency and severity, impacting seasonal water availability.

**Climate change** is expected to intensify seasonal fluctuations of freshwater availability in Europe. Drought events are also likely to further increase in frequency, intensity, and impact[4]. Given these factors and a worsening trend since 2010, a reduction in water scarcity by 2030 appears unlikely (Figure 1).

## Figure 2. Worst seasonal water scarcity conditions for European countries in 2022, measured by the water exploitation index plus (WEI+)




Cyprus and Malta faced the most significant water scarcity conditions of the EU Member States on the seasonal scale (seasonal WEI+ >40%). Greece, Portugal, Spain and Romania experienced water scarcity particularly during spring and summer. Malta is experiencing the permanent water scarcity conditions partly due to its natural hydro-climatic conditions. Among the EEA member countries, Türkiye is the most severely challenged (Figure 2).

In general, water scarcity conditions intensify between April and September in most countries. This is caused by a combination of dry weather, reduced flows and increased abstractions for irrigated agriculture, tourism and recreation, and other socio-economic activities during these periods.

Certain river sub-basins were affected by seasonal water scarcity in 2022. Belgium, Bulgaria, Cyprus, Denmark, France, Germany, Greece, Hungary, Lithuania, Malta, Netherland, Portugal, Romania, Spain and Slovakia (seasonal WEI+ >20%; see detailed information on seasonal WEI+ at Subunit scale) were all effected.

## Supporting information

**Definition**

The WEI+ provides a measure of total water consumption as a percentage of the renewable freshwater resources available for a given territory and period. The difference between water abstractions and the water returned to the environment by economic sectors before or after use is referred to as 'water consumption'.

The WEI+ is an advanced geo-referenced version of the WEI, endorsed by the Water Directors in 2012 as part of the overall indicator set for water scarcity and drought.

**Methodology**

In 2011, a technical working group established under the Water Framework Directive's Common Implementation Strategy proposed the implementation of a regional 'WEI+'. This would use two different optional formulas based on the landscape conditions of river basins, i.e., no human intervention or human intervention with hydrological cycle [5].

EEA implement the formula for renewable freshwater resources in river basins with human intervention, considering that the landscape characteristics of most river basins in Europe are not pristine. Using one formula of RWR aims also to make the WEI results comparable across all European river basins (see the EEA's updated conceptual model of WEI+ computation).

The regional WEI+ is calculated according to the following formula:

WEI+=(abstractions-returns)/renewable freshwater resources.

Renewable freshwater resources are calculated as 'ExIn+P-Eta±ΔS' for natural and semi-natural areas (free of human intervention), and as 'OUTFL+(abstraction-return)±ΔS' for densely populated areas, where:

ExIn=external inflow

P=precipitation

Eta=actual evapotranspiration

ΔS=change in water storage (lakes and reservoirs)

OUTFL=outflow to downstream/sea.

Change water storage in lakes and reservoirs is computed as ΔS =(P+INFL)-(Eta+OUTFL),

where:

INFL=Inflow in lakes and reservoir from upstream area

For further clarification on the methodological implementation together with the data sources, see the WAT001_Conceptual model of WEI+ computation.pdf

The WEI+ results are classified into 10% intervals for mapping purposes, ranking between 0 and 40, with a 20% WEI threshold is used to estimate the area and population affected by water scarcity at subunit scale for the EU-27. It is important to note that there is no formally agreed-upon threshold for identifying areas experiencing water scarcity in the EU.

Following the computation and classification of the WEI values, bar and pie charts are produced, together with static and dynamic maps to illustrate the extension of the WEI values over Europe.

Climate data and streamflow data have been integrated from Waterbase — Water Quantity database, Eurostat database (env_wat_res and env_watres_rbd) with the gap filling from the Joint Research Centre (JRC) Lisflood model[6]. The JRC Lisflood data cover hydro-climatic variables for Europe in a homogeneous way for the years 2000-2022 on a monthly scale.

Once the data series are complete, changes in water storage (ΔS) and outflow are computed for each spatial scale, including WFD subunit, river basin district, country level for Eionet Member countries, and EU-27 level.

The spatial reference data is RBD and SubUnit reported under the WISE Spatial data flow. The European Catchments and Rivers Network System (Ecrins) at a 250-meter resolution is used for processing the indicator variables to fill the gaps where the data is not available. Ecrins provides topological hydrology information and hierarchical relationships between catchments, river basins, and sub-basins, which has been adapted to align with river basin districts and subunits reported by EU Member States under the WISE Spatial data flow.

The primary data source for observed variables of the WEI formula is WISE SoE Water Quantity, which are reported annually by Eionet member countries at various spatial and temporal scales. Additionally, Eurostat data on annual water resources and abstraction is included in the indicator's computation.

If data is missing at the subunit scale but available at the country level, annual country-level data is disaggregated to the catchment scale of Ecrins to ensure a homogeneous monthly baseline, while reported data on monthly resolution from the subunit or river basin scale is included directly in the computation of the WEI+.

### Methodology for gap filling

The purpose of developing the WAT001 indicator is to provide a European overview of seasonal water scarcity in river basins. However, gaps in the database significantly hinder this objective, as WISE SoE and Eurostat datasets show large gaps in both temporal and spatial coverage across Europe. To address these gaps, both water abstraction and renewable water resources components are supplemented with gap-filling methods.

If the reported data is not available for renewable water resources, Copernicus data (Lisflood-JRC) is used to compute total outflow at the subunit, river basin, or country level, and to estimate changes in water storage of lakes and reservoirs.

Machine learning has recently been used to fill gaps in water abstraction data for agriculture. For industry, cooling water, and public water supply, gap filling follows the statistical method outlined in the Eurostat EDAMIS report.

In terms of water returns from the economy, if available, data from the Water Use table of the WISE SoE is integrated in the computation. However, this data is largely missing. To address these gaps, surrogate data is used, which includes sources of water supply, transfer and irrigation methods for agriculture, urban water use, and wastewater discharges from households and services. Additionally, data on fuel types, return coefficients, and the energy mix for cooling water in electricity generation are considered, along with water abstraction for other sectors. Due to data limitations, return coefficients are estimated nationally and applied uniformly across river basins and subunits within the countries.

The details of the gap filling methods per indicator variable can be seen in WAT001_Conceptual model of WEI+ computation_10 10 2024.pdf

## Uncertainties

### Methodology uncertainty

Monitoring data on lakes and reservoirs are incomplete. Using the modelled data may mask the actual volume of water stored in, and water flow in and out from reservoirs. Thus, the impact of the residence time, between water storage and use is unknown.

Water returns are largely based on return coefficients, which are estimated using various surrogate data. Furthermore, the return coefficients could not be estimated at finer spatial scales than the country. This creates uncertainty in the quantification and distribution of water returns from economic sectors, thus also leading to uncertainty with regard to the ‘water consumption component.

### Data set uncertainty

Quantifying water exchanges between the environment and the economy is, conceptually, very complex. A complete quantification of the water flows from the environment to the economy and, at a later stage, back to the environment, requires detailed data collection and processing, which have not been done at the European level. Thus, reported data must be used in combination with modelling to obtain data that can be used to quantify such water exchanges, with the purpose of developing a good approximation of ‘ground truth’. However, the most challenging issue is related to water abstraction and water use data, as the water flow within the economy is quite difficult to monitor and assess given the current lack of data availability. Therefore, several interpolation, aggregation or disaggregation procedures have to be implemented at finer scales, with both reported and modelled data.

Due to inconsistencies in the data for OUTFL and ΔS, the change in water storage variable could not be included in the WEI+ computation for some subunits and RBDs e.g. Romania. Subunits and River Basin Districts (RBDs) where ΔS is excluded are marked as 'changeInWaterStorageNOTINCLUDED' in the final dataset.

There is a significant break in the time series of water abstraction data for Kosovo, which causes spikes in the Water Exploitation Index (WEI) values for this country.

Spatial data for subunits and river basins are not available for Türkiye and the Western Balkan countries. Therefore, the WEI+ could only be computed at the country level for these Eionet countries.

Countries may report historical data during the current reporting period to WISE SoE or Eurostat. In such cases, previously gap-filled data are replaced with the reported data, which may change the country-specific or European-level overview. As a result, some differences may appear in parts of the indicator assessment.

### Rationale uncertainty

Due to the aggregation procedure used, slight differences exist in some cases between subunit, river basin district, and country levels for total renewable water resources and water use.

#### Policy/environmental relevance

### Justification for indicator selection

The WEI+ is a water scarcity indicator that measures the pressure human activities exert on renewable water resources, helping to identify areas prone to water stress. WEI+ values for countries and annual scales align with the UN SDG indicator 6.4.2 (‘Level of water stress’), which tracks progress toward target 6.4 on water scarcity and resource efficiency (note that ecological flows are not yet included). Assessing the WEI+ at finer spatial (e.g., river basin and subunit) and temporal (e.g., seasonal) scales enhances the monitoring of water scarcity issues, as country-level annual averages may obscure significant regional differences.  Calculating the proportional area affected by water scarcity, either seasonally or annually, using the WEI+ gives a better European overview than computing the WEI+ at the continental level.

## Policy context and targets

### Context description

The WEI is part of the set of water indicators published by several international organisations, such as the Food and Agricultural Organization of the United Nations (FAO), the Organisation for Economic Co-operation and Development (OECD), Eurostat and the Mediterranean Blue Plan. An indicator similar to WEI is also used to measure progress towards UN SDG target 6.4.2 at the global level[7]. Therefore, the WEI is an internationally accepted indicator for assessing the pressure of the economy on water resources, i.e. water scarcity.

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP)[8]. It contributes mainly to monitoring aspects of the 8th EAP Article 2.1. that requires that 'by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced. A healthy environment underpins the well-being of all people and is an environment in which biodiversity is conserved, ecosystems thrive, and nature is protected and restored, leading to increased resilience to climate change, weather- and climate-related disasters and other environmental risks. The Union sets the pace for ensuring the prosperity of present and future generations globally, guided by intergenerational responsibility'. The European Commission 8th EAP monitoring communication specifies that this indicator should monitor whether there is a reduction in water scarcity.

The purpose of the EU Water Framework Directive (2000/60/EC)[9] is — inter alia — to promote sustainable water use based on the long-term protection of available water resources. Ensuring a balance between water abstraction and recharge of groundwater, supports the aim of achieving good groundwater quantitative status. Good groundwater quantitative status also ensures that associated surface waters and dependent terrestrial ecosystems are not significantly harmed, and changes in groundwater flow do not cause salination or other types of intrusion.

The EU's new circular economy action plan explicitly addresses water stress and contains provisions for improving resource efficiency in the context of water resource management.

The new Water Reuse Regulation[10], aims at enhancing the use of reclaimed water in agriculture by setting out minimum requirements for water reuse. The replacement of freshwater abstractions with reclaimed water may decrease the pressure to surface water and groundwater.

The Common Agricultural Policy (CAP) promotes sustainable farming that ensures affordable, safe, and high-quality food, while protecting natural resources, enhancing biodiversity, and supporting rural communities. It also supports investments in water conservation, irrigation upgrades, and farmer training.

The European Green Deal aims to decouple economic growth from resource use by promoting a clean, circular economy with reduced environmental impact, while the Farm to Fork Strategy, as part of the Green Deal, targets sustainable food systems, where clean and sufficient water is an essential natural resource.

The new Climate Adaptation Strategy focuses on faster and more systemic climate adaptation and international cooperation for climate resilience. One of its main objectives is to support the reduction of water use and by promoting the wider use of drought management plans as well as sustainable soil management and land-use.

The recast Drinking Water Directive requires the assessment of the current level of leakages in water infrastructure and the implementation of measures for their reduction. The requirement covers at least water suppliers supplying more than 10 000 $m^3$ per day or serving more than 50 000 people.

The EU Biodiversity Strategy for 2030 aims at restoring freshwater ecosystems ("at least 25,000 km of free-flowing rivers"). In this regard, the EU Biodiversity Strategy emphasises the WFD requirement to review water abstraction and impoundment permits to implement ecological flows and achieve good status or potential of all surface waters and good status of all groundwater by 2027 at the latest.

## Targets

There are no specific quantitative targets directly related to this indicator. However, the Water Framework Directive (Directive 2000/60/EC)[9] requires Member States to promote the sustainable use of water resources based on the long-term protection of available water resources, and to ensure a balance between abstraction and the recharge of groundwater, with the aim of achieving good groundwater status and good ecological status or potential for surface waters.

Regarding WEI+ thresholds, it is important that agreement is reached on how to delineate non-stressed and stressed areas. Raskin et al[2] suggested that a WEI value of more than 20% should be used to indicate water scarcity, whereas a value of more than 40% would indicate severe water scarcity. These thresholds are commonly used in scientific studies[11]. Smakhtin et al.[12] suggested that a 60% reduction in annual total run-off would cause environmental water stress. The FAO uses a water abstraction value of above 25% to indicate water stress and of above 75% to indicate serious water scarcity[13]. Since no formally agreed thresholds are available for assessing water stress conditions across Europe, in the current assessment, the 20% WEI+ threshold is considered to distinguish stressed from non-stressed areas, while a value of 40% is used as the highest threshold for mapping purposes. The previous thresholds were proposed by Raskin at al.[2]originally for the WEI which takes water abstraction into account while the WEI+ is involving the net water consumption.

**Accuracy and uncertainties**

**Data sources and providers**

- Waterbase - Water Quantity, 2023, European Environment Agency (EEA)
- Annual freshwater abstraction by source and sector, Statistical Office of the European Union (EUROSTAT)
- Population on 1 January [tps00001], Statistical Office of the European Union (EUROSTAT)
- Lisflood, Joint Research Center (JRC)

## Metadata

**DPSIR**

Pressure

**Topics**

# Water # Climate change adaptation # Extreme weather

**Tags**

# Surface water # 8th EAP # Water abstraction # Groundwater # WAT001

**Temporal coverage**

2000-2022

**Geographic coverage**

Albania

Austria

Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG6: Clean water and sanitation

**Unit of measure**

WEI+ values are given as percentages, i.e. water use as a percentage of renewable water resources.

**Frequency of dissemination**

Once a year

## References and footnotes

1. EU, 2000, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p. 1-73. ↵
2. Raskin, P., Gleick, P. H., Kirshen, P., Pontius, R. and Strzepek, K., 1997, *Comprehensive assessment of the freshwater resources of the world — Water futures: assessment of long-range patterns and problems*, Document prepared for the fifth session of the United Nations Commission on Sustainable Development, 1997, Stockholm Environmental Institute, Stockholm. a b c
3. As there are no agreed threshold values available for the EU assessment of WEI+, we indicatively keep the same threshold values as WEI, until any new thresholds are proposed.

4. Climate change impacts and adaptation in Europe - Publications Office of the EU, ( https://op.europa.eu/en/publication-detail/-/publication/c707e646-99b7-11ea-aac4-01aa75ed71a1/language-en) accessed December 9, 2022.

5. Feargemann, H., 2012, 'Update on water scarcity and droughts indicator development', ( https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/c676bfc6-e1c3-41df-8d31-38ad6341cbf9/details) accessed December 15, 2020.

6. Burek, P., Knijff van der, J., Roo de, A., European Commission, Joint Research Centre and Institute for the Protection and the Security of the Citizen, 2013, *Lisflood — Distributed water balance and flood simulation model: revised user manual 2013*, Publications Office of the European Union, Luxembourg.

7. UN, 2021, 'Indicator 6.4.2 'Level of water stress: freshwater withdrawal as a proportion of available freshwater resources", ( https://www.sdg6monitoring.org/indicator-642/) accessed May 27, 2021.

8. EC, 2022, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the monitoring framework for the 8th Environment Action Programme: Measuring progress towards the attainment of the Programme's 2030 and 2050 priority objectives - COM/2022/357 final

9. EU, 2000, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy, OJ L 327, 22.12.2000, p. 1-73.

10. EU, 2020, Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse, OJ L 177, 5.6.2020, p. 32-55.

11. Alcamo, J., Henrichs, T. and Rösch, T., 2000, *World water in 2025 — Global modelling and scenario analysis for the World Commission on Water for the 21st century*, Report, 2, Centre for Environmental Systems Research, University of Kassel, Germany.

12. Smakhtin, V., Revenga, C. and Döll, P., 2004, *Taking into account environmental water requirement in global scale water resources assessment*, Research Report, 2, Comprehensive Assessment of Water Management in Agriculture, Colombo.

13. FAO, 2017, 'Step-by-step monitoring methodology for indicator 6.4.2 level of water stress: freshwater withdrawal in percentage of available freshwater resources', ( http://www.fao.org/elearning/course/SDG642/en/story_content/external_files/Step-by-step%20Methodology%20for%20indicator%206%204%202%20V20170719.pdf) accessed May 27, 2021.

European Environment Agency

# 8th Environment Action Programme

## Consumption footprint (based on life cycle assessment)

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

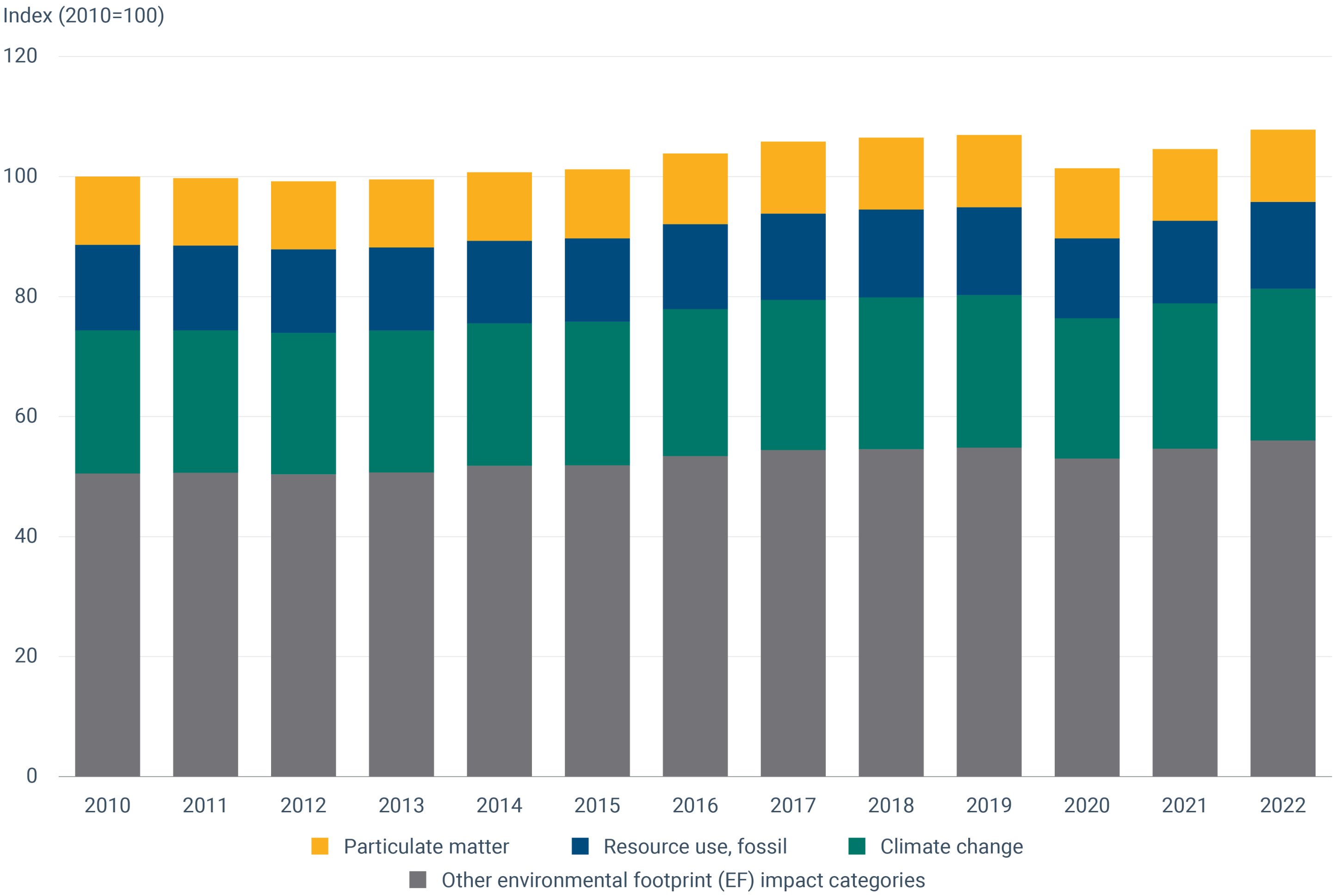
# Consumption footprint (based on life cycle assessment) in Europe

Published 16 Dec 2024



The European Union's 8th Environment Action Programme aims to significantly reduce its consumption footprint by 2030, and keep related environmental impacts within planetary boundaries. These impacts stem from consumption patterns and, depending on production locations, not confined to EU borders. During 2010-2022, the EU consumption footprint increased by around 8% and projections indicate a further increase by 2030, caused by economic growth and consumption patterns. The EU is not presently on track to reduce its consumption footprint sufficiently. Switching to less harmful products and curbing consumption levels are strongly recommended to reach the target.

## Figure 1. EU consumption footprint, in a single indexed score (2010=100), broken down into the most significant contributing impact categories of the Environmental Footprint (EF) method, from 2010 to 2022



The Eighth Environment Action Programme (8th EAP) calls for a rapid, significant reduction in the EU's consumption footprint to align with planetary boundaries. To achieve this, the EU must accelerate its transition to adopting a regenerative growth model, to give back to the planet more than it takes, as outlined in the Circular economy action plan.

The Consumption footprint estimates the environmental and climate impacts occurring as a result of EU citizens' consumption of products and their use. The EU consumption footprint indicator methodolgy[1] is based on life cycle assessment (LCA). It uses the European Commission's environmental footprint method to assess environmental impacts in 16 different categories, such as climate change, resource depletion, and particulate matter. LCA data for a set of representative products are used to calculate environmental impacts per product, irrespective of production location, and scaled up to represent impacts from entire EU consumption, based on consumption statistics. The indicator can be aggregated to give a single score, based on a normalisation and weighting system (represented in Figure 1).

The EU's consumption footprint per capita for the average EU citizen increased, by around 8% in the period 2010-2022 (Figure 1). Gross domestic product (GDP) per capita increased by almost 19% over the same period. This indicates that the impacts of the EU's consumption are growing at a slower pace than its economy, suggesting a relative decoupling of the consumption footprint from economic growth.

However, on a per capita basis, the consumption footprint and GDP still appear to be somewhat correlated (e.g. both declined in 2020 during the economic slowdown from pandemic-related measures). This means that reducing the impacts of EU consumption in absolute terms in a growing economy will be challenging.

In 2022, food consumption contributed the most (49%) to the total environmental impact in the EU, followed by housing (17%) and mobility (16%). The largest contributions to the consumption footprint are those related to climate change (23%), the use of fossil resources (13%) and particulate matter release (11%).

The environmental impact of EU citizens' consumption is considered high overall. Evidence increasingly suggests that, based on current consumption footprint levels, the EU exceeded its fair share of planetary boundaries for five environmental impact categories in 2022, including particulate matter, climate change and freshwater ecotoxicity[2].

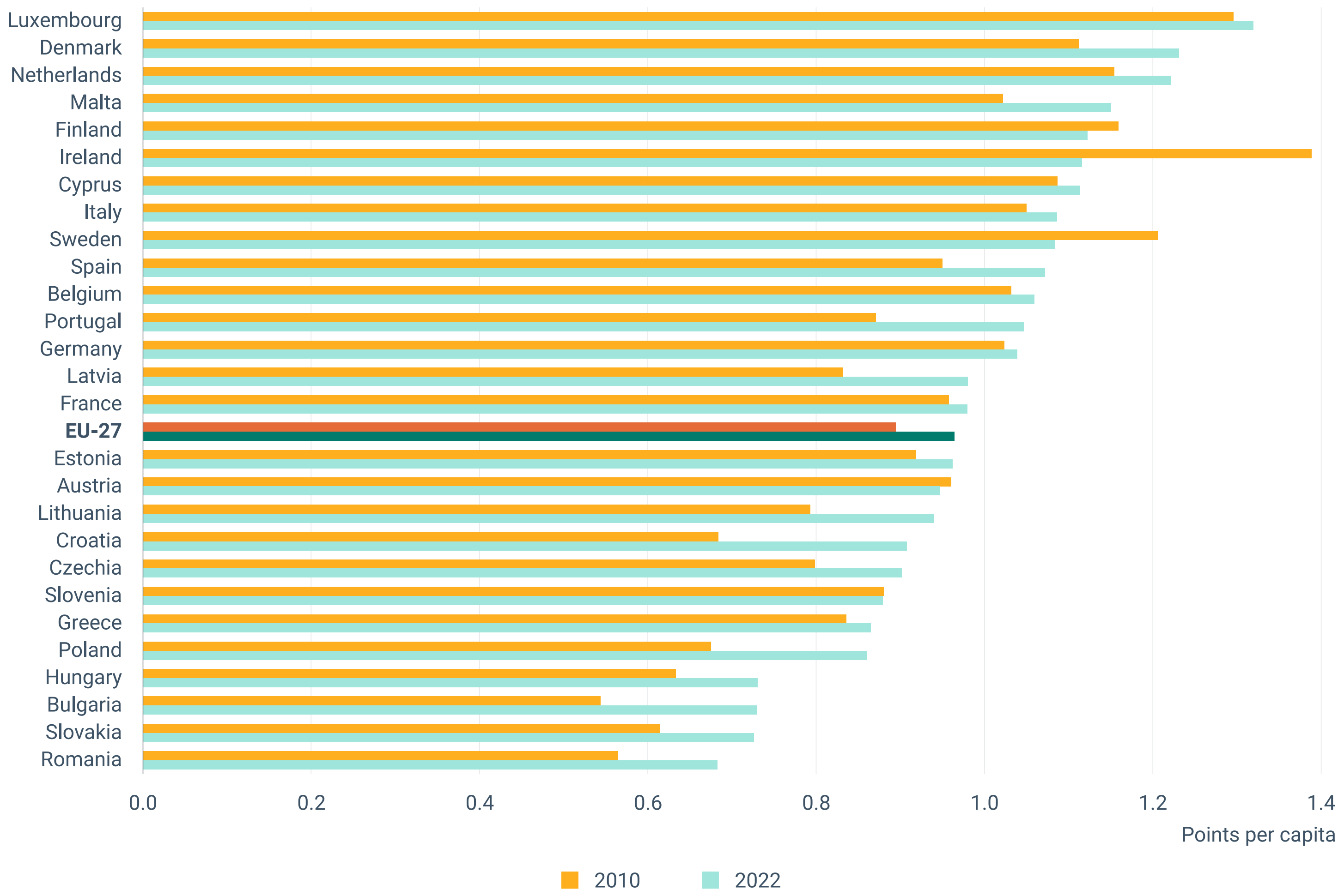
Based on current patterns and expected economic growth, the EU's consumption footprint is projected to increase again by 2030[3]. Recent trends show the consumption footprint increased by 6.3% between 2020 and 2022. Therefore, the EU is not on track to meet its aim of significantly reducing this footprint by 2030.

The EU may reduce its consumption footprint by:

- reducing the overall amount of goods and services consumed;
- shifting to the consumption of goods with a lower environmental impact, or;
- a combination of the above.

It is worth noting that service consumption has less of an impact on the environment than the consumption of goods. Adopting circular business models based on sharing or product-as-a-service schemes for example, would be beneficial.

## Figure 2. Level of consumption footprint (points per capita) for EU countries in 2022 compared to 2010




In 2022, Luxembourg had the highest consumption footprint among the 27 EU Member States, while Romania had the lowest, at just over half of Luxembourg's. Twelve countries had a footprint lower than the EU average. Between 2010 and 2022, 23 Member States showed increases in their consumption footprints, while only four showed decreases.

Ireland showed the highest decrease of 20%, followed by Sweden with 10%. However, most countries increased their footprint with Bulgaria, Croatia, Poland, Romania and Portugal registering increases higher than 20%. Interpreting these changes in national footprints is challenging. They depend on individual national economic structures and consumption patterns, as well as economic downturns over the 2010-2022 for some Member States. The changes may not be obvious to any concrete measures pursued by the countries to improve, optimise or decrease environmentally-related consumption patterns.

## Supporting information

### Definition

The EU consumption footprint indicator represents a summary of the environmental and climate impacts associated with the EU's consumption of goods and services, regardless of where in the world these goods and services are produced. The indicator is based on consumption statistics and process-based life cycle assessment (LCA) structured in a basket of representative product of main areas of consumption. The assessment includes the 16 impact categories of the European Commission's environmental footprint method [4], which are aggregated into a single weighted score.

**Methodology**

Different methodological approaches can be taken to calculating consumption footprints. The two most widely used are the 'top-down' and the 'bottom-up' approaches. The former derives environmental impacts of EU consumption from the observed environmental impacts of economic production, using macro-economic (input-output) modelling. The latter is based on combining macro-scale consumption statistics and LCA data to construct the consumption footprint by focusing on a basket of representative products for a number of consumption areas.

The footprint presented in this indicator is based on the latter methodological approach, as this has been developed by the European Commission's Joint Research Centre. The methodology documents available through the Consumption Footprint Platform explain the precise method and calculations used to derive this consumption footprint [5].

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting targets of the 8th EAP. It contributes mainly to monitoring progress in relation to aspects of 8th EAP Article 3(s), which requires the following: 'significantly decreasing the Union's material and consumption footprints to bring them into planetary boundaries as soon as possible, including through the introduction of Union 2030 reduction targets, as appropriate' [6]. The European Commission Communication on the 8th EAP monitoring framework specifies that this indicator should be used to monitor the EU's progress towards achieving the target to 'significantly decrease the EU's consumption footprint, i.e. the environmental impact of consumption' [7].

**Accuracy and uncertainties**

**Data sources and providers**

- EU consumption footprint weighted score, Joint Research Center (JRC)

## Metadata

**DPSIR**

Impact

**Topics**

# Sustainability solutions

**Tags**

# WST010 # 8th EAP # service consumption # Sustainability # consumption footprint
# EU consumtion

**Temporal coverage**

2010-2022

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Performance indicator (Type B - Does it matter?)

**UN SDGs**

SDG12: Responsible consumption and production

**Unit of measure**

Figure 1: The EU consumption footprint is shown as a single indexed score (2010=100) and is broken down according to the impact categories of the environmental footprint (EF) method that make the most significant contribution to the consumption footprint — 'climate change', 'resource use, fossil' and 'particulate matter' — and other EF impact categories

Figure 2: Points per capita

Extra figure: Number of times the planetary boundaries are transgressed

**Frequency of dissemination**

Once a year

## References and footnotes

1. Sanye Mengual, E. and Sala, S., 2023, *Consumption footprint and domestic footprint: assessing the environmental impacts of EU consumption and production*, JRC Science for Policy Report, European Commission, Joint Research Centre, Publications Office of the European Union, Luxembourg. ↵
2. The EU's consumption footprint is transgressing the planetary boundaries for the environmental footprint categories of particulate matter, freshwater ecotoxicity, climate change and resource use (for both fossil

and mineral and metal resources) (EC, 2023; Sanye Mengual and Sala, 2023).

3. EC, 2022, 'Zero pollution outlook 2022', *EU Science Hub* ( https://joint-research-centre.ec.europa.eu/scientific-activities-z/zero-pollution-outlook-2022_en ) accessed July 5, 2023.

4. EU, 2021, Commission Recommendation (EU) 2021/2279 of 15 December 2021 on the use of the environmental footprint methods to measure and communicate the life cycle environmental performance of products and organisations, OJ L 471, 30.12.2021, p. 1-396.

5. EC, 2023, 'Consumption Footprint Platform — EPLCA', *European Commission* ( https://eplca.jrc.ec.europa.eu/ConsumptionFootprintPlatform.html ) accessed February 1, 2023.

6. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union environment action programme to 2030, OJ L 114, 12.4.2022, p. 22-36.

7. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme’s 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Employment in the environmental goods and services sector

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

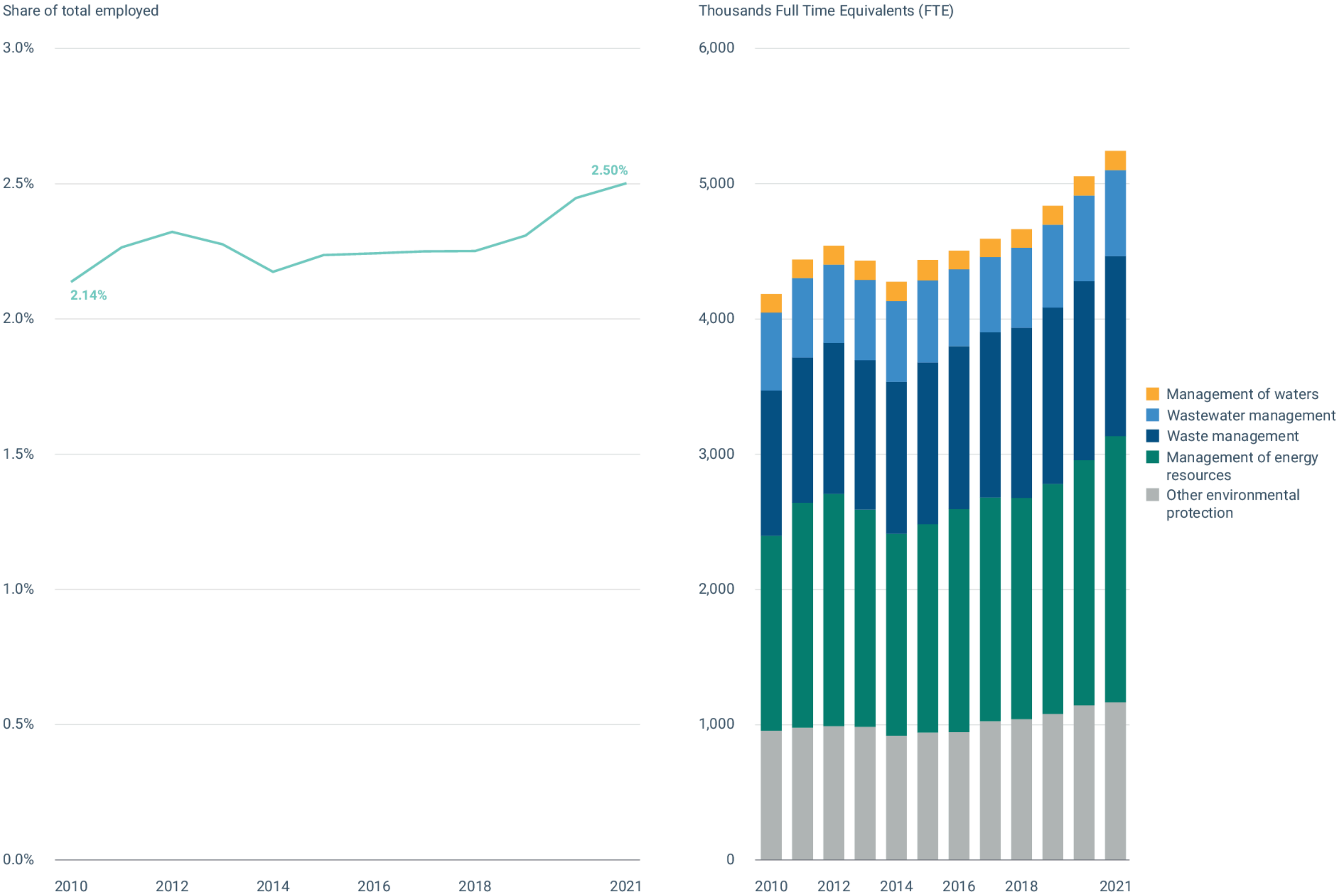
# Employment in the environmental goods and services sector in Europe

Published 26 Jun 2024



Employment in the EU's environmental goods and services sector grew at a faster rate than the EU's overall employment rate in the last decade. It increased from 2.1% of total employment in 2010 to 2.5% in 2021, with the number of full-time equivalent employees in this sector reaching 5.2 million. This was mainly due to the creation of jobs related to renewable energy, energy efficiency and waste management. The EU aims to accelerate the green transition of its economy and become carbon neutral by 2050. This is expected to boost jobs in the EU's green economy in the coming years and therefore further increase the share of green employment in the EU economy.

## Figure 1. Employment in the EU's environmental goods and services sector by domain, 2010-2021



The European Green Deal and the Eighth Environment Action Programme (8th EAP) aim to accelerate the green transition of the European Union's (EU) economy. The EU's environmental goods and services sector, also known as **the green economy**, produces goods and provides services that are used for environmental protection and resource management activities.

Employment in the EU's green economy as a share of employment in the EU's whole economy **increased** by 0.4 percentage points (or 1.1 million full-time equivalents (FTEs)) from 2010 to 2021. This represents an increase of 25%, compared with an increase of only 7% in employment in the EU's overall economy in the same period. This shows that pursuing environmental objectives has the potential to create jobs in the EU.

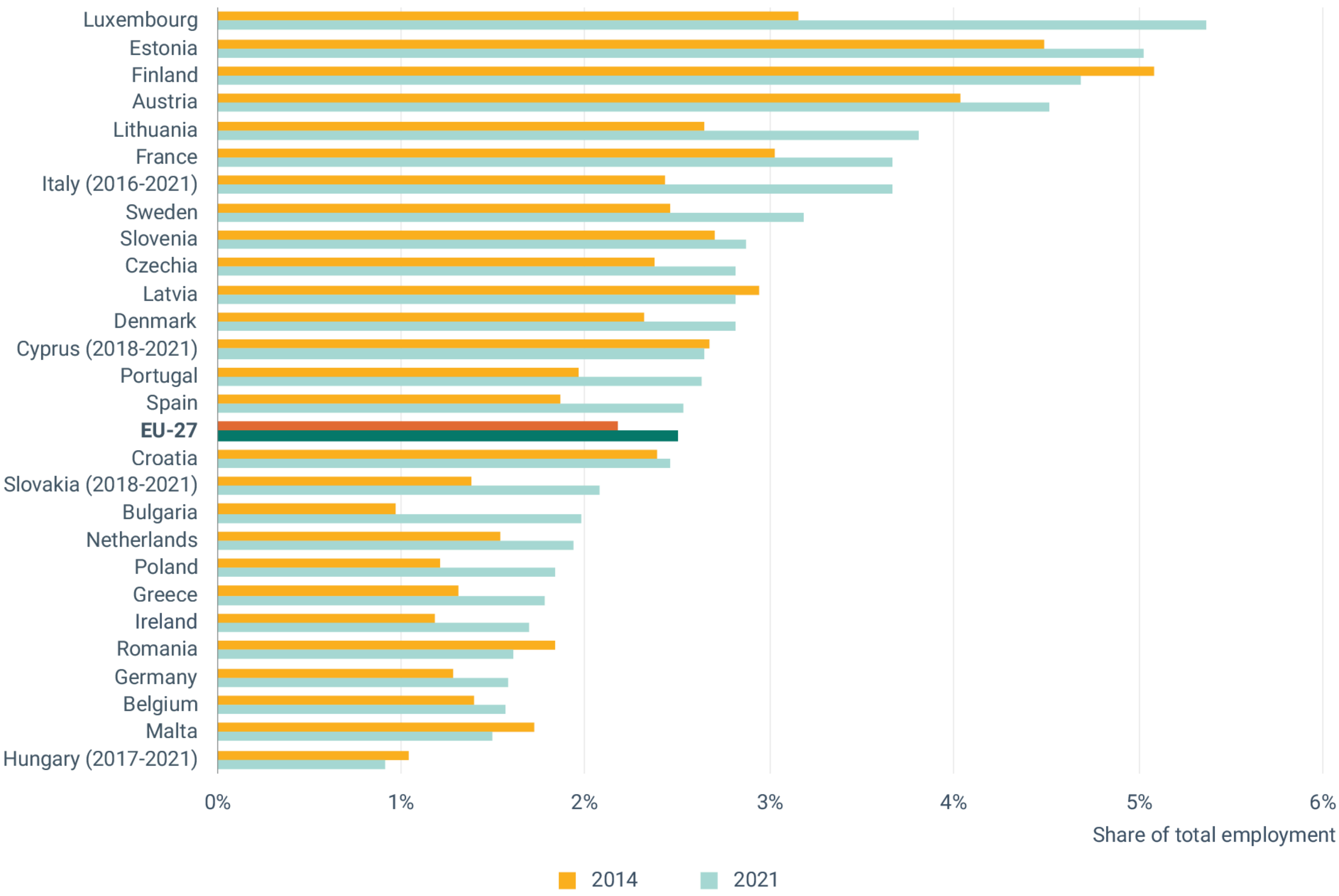
By 2021, the environmental goods and services sector **employed 5.2 million** people (in FTEs) in the EU, accounting for about 2.5% of total EU employment. The increase in green employment between 2010 and 2021 was largely driven by an increase of 525,000 FTEs in the number of jobs related to the management of energy resources[1]. For instance jobs related to:

- producing renewable energy;
- manufacturing equipment needed to generate renewable energy, such as wind turbines and photovoltaic cells;
- manufacturing energy-efficient equipment;
- research and development (R&D) activities;
- installation, consultancy and management services.

The **second largest contributor** to the increase in green employment was waste management, with the number of jobs in this domain increasing by 259,000 FTEs (+24%) over the period. Employment in all other domains increased to varying degrees. Modest increases were found in the management of water (+4%), wastewater management (+10%) and other environment protection domains (+22%).

Steps taken to support the green transition will create more green employment in the EU by 2030, mainly through applying circular economy principles[2] and moving towards a low-carbon economy[3][4][5]. It is therefore expected that, through policies, measures and investments, green employment will account for a higher share of total employment in the EU by 2030.

## Figure 2. Employment in the environmental goods and services sector as a share of total employment, by EU Member States, 2014 and 2021




Shares of green employment in total employment increased in most EU Member States between 2014 and 2021. Exceptions were in Malta (-13%), Hungary (-13%), Romania (-12%), Finland (-8%), Latvia (-4%) and Cyprus (-1%). The largest increases were reported for Bulgaria (104%), Luxembourg (70%) and Poland (52%).

The **domains** accounting for most employment in the environmental economy differ between EU Member States. For example, during 2021, employment in resource management activities (i.e. management of energy and of water resources) accounted for most environmental employment in Luxembourg (81%), Sweden (77%), Finland and Estonia (66% in both countries). In contrast, employment in environmental protection activities (e.g. waste and wastewater management activities) accounted for most environmental employment in Belgium (78%), Malta (75%), and Croatia (73%) [6].

**Highest shares** of green employment in total employment for 2021 were in Luxembourg and Estonia, with green jobs making up more than 5% of all jobs in these countries. Moreover, a share of close to 5% was reported for Finland and Austria. The lowest shares, of 1.5% or less, were reported for Hungary and Malta.

## Supporting information

### Definition

The indicator 'Employment in the environmental goods and service sector' monitors employment in the EU's environmental (or green) economy. The indicator builds on Eurostat statistics on employment and growth in the EU's environmental economy, as they are defined in the European environmental goods and service sector

(EGSS) accounts. ‘The environmental economy encompasses activities and products that serve either of two purposes: “environmental protection” — that is, preventing, reducing and eliminating pollution or any other degradation of the environment, or “resource management” — that is, preserving natural resources and safeguarding them against depletion’ [6].

For further information, see Eurostat (2016).

**Methodology**

This indicator is directly based on data published by Eurostat, and the underpinning methodology can be found in Eurostat [6]. EU-level data are based on Eurostat estimates. A detailed discussion of statistics on the environmental goods and services sector can be found in Eurostat (2016).

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting targets of the 8th EAP. It contributes mainly to monitoring progress in relation to aspects of Article 2.1, which requires that, ‘by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced. A healthy environment underpins the well-being of all people and is an environment in which biodiversity is conserved, ecosystems thrive, and nature is protected and restored, leading to increased resilience to climate change, weather- and climate-related disasters and other environmental risks. The Union sets the pace for ensuring the prosperity of present and future generations globally, guided by intergenerational responsibility’ [7]. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should monitor the ‘increase ofthe shares… of green employment in the whole economy’ [8].

**Accuracy and uncertainties**

**Data sources and providers**

- Employment in the environmental goods and services sector [env_ac_egss1__custom_10715540], Statistical Office of the European Union (Eurostat)
- Employment by A*10 industry breakdowns [NAMA_10_A10_E__custom_10717044], Statistical Office of the European Union (Eurostat)

## Metadata

**DPSIR**

Response

**Topics**

# Sustainability solutions

**Tags**

# green economy # 8th EAP # environmental goods # environmental economy # SUSO002 # Employment

**Temporal coverage**

2010-2021

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG8: Decent work and economic growth

**Unit of measure**

Employment in the environmental goods and services sector is measured in thousands of full-time equivalents (total hours worked divided by the average annual hours worked in a full-time job) and as a share (%) of total employment.

**Frequency of dissemination**

Once a year

## References and footnotes

1. Eurostat, 2016, *Environmental goods and services sector accounts handbook: 2016 edition*, Publications Office of the European Union, Luxembourg. ↵
2. A study estimates that applying circular economy principles across the EU economy has the potential to create around 700,000 new jobs by 2030 (see footnote No. 5) ↵

3. EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions ‘A new circular economy action plan for a cleaner and more competitive Europe’, COM(2020) 98 final of 11 March 2020.

4. EC, 2020, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions ‘A new industrial strategy for Europe’, COM(2020) 102 final of 10 March 2020.

5. IRENA and ILO, 2022, *Renewable energy and jobs: annual review 2022*, International Renewable Energy Agency and International Labour Organization.

6. Eurostat, 2024, 'Environmental economy — statistics on employment and growth', *Eurostat Statistics Explained* ( https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_economy_%E2%80%93_statistics_on_employment_and_growth).</div>

7. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a general Union environment action programme to 2030, OJ L 114, 12.4.2022, p. 22-36.

8. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme’s 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Gross value added of the environmental goods and services sector

8TH EAP HEADLINE INDICATOR, 2024

European
Environment
Agency

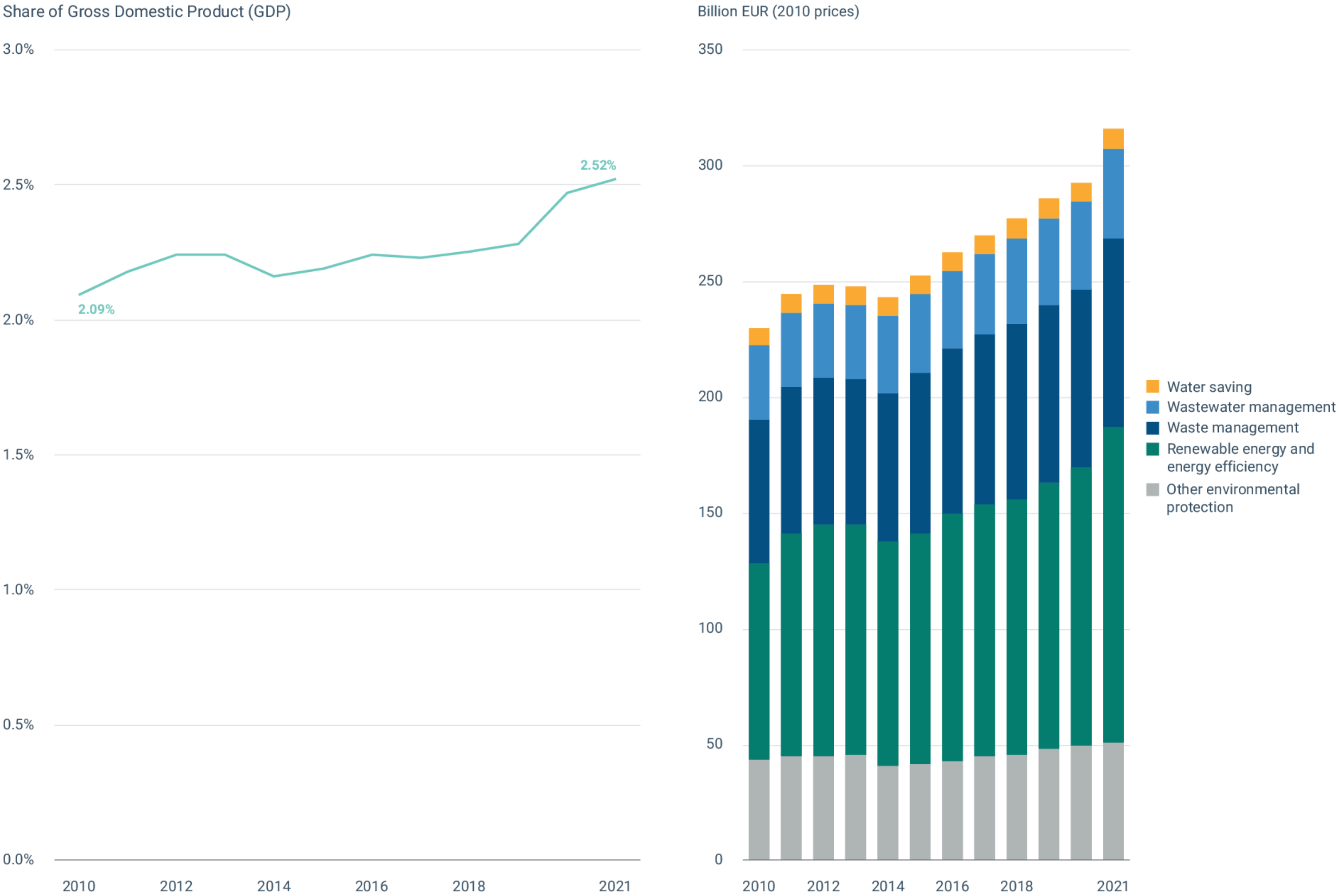
# Gross value added of the environmental goods and services sector in Europe

Published 26 Jun 2024



The environmental goods and services sector contribution to the overall economy in the EU, in terms of value added, increased from 2.1% in 2010 to 2.5% in 2021, surpassing EUR 315 billion in 2010 prices. This was mainly caused by significant increases in environmental economy activities related to renewable energy production, energy efficiency, and waste management. The EU aims to achieve a green transition and carbon-neutral economy by 2050. This requires further significant increases in environmental economy activities. It is expected that the EU's environmental economy will account for an increasing share of the whole economy in the coming years.

## Figure 1. Gross value added of the EU's environmental goods and services sector by domain, 2010-2021



The European Green Deal and the Eighth Environment Action Programme (8th EAP) aim to accelerate the green transition of the European Union's (EU) economy. The EU's environmental goods and services sector, also known as the **green economy**, produces goods and provides services that are used in environmental protection and resource management.

The **contribution** of the environmental economy to the overall economy (i.e. to gross domestic product (GDP)) in the EU increased from 2.1% in 2010 to 2.5% in 2021. Over this period, the environmental economy increased by 2.9% annually, on average, while EU GDP increased by 1.2%.

In terms of **gross value added** (GVA), the main domains of the green economy increased in the period 2010-2021. Most growth was due to increases in the GVA of renewable energy and energy efficiency activities, followed by waste management activities. In 2021, green economy activities contributed a GVA of EUR 316 billion (2010 prices) to the EU-27 economy.

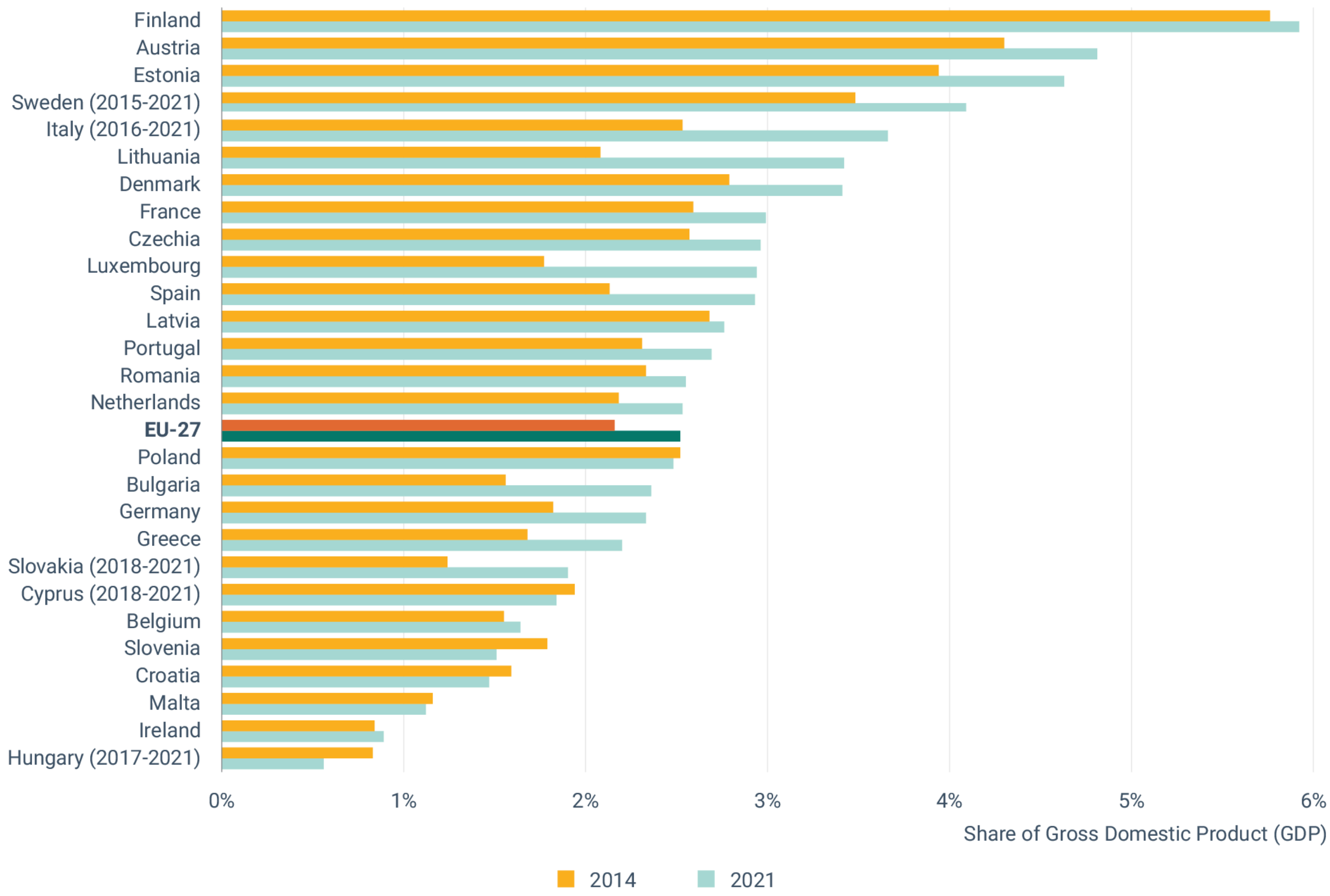
The European Green Deal increases the ambition of EU environment and climate policy, to support the transition to a carbon-neutral, circular, green economy by 2050. It is expected that the contribution of the green economy to EU GDP will increase further in the coming years.

The application of **circular economy principles** across the EU economy is expected to increase EU GDP by an additional 0.5% by 2030[1]. Significant additional economic activity will be required to implement the 'Fit for 55' package, which aims to increase output from renewable energy sources, such as solar energy or offshore wind sources, and improve energy efficiency. The Net Zero Industry Act, which aims to scale up the manufacturing of clean technologies in the EU, will also boost the competitiveness of EU industry and increase economic activity within the EU.

Additional resources have been made available to support the **expansion** of the EU's environmental economy. The EU's 2021-2027 budget has earmarked additional funding for climate- and biodiversity-related activities [2]. Grants and loans are available through the 2021-2026 EU Recovery and Resilience Facility (RRF)[2] for climate-related activities and through the 2022-2027 REPowerEU plan for activities related to renewable energy and energy efficiency. The RRF was created to mitigate the social and economic impacts of the COVID-19 pandemic. The REPowerEU plan was devised to rapidly reduce the EU's dependence on Russian fossil fuels following Russia's invasion of Ukraine and accelerate the clean energy transition.

Environmental economy activities are expected to increase in importance at global level. A recent report estimates that the **global market volume** for environmental technology and resource efficiency activities will increase by 7.3% per year until 2030[3]. Increasing opportunities for the environmental economy, particularly for economic sectors that contribute to achieving net-zero emissions, are also highlighted in the International Energy Agency reports 'World energy outlook 2023'[4] and 'Energy technology perspectives 2023'[5].

## Figure 2. Gross value added of the environmental goods and services sector as a share of gross domestic product, by EU Member States, 2014 and 2021




**Shares** of the environmental economy in the total economy increased in 19 of the EU Member States between 2014 and 2021, with the biggest increases reported for Luxembourg and Lithuania. Shares varied considerably across Member States in 2021, from approximately 0.5% in Hungary to more than 4% in Finland, Austria, Estonia, and Sweden.

## Supporting information

### Definition

The indicator 'Gross value added of the environmental goods and services sector' monitors the gross value added of the economic activities of the EU's environmental (or green) economy. The indicator builds on Eurostat statistics on employment and growth in the EU's environmental economy, as they are defined in the European environmental goods and services sector accounts. 'The environmental economy encompasses activities and products that serve either of two purposes: "environmental protection" — that is, preventing, reducing and eliminating pollution or any other degradation of the environment, or "resource management" — that is, preserving natural resources and safeguarding them against depletion'[6].

For further information, see Eurostat (2016).

### Methodology

This indicator is directly based on data published by Eurostat, and the underpinning methodology can be found in Eurostat (2023). EU-level data are based on Eurostat estimates. A detailed discussion of statistics on the environmental goods and services sector can be found in Eurostat (2016).

The data were deflated to 2010 prices by using the implicit GDP deflator series (indexed to 2010) published by Eurostat.

**Policy/environmental relevance**

This indicator is a headline indicator for monitoring progress towards meeting targets of the 8th EAP. It contributes mainly to monitoring progress in relation to aspects of Article 2.1, which requires that, 'by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced. A healthy environment underpins the well-being of all people and is an environment in which biodiversity is conserved, ecosystems thrive, and nature is protected and restored, leading to increased resilience to climate change, weather- and climate-related disasters and other environmental risks. The Union sets the pace for ensuring the prosperity of present and future generations globally, guided by intergenerational responsibility' [7]. The European Commission communication on the 8th EAP monitoring framework specifies that this indicator should monitor the 'increase ofthe shares of the green economy... in the whole economy' [8].

**Accuracy and uncertainties**

**Data sources and providers**

- Production, value added and exports in the environmental goods and services sector (env_ac_egss2), Statistical Office of the European Union (Eurostat)
- GDP and main components (output, expenditure and income) [nama_10_gdp__custom_10844782], Statistical Office of the European Union (Eurostat)
- Production, value added and exports in the environmental goods and services sector [ENV_AC_EGSS2__custom_10778178], Statistical Office of the European Union (Eurostat)

## Metadata

**DPSIR**

Response

**Topics**

# Sustainability solutions

**Tags**

# GDP # Gross value added # green economy # 8th EAP # GVA # goods and services # environment # European Green Deal # environmental economy # SUSO003 # green transition

**Temporal coverage**

2010-2021

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG8: Decent work and economic growth

**Unit of measure**

The gross value added of the environmental goods and services sector is measured in billion euros (EUR) and as a share (%) of total economy GDP.

**Frequency of dissemination**

Once a year

## References and footnotes


1. EC, 2020, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'A new circular economy action plan for a cleaner and more competitive Europe', COM(2020) 98 final of 11 March 2020. ↵
2. EC, 2021, *The EU's 2021-2027 long-term budget and NextGenerationEU — facts and figures*, Publications Office of the European Union, Luxembourg. a b
3. BMU, 2021, *GreenTech made in Germany 2021: environmental technology atlas for Germany*, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin. ↵
4. IEA, 2023, *World Energy Outlook 2023*, International Energy Agency.

5. IEA, 2023, *Energy technology perspectives 2023*, International Energy Agency.

6. Eurostat, 2023, 'Environmental economy — statistics on employment and growth', *Eurostat Statistics Explained* (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_economy_%E2%80%93_statistics_on_employment_and_growth) accessed March 7, 2023.

7. EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030, OJ L 114, 12.4.2022, p. 22-36.

8. EC, 2022, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the monitoring framework for the 8th Environment Action Programme: measuring progress towards the attainment of the programme's 2030 and 2050 priority objectives, COM (2022) 357 final of 26 July 2022.

European Environment Agency

# 8th Environment Action Programme

## Environmental inequalities: income-related environmental inequalities associated with air pollution in Europe

8TH EAP HEADLINE INDICATOR, 2024

European Environment Agency

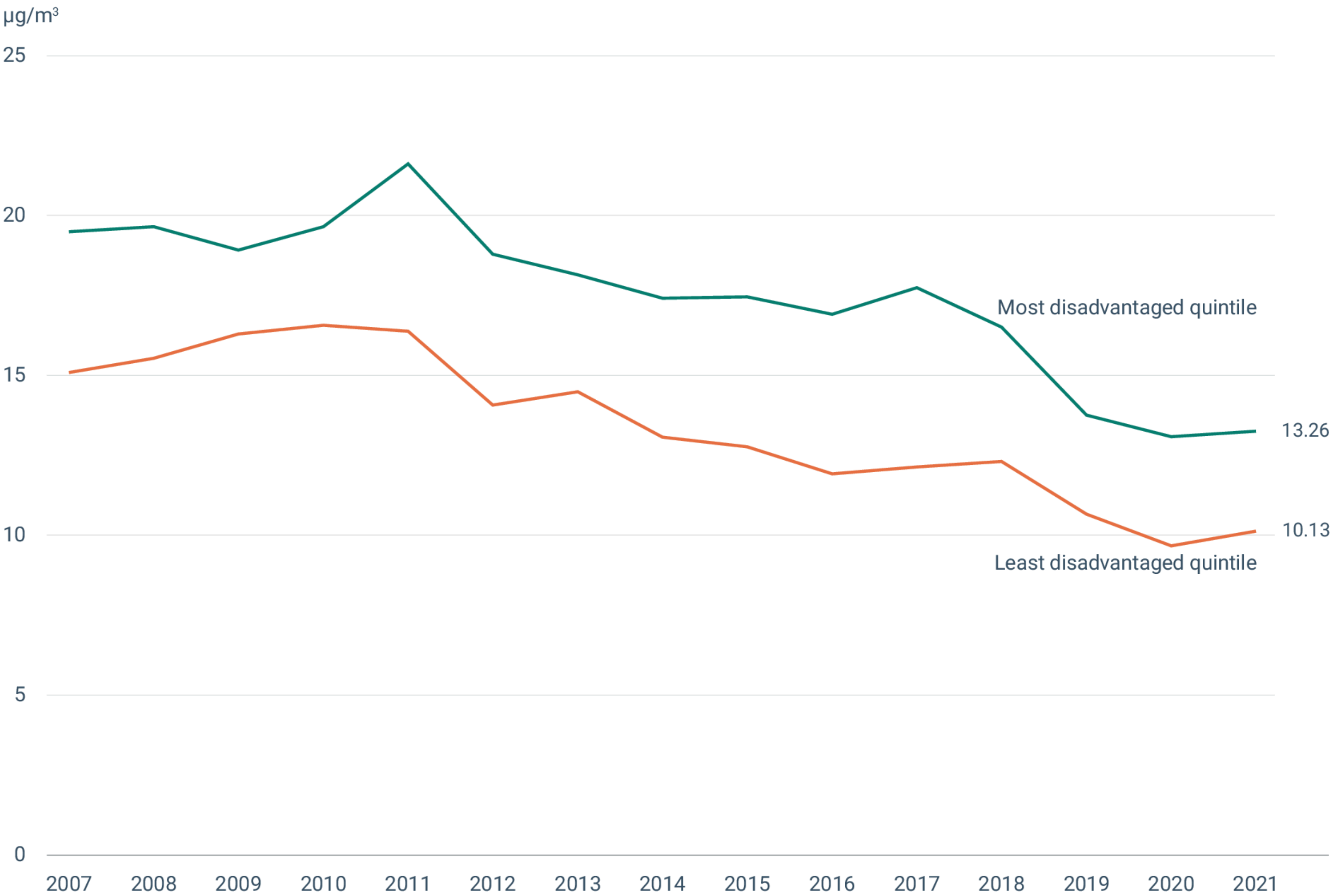
# Income-related environmental inequalities between regions associated with air pollution in Europe

Published 27 Sept 2024



Air pollution poses the greatest environmental risk to health in Europe. Fine particulate matter ($PM_{2.5}$) causes more premature deaths in Europe than any other air pollutant. Despite improving trends in air pollution for both the richest and poorest regions of the European Union over the 2007-2021 period, inequalities remain with $PM_{2.5}$ concentrations consistently higher by around one third in the poorest regions.

## Figure 1. Population-weighted concentration of $PM_{2.5}$ in the richest and poorest (as measured by GDP per capita, PPS) quintile of NUTS3 regions in the EU-27, 2007-2021



Air pollution poses the greatest environmental risk to health in Europe. Fine particulate matter with a diameter of 2.5μm or less ($PM_{2.5}$) is the ambient air pollutant associated with the highest number of **premature deaths**, with no thresholds below which exposure is considered safe in terms of health[1].

$PM_{2.5}$ exposure is demonstrated to be a reliable indicator of risk associated with air **pollution** in general[2]. Monitoring $PM_{2.5}$ levels is therefore useful for exploring income-related inequalities in the distribution of health impacts of air pollution and environmental risks.

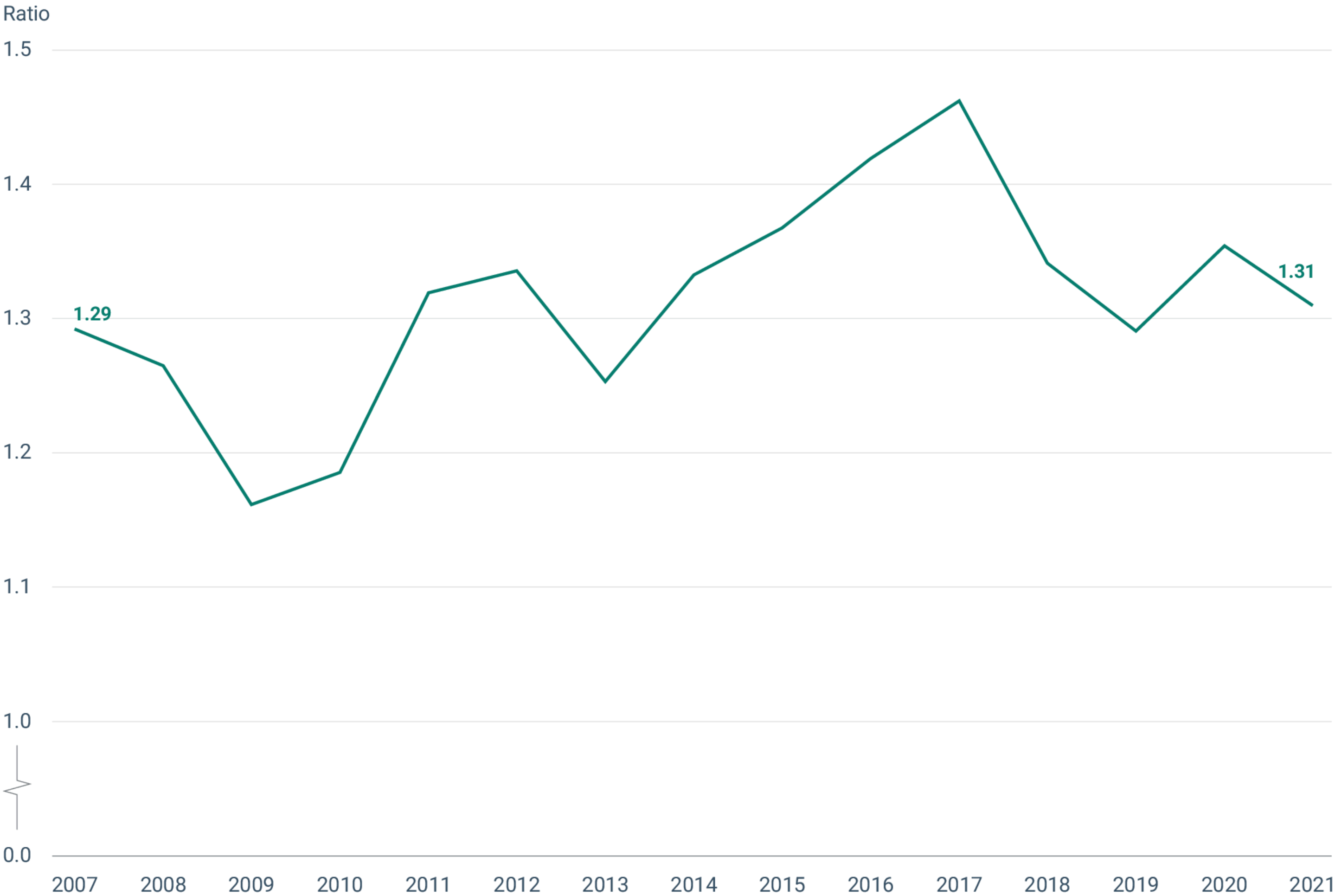
These inequalities are explored by comparing the **exposure** to air pollution by fine particulate matter experienced by the population living in the poorest regions of the EU with that in the richest regions. The analysis uses population-weighted concentrations of $PM_{2.5}$ in the 20% of EU NUTS3 regions (i.e. in small regions similar to a prefecture) with the least per capita income (in terms of purchasing power) and the 20% of EU NUTS3 regions with the highest per capita income. Exposure at NUTS3 is an imperfect proxy for actual inequalities in air pollution exposure, yet data availability limitations currently preclude a finer analysis[3]

Between 2007 and 2021, air quality, measured as population-weighted **concentrations** of $PM_{2.5}$, improved in both the least disadvantaged (richest) and the most disadvantaged (poorest) quintiles of the EU-27's NUTS3 regions (Figure 1). Regions in the richest quintile had lower initial $PM_{2.5}$ levels (around 15μg/$m^3$ in 2007) than those in the poorest quintile (19.5μg/$m^3$ in 2007). Compared with 2020, $PM_{2.5}$ concentrations increased in 2021 on average in both the richest and the poorest quintiles, yet more so in the richest (with an average increase of 0.46μg/$m^3$) than in the poorest (average increase of 0.18μg/$m^3$).

$PM_{2.5}$ concentrations have **decreased** at relatively similar rates[4] in regions in the richest quintile (3.49% average decrease in the analysed period)[5]and in the poorest quintile (2.97% average decrease). Despite improving trends in air pollution in both the richest and the poorest regions of the EU over 2007-2021, inequalities remained with levels of $PM_{2.5}$ consistently higher by around one third in the poorest regions (Figure 2).

The indicator, defined as the ratio of population weighted concentration of $PM_{2.5}$ in EU NUTS3 regions in the most and the least deprived quintiles, remained **overall stable**[6]over the 2007 - 2021 period, and well above 1.0. This shows that there has been no progress in reducing environmental inequalities in the EU so far, at least for air pollution.

## Figure 2. Ratio of $PM_{2.5}$ population weighted concentrations: Most Deprived (i.e. poorest) Quintile/Least Deprived (i.e. richest) Quintile (GDP per capita PPS)




Some of the **most polluted** NUTS3 regions spatially coincide with the poorest regions in the eastern part of Europe. However, there are pockets of highly polluted NUTS3 regions elsewhere in Europe with both high and low purchasing power per capita. Almost no NUTS3 regions in the richest quintile are in the quintile with the most pollution.

The absence of disaggregated projections at the NUTS3 level for both $PM_{2.5}$ concentrations and purchasing power makes evidence-based predictions challenging. While there are national level projections in $PM_{2.5}$ emissions and concentrations (i.e. including cross-border transfers) by country stemming from the third clean air outlook, these cannot be readily used to derive NUTS3-level extrapolations, nor would it be reasonable to assume that NUTS3 GDP levels will remain constant. Therefore, no reasonable prediction can be given for this indicator based on existing evidence.

## Supporting information

### Definition

This indicator monitors concentrations of $PM_{2.5}$ in the richest and poorest NUTS3 regions of the EU-27. More specifically it measures the ratio ofpopulation-weighted $PM_{2.5}$ concentrations of the most disadvantaged quintile compared to the ones of the least disadvantaged quintile (based on GDP per capita at purchasing power standard) at NUTS3-region level. Population-weighting is a statistical technique that assigns greater weight to the air pollution experienced where most people live. GDP: Gross Domestic Product, a basic measure of the overall size of a country's or region's economy. Per capita (Latin: "per head") indicates the average per person in a group, in this case the population of a given NUTS3 region. NUTS3 is the smallest subdivision of the NUTS classification (Nomenclature of territorial units for statistics), a hierarchical system for dividing up the economic territory of the EU. PPS: purchasing power standard, an artificial currency unit with which theoretically, one could buy the same amount of goods and services in each country. PPS is a more accurate way to compare wealth per capita than raw GDP because it reduces the effect of price differences. $PM_{2.5}$, particulate matter with a diameter of 2.5μm or less.

The definitions of GDP, per capita and PPS come from the Eurostat glossary: (https://ec.europa.eu/eurostat/statistics-explained).

**Methodology**

The indicator is formally defined as '$PM_{2.5}$ exposure ratio between most disadvantaged and least disadvantaged quintile (GDP per capita at purchasing power standard) at NUTS3 region level'.

The indicator is calculated via the formula:

Exposure ratio = Pop. weighted $PM_{2.5}$ exposure (μg/$m^3$) MDQ/Pop.weighted $PM_{2.5}$ exposure (μg/$m^3$) LDQ.

Where:

'Pop. weighted $PM_{2.5}$ exposure (μg/$m^3$) MDQ' is the annual average population-weighted concentration of $PM_{2.5}$ in ambient air measured in micrograms per cubic meter of the most deprived (i.e. poorest) quintile of NUTS3 regions, measured based on GDP per inhabitant at purchasing power standard in euros.

'Pop. weighted $PM_{2.5}$ exposure (μg/$m^3$) LDQ' is the annual average population-weighted concentration of $PM_{2.5}$ in ambient air measured in micrograms per cubic meter of the least deprived (i.e. richest) quintile of NUTS3 regions, measured based on GDP per inhabitant at purchasing power standard in euros.

Because the numberator and denominator of this indicator are in the same units, the resulting ratio has no units. Both parts of this ratio are easily measurable and based on readily available data. In an environmentally equal Europe, in terms of $PM_{2.5}$, this ratio would be close to one. If the poorer regions were more polluted than the richer regions, the ratio would be greater than one; a ratio of lower than one would indicate the opposite.

**Policy/environmental relevance**

This indicator will provide an objective and comparable estimate over time of the inequalities in $PM_{2.5}$ exposure (and thus of associated health risks) between the poorest and the richest regions in Europe.

This indicator is a proxy headline indicator on environmental inequalities for monitoring progress towards the $8^{th}$ Environment Action Programme ($8^{th}$ EAP). It contributes mainly to monitoring aspects of the $8^{th}$ EAP Article 2.1 that requires 'by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced'.

It further contributes to monitoring aspects of the Article 3.f which requires 'ensuring that social inequalities resulting from climate- and environmental-related impacts and policies are minimised and that measures taken to protect the environment and climate are carried out in a socially fair and inclusive way'. The European Commission Communication on the $8^{th}$ EAP monitoring framework specifies that this indicator should monitor whether the EU 'reduces environmental inequalities and ensures a fair transition', (EC, 2022).

EU, 2022, Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030, OJL 114, 12.4.2022, https://eur-lex.europa.eu/legal-

content/EN/TXT/?uri=CELEX:32022D0591 accessed October 24, 2022.

**Accuracy and uncertainties**

GDP per capita at NUTS3 level is an imperfect measure of economic deprivation, but it is a fair proxy that is published regularly and is easy to understand for most audiences. The assessment of population weighted concentrations also has uncertainties inherent to the estimation, though those are known and limited. The trend analyses for this indicator is performed via linear regression and a T test for the significance of slope value. The indicator showed from 2007 to 2020 a small but statistically significant ($p<0.05$) upward linear slope of 0.02. However, with such a small value and a standard error of around 0.01, this trend cannot be assessed as significantly different from stable.

**Data sources and providers**

- Gross domestic product (GDP) at current market prices by NUTS 3 regions [nama_10r_3gdp], Statistical Office of the European Union (Eurostat)
- Air Quality Health Risk Assessments, European Environment Agency (EEA)

## Metadata

**DPSIR**

State

**Topics**

# Air pollution  # Environmental inequalities  # Environmental health impacts

**Tags**

# 8th EAP  # income  # AIR009  # inequalities  # air pollution

**Temporal coverage**

2007-2021

**Geographic coverage**

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain

Sweden

**Typology**

Descriptive indicator (Type A - What is happening to the environment and to humans?)

**UN SDGs**

SDG3: Good health and well-being

**Unit of measure**

The population-weighted concentrations of $PM_{2.5}$

are measured in micrograms per cubic meter and the ratio of population-weighted concentrations of $PM_{2.5}$ has no units, it is expressed as ratio.

**Frequency of dissemination**

Once a year

## References and footnotes

1. WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, 2021, ( https://www.who.int/publications-detail-redirect/9789240034228) accessed March 5, 2023. ↲
2. Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., Amann, M., Anderson, H. R., Andrews, K. G., Aryee, M., Atkinson, C., Bacchus, L. J., Bahalim, A. N., Balakrishnan, K., Balmes, J., Barker-Collo, S., Baxter, A., Bell, M. L., Blore, J. D. et al., 2013, 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010', *Lancet* 380(9859), pp. 2224–2260. ↲
3. Within a city the inequalities can be much higher than between NUTS3 regions, depending on the local situation (proximity to main roads, industry, etc.). However, while we have data on exposure to fine particles at a very fine scale (down to a 1 by 1 km cell grid), we do not have Europe-wide data on GDP at a level smaller than NUTS3. Therefore, NUTS3 is the smallest scale at which we can calculate the indicator as currently defined. ↲
4. No statistically significant difference in the trends. ↲
5. Mean change of three-year moving average. ↲
6. With a small but statistically significant ($p<0.05$) upward linear slope of around 0.02 and a standard error of around 0.01. ↲

European Environment Agency