European Environment Agency

8th Environment Action Programme

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

8TH EAP HEADLINE INDICATOR, 2024

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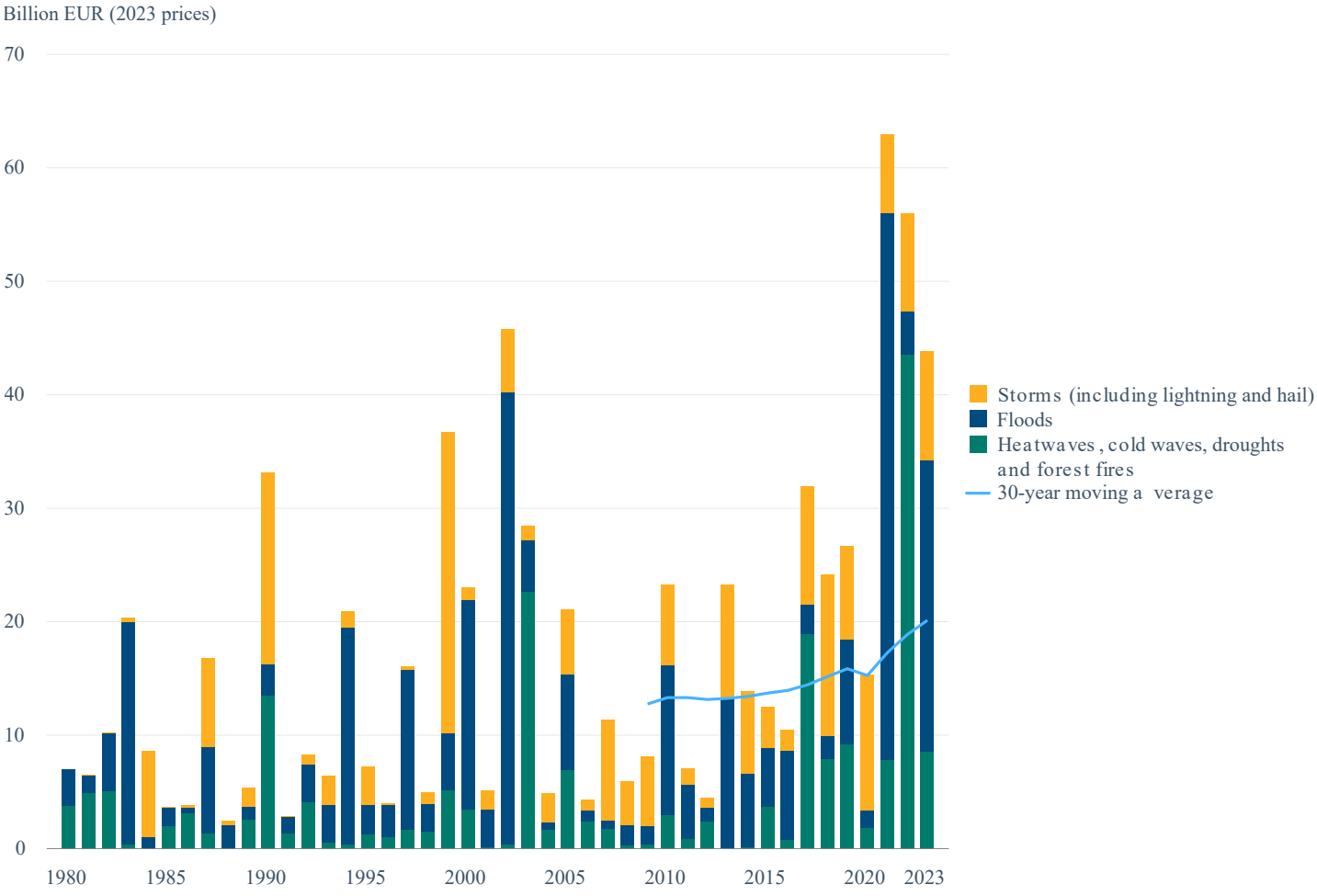
Weather- and climate-related extremes caused economic losses of assets estimated at EUR 738 billion during 1980 - 2023 in the European Union, with over EUR 162 billion (22%) between 2021 and 2023. Analysing trends in economic losses is challenging, primarily due to large annual variability. Statistical 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 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' [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.
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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.
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11. CMCC, 2021, 'G20 Climate Risk Atlas: Impacts, policy, economics - European Union', *CMCC* (https://files.cmcc.it/g20climaterisks/Eu27.pdf) accessed November 9, 2021.
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12. EEA, 2024, *European Climate Risk Assessment Executive summary*, EEA Report, 01/2024, European Environment Agency.
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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.
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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.
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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.
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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).
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17. EC, 2021, Commission Staff Working Document — Closing the climate protection gap - Scoping policy and data gaps, SWD(2021) 123 final.
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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.
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19. EEA, 2022, *Advancing towards climate resilience in Europe —Status of reported national adaptation actions in 2021*, EEA Report, 11/2022, European Environment Agency.
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22. EEA, 2020, *Monitoring and evaluation of national adaptation policies throughout the policy cycle*, 6/2020, Europeam Environment Agency (EEA), Copenhagen Denmark.
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23. IRDR, 2014, *IRDR Peril Classification and Hazard Glossary*, Integrated Research on Disaster Risk.
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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.
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25. For the dataset 1980-2023, the trendline through 30-year moving average (2009-2023): y=0.4479(x-1979)-1.6548.
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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.
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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.
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