

Pesticides in rivers, lakes and groundwater in Europe

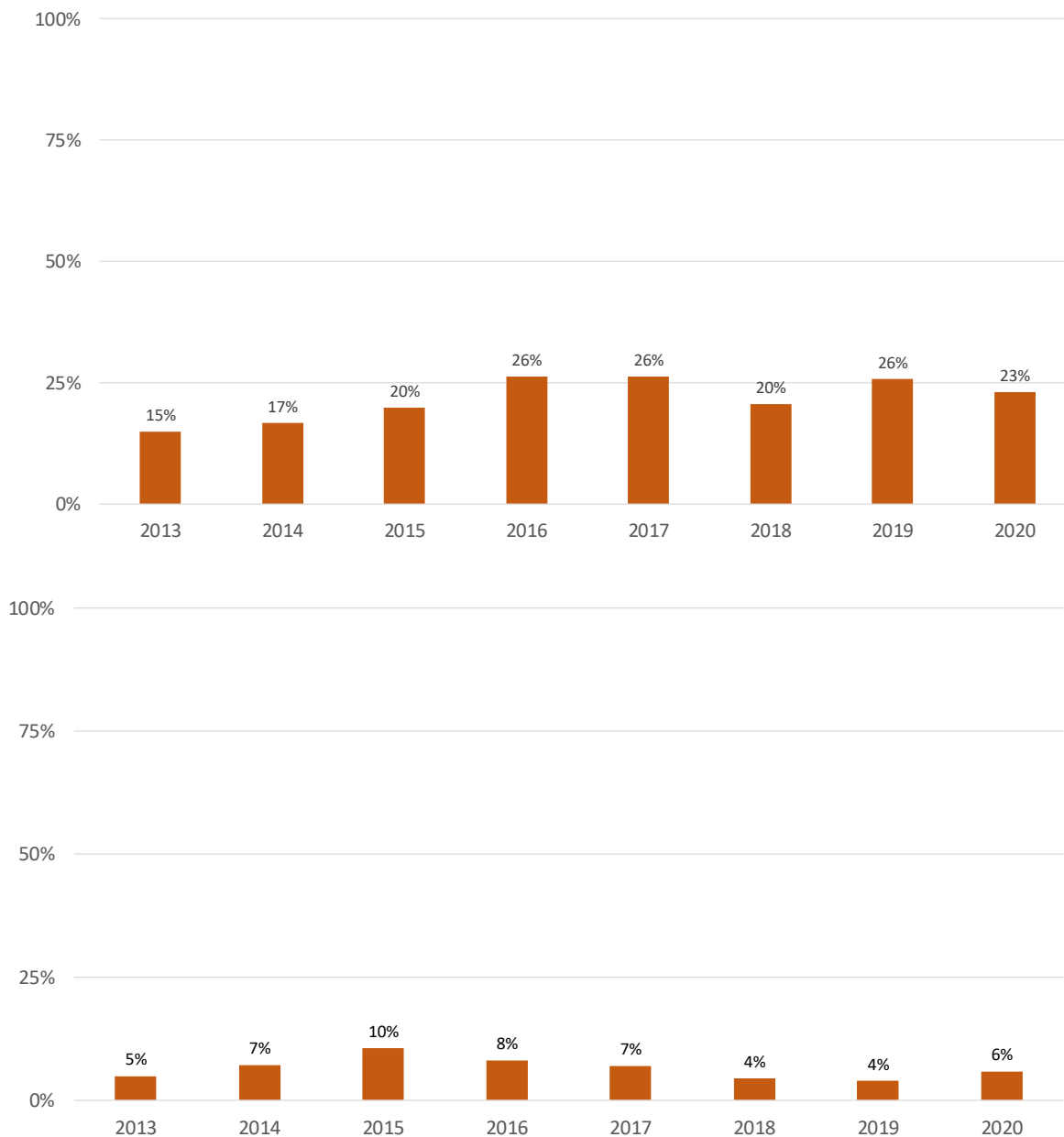
Last update 28/07/2022 – next update

EU level

Summary

Pesticides¹ were assessed against effect or quality thresholds between 2013 and 2020. One or more pesticides was detected above its effect threshold at 15-26% of all surface water monitoring sites each year. Exceedances were mainly caused by the insecticide imidacloprid in surface waters, and the herbicides MCPA, metolachlor and metazachlor. Exceedances of one or more pesticides were detected at between 4% and 10% of groundwater monitoring sites, mainly by atrazine and its metabolites. No trends can be derived at this time and between-year changes may not be significant.

Figure 1. Percentage of reported monitoring sites with pesticides exceeding thresholds per year in a) surface waters and b) groundwater in Europe weighted by country area.



¹ Pesticides include both active substances from plant protection products and biocides as well as their relevant metabolites.

Aggregate level assessment

Pesticides can contaminate surface waters and groundwater and if their concentrations are above critical thresholds, they can be harmful to the environment.

The European Green Deal (EC 2019) sets targets to reduce the use of and risks from chemical pesticides by 50% by 2030 in the zero pollution action plan (EC 2021), farm to fork strategy (EC, 2020b) and biodiversity strategy (EC, 2020a), with a focus on protecting ecosystems and improving biodiversity.

The Water Framework Directive (WFD) (EU 2000) sets environmental quality standards for pesticides in surface water. To assess the chemical status of groundwater, a precautionary quality standard of 0.1 µg/L is set for pesticides according to the Groundwater Directive (EU 2006), reflecting the desire to keep pesticide concentrations in groundwater at low levels.

Figure 1 shows that in 15% to 26% of all surface water monitoring sites, one or more pesticides were detected above effect threshold each year between 2013 and 2020. Exceedances of one or more pesticides were detected at between 4% and 10% of groundwater monitoring sites.

Pesticides most often causing exceedance in surface waters are the insecticide imidacloprid, and the herbicides MCPA, metolachlor and metazachlor, all of which were approved for use in plant protection products during the monitoring period, though some are no longer approved. In groundwater, the herbicide atrazine and its metabolites cause most exceedances. Atrazine was not approved for use in plant protection products during the monitoring period. Despite restrictions on atrazine since 2007, it continues to be found in groundwater because it is very persistent.

It is not yet possible to determine a trend in Figure 1. Losses from the application of pesticides may vary considerably between years, depending upon, for example, crop type and the weather, while the frequency of monitoring of pesticides in surface waters can be limited to one year out of three. Changes to the approval status of pesticides influence their use and presence in water, which can also lead to difficulties in interpreting trends over time. For these reasons, changes between years may not be significant. It is anticipated that a trend will become apparent in the next few years.

Country level

Figure 2. Percentage of reported monitoring sites with pesticides exceeding thresholds in surface waters, different sized rivers, lakes and groundwater in European countries in time period 2013 – 2020

Country	Surface waters	Rivers, large	Rivers, medium	Rivers, small	Lakes	Groundwater
Austria	7% (46)	0% (9)	4% (24)	22% (9)	n.d.	3% (2 009)
Belgium	49% (97)	0% (4)	54% (63)	43% (28)	n.d.	11% (397)
Bulgaria	0% (94)	n.d.	0% (70)	0% (20)	0% (2)	2% (133)
Croatia	54% (50)	86% (14)	41% (22)	50% (8)	0% (4)	16% (58)
Cyprus	0% (55)	n.d.	0% (44)	n.d.	0% (4)	0% (83)
Czechia	55% (732)	n.d.	56% (624)	43% (100)	88% (8)	10% (655)
Denmark	5% (22)	n.d.	0% (5)	25% (4)	n.d.	4% (1 111)
Estonia	10% (87)	0% (2)	11% (44)	30% (10)	3% (31)	0% (167)
Finland	50% (22)	20% (5)	69% (13)	0% (1)	0% (2)	n.d.
France	30% (1 763)	35% (109)	29% (1 080)	33% (316)	16% (140)	23% (1 792)
Germany	37% (267)	53% (43)	37% (181)	47% (17)	9% (22)	3% (1 123)
Greece	13% (233)	29% (7)	11% (165)	15% (26)	13% (32)	n.d.
Hungary	40% (5)	0% (1)	50% (4)	n.d.	n.d.	n.d.
Iceland	0% (2)	n.d.	n.d.	n.d.	0% (1)	n.d.
Ireland	43% (249)	n.d.	46% (99)	34% (35)	40% (86)	0% (222)
Italy	39% (2 011)	n.d.	42% (776)	35% (718)	18% (152)	17% (3 445)
Latvia	42% (33)	n.d.	50% (24)	0% (1)	25% (8)	6% (163)
Lithuania	19% (52)	n.d.	28% (32)	0% (19)	100% (1)	4% (54)
Luxembourg	0% (2)	n.d.	0% (2)	n.d.	n.d.	n.d.
Netherlands	56% (321)	46% (13)	43% (14)	49% (90)	60% (204)	n.d.
Norway	0% (21)	0% (4)	0% (11)	0% (5)	0% (1)	n.d.
Poland	1% (904)	5% (42)	1% (269)	0% (631)	0% (377)	0% (316)
Portugal	14% (106)	33% (6)	18% (72)	0% (20)	n.d.	4% (203)
Romania	n.d.	n.d.	n.d.	n.d.	n.d.	1% (139)
Serbia	14% (79)	0% (1)	8% (13)	33% (9)	7% (41)	2% (53)
Slovakia	14% (36)	50% (4)	10% (31)	n.d.	n.d.	41% (216)
Slovenia	15% (20)	0% (1)	18% (17)	0% (2)	n.d.	7% (54)
Spain	20% (2 440)	n.d.	21% (1 185)	18% (770)	16% (122)	11% (1 419)
Sweden	28% (18)	n.d.	36% (11)	14% (7)	n.d.	n.d.
Switzerland	0% (1)	n.d.	0% (1)	n.d.	n.d.	8% (51)
Total	23% (9 768)	22% (265)	24% (4 896)	21% (2 846)	21% (1 238)	8% (13 863)

■ 0% ■ 0-10% ■ 10-20% ■ 20-30% ■ > 30% n.d. No data () total number of reported monitoring sites in time period 2013 to 2020

Disaggregate level assessment

Between 2013 and 2020, pesticides were reported from a total of 9,768 monitoring sites for surface waters and 13,863 sites for groundwater. The number of monitoring sites reporting data for surface waters varies by country from less than 10 sites (Hungary, Iceland, Luxembourg, Switzerland) to more than 1,000 sites (France, Italy, Spain). There is similar variation in groundwater monitoring sites: numbers range from 54 sites in Lithuania to more than 3,000 sites in Italy (and more than 1,000 sites in Austria, Denmark, France, Germany, Spain).

The number of pesticides reported in surface waters ranges from fewer than 10 substances (Iceland, Luxembourg, Norway, Switzerland) to more than 100 substances (Czechia, France, Germany, Italy, Netherlands, Spain). For groundwater, the lowest number of pesticides was reported from Austria (6) and the highest number from France (215).

Exceedance rates of more than 30% were reported in 16 out of 29 countries for surface waters and in one out of 22 countries for groundwater. High exceedance rates were mainly reported at monitoring sites in small and medium-sized rivers.

Supporting information

The indicator ‘Pesticides in rivers, lakes and groundwater in Europe’ shows:

- the percentage of reported monitoring sites with pesticides exceeding thresholds in surface waters and groundwater in Europe weighted by country area;
- the percentage of reported monitoring sites with pesticides exceeding thresholds in surface waters, different sized rivers, lakes and groundwater in European countries, 2013-2020.

Methodology

A detailed description of the methodology used to develop the pesticides indicator is provided in an [ETC/ICM methods paper](#).

Policy/environmental relevance

Justification for indicator selection

Pesticides are a topic of considerable public and policy interest across the environment, agriculture and human health domains. Since 2021, an overview of pesticides in the aquatic environment across Europe, as well as a standardised methodology in the form of an indicator to assess pesticide contamination levels in aquatic ecosystems is available.

The indicator may not be comparable with nationally developed assessments of pesticides in water because the methodologies for calculating exceedances may differ.

Policy context and targets

Context

The [Water Framework Directive \(WFD\)](#) and its daughter directives on [environmental quality standards in water policy](#), as [amended in 2013](#), and [quality standards for groundwater](#) set quality objectives and targets for pesticides in surface waters and groundwater and should protect water quality from pesticide pollution.

According to the WFD, pesticide concentrations above critical threshold levels lead to surface waters failing to achieve ‘good chemical status’, based on pesticides listed as priority substances, and ‘good ecological status’, based on pesticides listed as river basin-specific pollutants. The WFD also lists pesticides that are groundwater pollutants to assess the chemical status of groundwaters. For each pesticide, a quality standard of 0.1 µg/L was set in the [Groundwater Directive](#), which is not a health-based, but a general precautionary limit value.

Failure to achieve effect thresholds and quality standards in water means failure to achieve the environmental objectives of the WFD.

The [European Green Deal](#) and its associated strategies and actions — the [farm to fork strategy](#), [biodiversity strategy](#), [chemicals strategy for sustainability](#) and [zero pollution action plan](#) — brings renewed ambition to significantly reduce the use of and risk from pesticides and improve the risk assessment of chemicals.

EU policies aimed at reducing the potential risk from pesticides are also supported by the [Plant Protection Products Regulation](#), the [Sustainable Use of Pesticides Directive](#) and the [Biocidal Products Regulation](#).

- The Plant Protection Products Regulation sets out rules for the authorisation of plant protection products and their marketing, use and control. Based on this regulation, the [Seventh Environment Action Programme](#) set the objective that, by 2020, the use of plant protection products should not have any harmful effects on human health, or unacceptable influence on the environment, and that such products should be used sustainably.
- The Sustainable Use of Pesticides Directive aims to reduce the risks and impacts of pesticide use on human health and the environment and to promote the use of integrated pest management and alternatives such as non-chemical approaches.
- The Biocidal Products Regulation focuses on the marketing and use of biocidal products.

Targets

Legislation concerning pesticides in environmental waters is primarily set by the WFD (2000/60/EC). For surface waters, environmental quality standards (EQSs) are set in the EQS Directive (2008/105/EC), as updated by the Priority Substances Directive (2013/39/EU). EQSs are based on substances’ toxicity to or via the aquatic environment. There are 33 priority substances (or groups of substances); these include a limited number of pesticides. Member States can also identify ‘river basin specific pollutants’ for which they set the EQS. For groundwater, the Groundwater Directive (2006/118/EC), as updated by Directive 2014/80/EU, sets a common quality standard of 0.1 µg/L for any individual pesticide.

Within the European Green Deal, the EU set targets for reducing the use of and risk from chemical pesticides by 50% by 2030 in the zero pollution action plan, the farm to fork strategy and the biodiversity strategy, with a focus on improving and protecting ecosystems and biodiversity.

Accuracy and uncertainties

Methodology uncertainty

For surface waters, effects thresholds could be identified for only 48% of the pesticides reported; 52% of all pesticides reported could not be considered in the assessment.

The calculation method used to determine exceedance rates with country weightings reduces any imbalance in the data reported with respect to the numbers of monitoring sites and pesticides reported. This reduces the impact of high levels of reporting by a few countries on the overall percentage of monitoring sites with exceedances.

This country weighting means that unusually high or low exceedance rates within a country may affect the overall indicator. This can also occur if data for only a few monitoring sites are reported but a relatively high or low proportion of these are exceedances. A minimum number of monitoring sites reported per country and year would be needed to reduce this imbalance.

There is a lack of a consistent time series of comparable data. Instead, the data for many monitoring sites were not reported for more than a few years, which disperses the spatial and temporal coverage of the data set.

Data set uncertainty

Monitoring data are not evenly spread across Europe, and there is considerable variation between countries in the number of monitoring sites reported and in the number of substances measured. The results are dominated by countries with the highest numbers of monitoring sites and substances reported, which is addressed using a weighting factor. However, a minimum number of monitoring sites and substances should be reported to achieve a representative overview of pesticide concentration in European waters.

Rationale uncertainty

In surface waters, ecotoxicologically-based effect thresholds were determined to assess exceedance rates at monitoring sites. Those thresholds indicate potential pollution by pesticides affecting communities in aquatic ecosystems. Using the lowest ecotoxicologically-based effect threshold is the most conservative criterion. The EQS have not necessarily been defined in each country with the same criteria as used here, which makes comparisons with this indicator difficult.

In groundwater, exceedances were assessed against the 0.1µg/L quality standard set out in the Groundwater Directive. No regulated quality standards for non-relevant metabolites are available and so they were excluded from the assessment.

The indicator demonstrates a need to harmonise limit values (including nationally set river basin-specific pollutant EQS values).

Data sources and providers

[Area by NUTS 3 region](#)

Institutional mandate

Metadata

DPSIR

Pressure

Topics

[Water and marine environment](#)

Tags

[Surface waters](#), [Water Framework Directive](#), [Groundwater](#), [WAT009](#),

Temporal coverage

2013-2020

Geographic coverage

- Austria
- Belgium
- Bulgaria
- Croatia
- Cyprus
- Czechia
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy

- Latvia
- Lithuania
- Luxembourg
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Serbia
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland

Typology

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

UN SDGs**Unit of measure**

The indicator is expressed as percentages of monitoring sites where one or more pesticides exceed the effect threshold for surface waters or the quality standard for groundwater. To reduce the impact of uneven spatial and temporal data reporting, we used a country area weighting factor:

\sum Share of monitoring sites with exceedances per country (%) \times country area (km²) /

\sum Area of countries with reported monitoring sites per year (km²)

The country weighting factor was not used for Figure 2 in the indicator.

Frequency of dissemination

Once a year

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