European Environment Agency

8th Environment Action Programme

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

8TH EAP HEADLINE INDICATOR, 2023

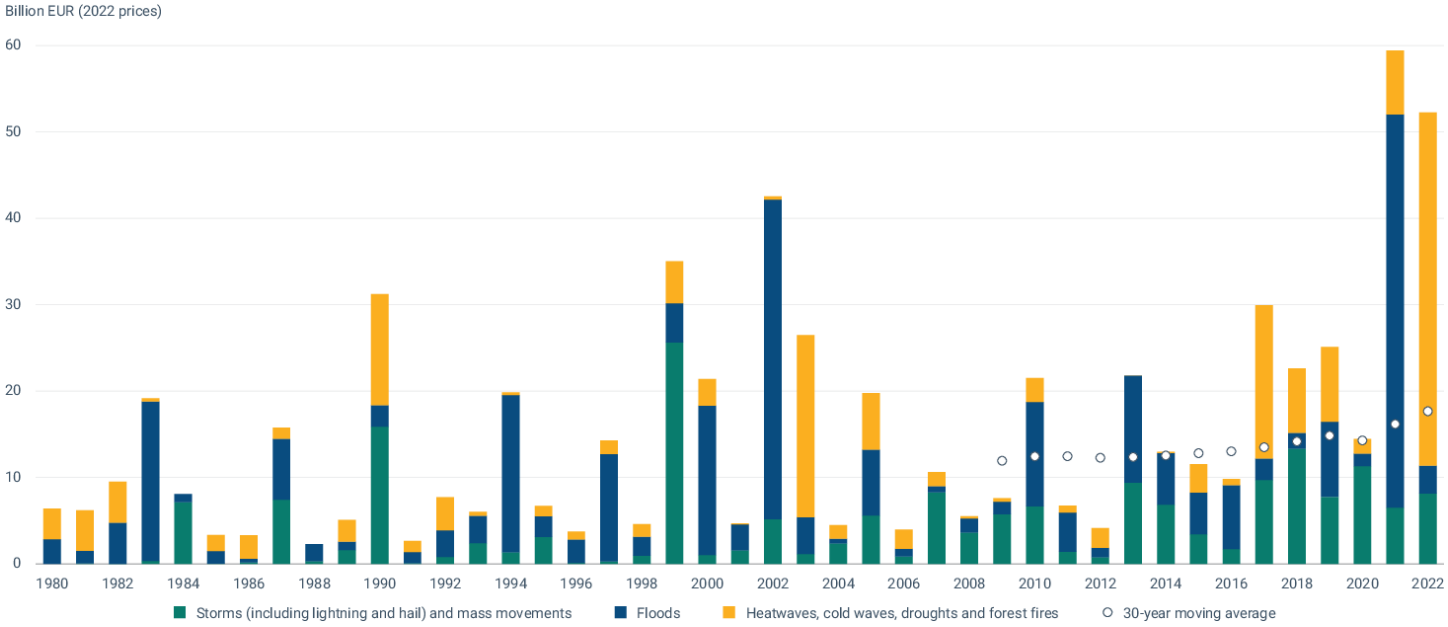
European Environment Agency

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

Published 06 Oct 2023

Between 1980 and 2022, weather- and climate-related extremes caused economic losses of assets estimated at EUR 650 billion in the EU Member States, of which EUR 59.4 billion in 2021 and EUR 52.3 billion in 2022. Analysing trends in economic losses is difficult, partly because of high variability from year to year. Some statistical analysis has revealed, however, that economic losses increase over time. As severe weather- and climate-related extreme events are expected to intensify further, it seems unlikely that the associated economic losses will reduce by 2030.

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



Source: Risklayer/EEA.

Climate-related hazards, such as temperature extremes, heavy precipitation and droughts, pose risks to human health and the environment and can lead to substantial economic losses [1]. The 2021 EU Adaptation Strategy aims to build resilience and ensure that the EU is well prepared to manage these risks and adapts to the impacts of climate change. The EU aims, among other goals, to ultimately reduce the overall monetary losses from weather- and climate-related events [2].

Between 1980 and 2022, climate-related extremes amounted to an estimated EUR 650 billion (2022 prices) in the EU. Hydrological hazards (floods) account for almost 43% and meteorological hazards (storms,including lightning and hail, together with mass movements) for around 29% of the total. For the climatological hazards, heat waves cause around 20% of the total losses while the remaining +/-8% are caused by droughts, forest fires and cold waves together. The most expensive hazards during the period 1980-2022 include the 2021 flooding in Germany and Belgium (EUR 44 billion), the 2022 compound drought and heat events over the whole continent (EUR 40 billion), the 2002 flood in central Europe (EUR 34 billion), the 1999 storm Lothar in Western Europe (EUR 17 billion), the 2003 drought and heatwave across the EU (EUR 17 billion), and the 2000 flood in France and Italy (EUR 14 billion), all at 2022 prices.

A relatively small number of events is responsible for a large proportion of the economic losses: 5% of the climate-related events with the biggest losses are responsible for 59% of losses and 1% of the events causes 28% of losses (EEA's own calculations based on the original dataset). This results in high variability from year to year. Reasons for this are multiple, including the development of assets in vulnerable areas and a potential reporting bias over time, but also because most weather- and climate-related extremes across the world and in Europe, have become more severe and frequent as a result of human-caused climate change [3].

Nevertheless, the average annual (constant prices, 2022 euros) losses were around EUR 10.4 billion in 1981-1990, 12.2 billion in 1991-2000, 14.7 billion in 2001-2010 and 15.9 billion in 2011-2020. With EUR 59.4 billion and EUR 52.3 billion, 2021 and 2022 have the highest annual values for the whole time series (followed by 2002, 1999 and 1990). Furthermore, a statistical analysis of a 30-year moving average reveals that economic losses increased over the years. A linear trendline through these 30-year averages represent a 41% increase over the 2009 to 2022 period, or 2.5% per year.

The Intergovernmental Panel on Climate Change predicts that climate-related extreme events will become more frequent and severe around the world[4]. This could affect multiple sectors and cause systemic failures across Europe, leading to greater economic losses[5][6]. Therefore, although this is uncertain, it seems unlikely that the associated economic losses will reduce by 2030.

The future cost of climate-related hazards depends not only on the frequency and severity of events but also on several other factors, such as the value of the assets exposed[7][5] and the envisaged climate adaptation measures. Some studies show the benefits of adaptation measures, including nature-based solutions, to mitigate the impacts of weather- and climate-related extremes in Europe[8] [9]. Therefore, a comprehensive, integrated approach is required to adapt to and manage the risks. Enhancing society's resilience to climate change through a focus to increasing adaptive capacity is key to the EU's adaptation strategy which was adopted on 24 February 2021. If fully implemented the EU adaptation strategy can contribute to limiting the economic costs of the weather- and climate-related events and to closing the climate protection gap[10] [11][12][13][14]. An example of such an activity coordinated by the European Commission is the Climate Resilience Dialogue [15].

Figure 2. Economic losses and fatalities caused by weather -and climate - related extreme events (1980-2022) - per country

Country	Total losses (Million EURO)	Losses per sq.km (EURO)	Losses per capita (EURO)	Insured losses (Million EURO)	Insured losses (%)	Fatalities
Austria	13216	157566	1626	2333	18	755
Belgium	16208	528524	1543	6310	39	4690
Bulgaria	4741	42715	594	86	2	256
Croatia	3667	64802	830	92	3	906
Cyprus	423	45701	597	7	2	67
Czechia	16274	206334	1567	1896	12	715
Denmark	8881	206896	1646	5459	61	532
Estonia	306	6750	217	44	14	5
Finland	2286	6755	440	70	3	7
France	120613	188907	1947	41727	35	45260
Germany	167299	467879	2065	50391	30	101334
Greece	11934	90622	1129	401	3	4643
Hungary	8919	95894	875	479	5	874
Ireland	3537	50568	869	519	15	68
Italy	111110	367817	1918	5081	5	21758
Latvia	1182	18295	513	64	5	87
Lithuania	1695	25968	511	9	1	102
Luxembourg	1252	482413	2700	622	50	170
Malta	47	148848	118			5
Netherlands	9996	267420	629	3865	39	4315
Poland	18166	58237	480	1214	7	2551
Portugal	15042	163099	1470	535	4	10339

Country	Total losses (Million EURO)	Losses per sq.km (EURO)	Losses per capita (EURO)	Insured losses (Million EURO)	Insured losses (%)	Fatalities
Romania	17525	73513	816	178	1	1438
Slovakia	1773	36159	333	73	4	119
Slovenia	6934	342051	3452	276	4	315
Spain	83782	165582	1977	3990	5	18954
Sweden	3658	8175	402	969	26	43
Iceland	25	248	88			3
Liechtenstein	21	129169	631	10	48	0
Norway	4965	12912	1073	3551	72	41
Switzerland	18743	453957	2542	6690	36	2281
Türkiye	6012	7705	92	402	7	1788
Total EU-27	650467			126690		220308

Source: Risklayer/EEA.

The economic impact of climate-related extremes varies considerably across countries. In absolute terms, the highest economic losses in the period 1980-2022 in the EU were gauged in Germany followed by France then Italy. The highest losses per capita were reckoned in Slovenia, Luxembourg and Germany, and the highest losses per area (in km^2) were in Belgium, Luxembourg and Germany.

According to the estimates, less than 20% of the total losses were insured, although this varied considerably among countries, from less than 2% in Lithuania, Romania, Cyprus and Bulgaria to over 35% in Denmark, Luxembourg, Belgium and the Netherlands. There were also significant differences between the types of events: for meteorological events, over one-third of the losses were insured, while this was less than 15% for hydrological events and little more than 10% for heatwaves and all other climatological events, including droughts and forest fires.

The EU adaptation strategy aims to promote action at national level. All countries have a national adaptation policy [16][13] 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[14]. 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 is 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, while further detail is provided on Climate-ADAPT with a 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) [17].

Methodology

Data have been adjusted to account for inflation. They are presented in 2022 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. 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 2022 is based on a linear trendline determined with the least squares method.

The European Commission is working with Member States, the ISDR and other international organisations to improve data on disaster losses. The JRC 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 [11] and in the activities of the Climate Resilience Dialogue, publishing an interim report in July 2023 [18].

Article 6 of the European Union Civil Protection Mechanism (2013) 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. It is summarised in an Overview of natural and man-made disaster risks the European Union may face (2020 edition).

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 [19][2]. 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' [19]. 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 [2].

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

Metadata

DPSIR

Impact

Topics

 # Climate change adaptation

Tags

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

Temporal coverage

1980-2022

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

Climate action, ,No poverty

Unit of measure

Losses in Euros, million and billion Euros, 2022 prices, fatalities as absolute numbers.

Frequency of dissemination

Once a year

Contact

info@eea.europa.eu

References and footnotes

1. Geotechnical 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. ↲
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. a b c
3. 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. ↲
4. Seneviratne et al_2021_Weather and climate extreme events in a changing climate.pdf, (https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_11.pdf) accessed November 9, 2021. ↲

5. Bednar-Friedl, B., Biesbroek, R., Schmidt, D. N., Alexander, P., Børsheim, K. Y., Camicer, J., Georgopoulou, E., Haasnoot, M., Le Cozannet, G., Lionello, P., Lipka, O., Möllmann, C., Muccione, V., Mustonen, T., Piepenburg, D. and Whitmarsh, L., 2022, 'Europe', in: Pörtner, H.-O., Roberts, D. C., Tignor, M. M. B., 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.
a b
6. CMCC, 2021, 'G20 Climate Risk Atlas: Impacts, policy, economics - European Union', *CMCC* (https://files.cmcc.it/g20climaterisks/Eu27.pdf) accessed November 9, 2021.
↵
7. 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.
↵
8. 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.
↵
9. 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 (https://www.nature.com/articles/s41467-020-15665-3) accessed April 4, 2023.
↵
10. 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, 2021a, p. 3)
↵
11. EC, 2021, Commission Staff Working Document — Closing the climate protection gap - Scoping policy and data gaps, SWD(2021) 123 final.
a b
12. 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.
↵
13. EEA, 2022, *Advancing towards climate resilience in Europe —Status of reported national adaptation actions in 2021*, EEA Report, 11/2022, European Environment Agency.
a b
14. 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).
a b

15. EC, 2023, 'Climate Resilience Dialogue', (https://climate.ec.europa.eu/eu-action/adaptation-climate-change/climate-resilience-dialogue_en) accessed August 30, 2023.
↲

16. EEA, 2020, *Monitoring and evaluation of national adaptation policies throughout the policy cycle*, EEA Report, 6/2020, European Environment Agency.
↲

17. IRDR, 2014, *IRDR Peril Classification and Hazard Glossary*, Integrated Research on Disaster Risk.
↲

18. Climate Resilience Dialogue, 2023, *Climate Resilience Dialogue - interim report*,
↲

19. 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