



**Environmental risk and
business strategies in a
changing world**
Case studies:
Proposed lead ban
**Economic losses caused by
weather extreme events**

GEOGRAFIA DEI CAMBIAMENTI
GLOBALI E CITTÀ SOSTENIBILI

Trieste, 7 November 2025

Bruno Barbera

Why should a company deal with the environment and the changes on our Planet?

- Adaptation to a market orientation.
- Savings and competitiveness (long term).
- Social responsibility as an ethical and communicative element.
- Sustainable finance.
- Legislative obligations.

***Multiple responses,
often linked together***



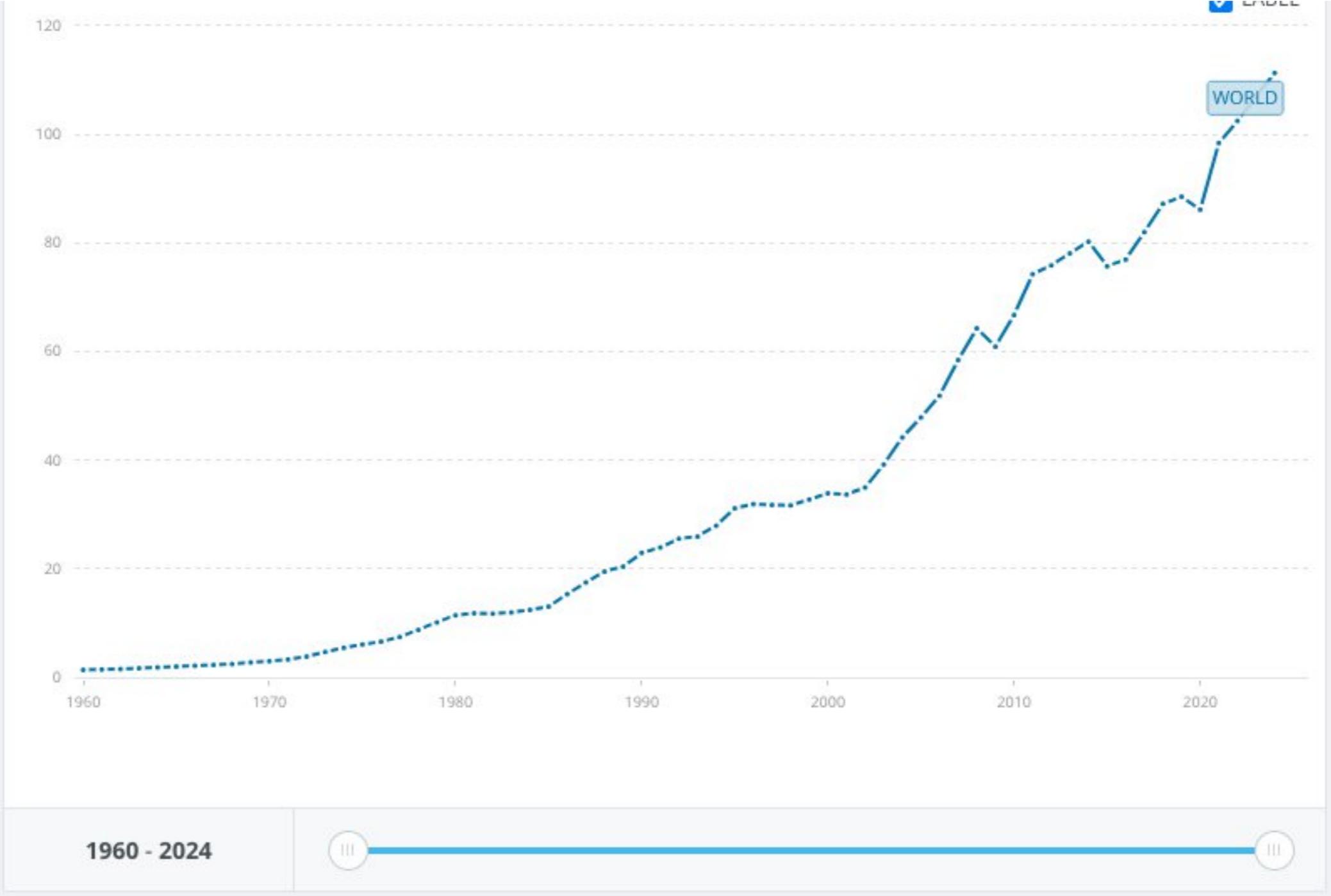
What really is the state
of the environment?
Must it be protected?

The background of the slide is a photograph of two industrial smokestacks. The stack on the left is emitting a thick, dark plume of smoke that rises into the sky. The stack on the right is also emitting smoke, though it is less dense. The sky is filled with large, billowing clouds, some of which are illuminated by a low sun, creating a dramatic, hazy atmosphere. A large, semi-transparent white circle is overlaid on the right side of the image, containing the title text.

THE RELATIONSHIP BETWEEN DEVELOPMENT AND POLLUTION

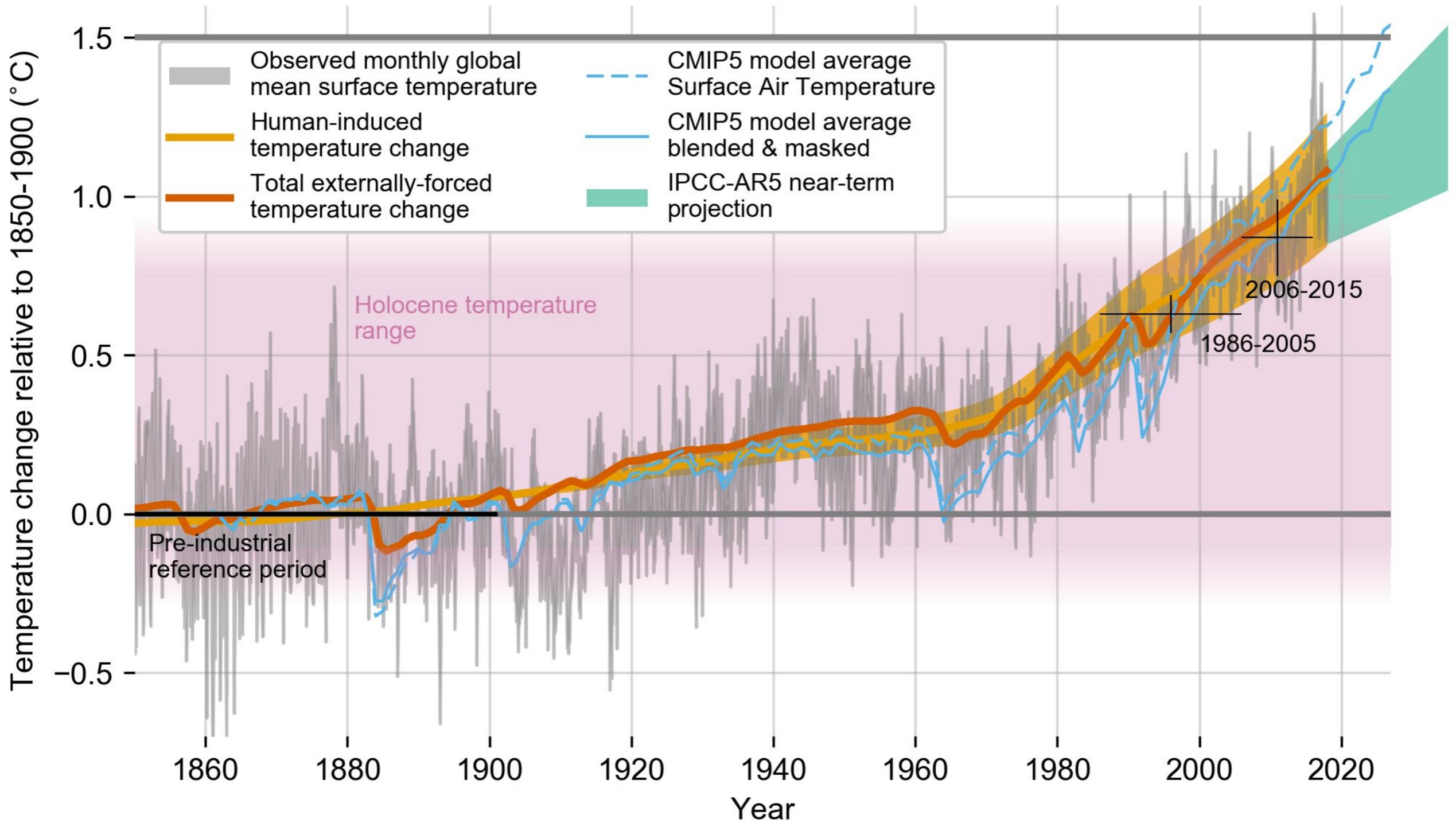
GDP world (US\$)

trillion



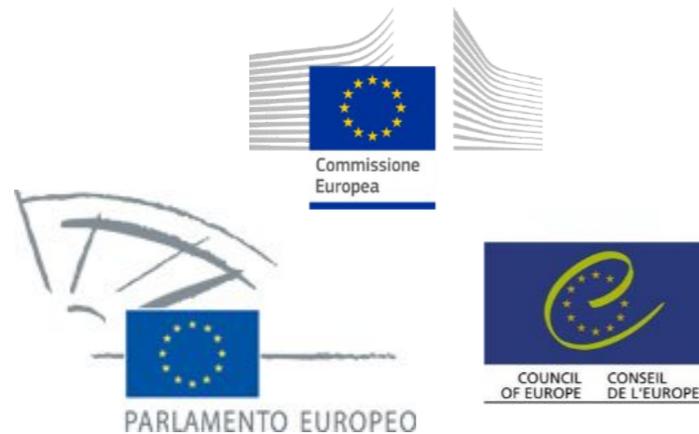
Source:  THE WORLD BANK
IBRD · IDA

Global warming



Source:
IPCC - Intergovernmental Panel on Climate Change

Europe: health and environmental protection



DECISION No 1386/2013/EU OF
THE EUROPEAN PARLIAMENT
AND OF THE COUNCIL
of 20 November 2013
on a General Union Environment
Action Programme to 2020
'Living well, within the limits of
our planet'
7th Community
Environment
Action Programme

56. In addition to the significant health and environmental benefits, the advantages given by the effective implementation of the Union's environmental legislation are threefold:

- the creation of a level playing field for economic actors operating in the internal market,
- the stimulation of innovation,
- the promotion of “first mover” advantages in different sectors for European businesses.

**Then: also stimulating
innovation and competitiveness**

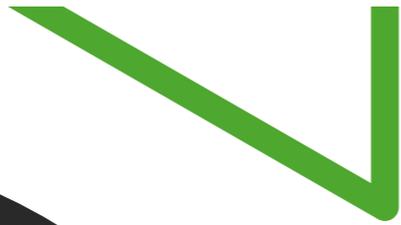
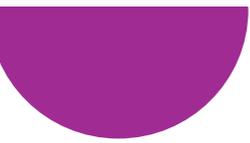


Legislation

It presides over the public interest in environmental protection.

A risk?

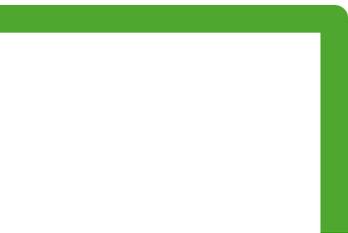
No: a point of attention



Strategic Scenarios

They are often **not** under the enterprise's control

How to manage them?



2030 AGENDA



FOR SUSTAINABLE DEVELOPMENT

Strategic directions:

Institutional sources
Institutional responses
Different approaches

2014-2020

Cohesion Policy
#CohesionPolicy supports

SMEs

E.g. promoting
resource efficiency
EUR 33.2 billion

LOW-CARBON
ECONOMY

E.g. stimulating
energy efficiency
EUR 39.7 billion

ENVIRONMENT &
RESOURCE EFFICIENCY

E.g. boosting green growth
EUR 35 billion

WASTE MANAGEMENT
EUR 5.5 billion

RESEARCH &
INNOVATION

E.g. developing innovative approaches
EUR 41.1 billion

Circular Economy
#CircularEconomy



Disclaimer: based on data available @ November 2015

<http://europa.eu/!Pv83Tr>

@EU_Regional



Strategic Scenarios

Related to the world situation, conditioned or not by the environmental match

Accessibility to environmental resources (raw materials, water, soil,

International policy scenarios (wars)

Agreements between countries to manage global scenarios

Energy market (Russian gas ...)

Changing cultural patterns
greenhushing

Trade agreement

Unilateral impositions on markets (USA fees vs EU, ..)



Sustainability Strategies

Environmental sustainability, in the many aspects mentioned, can be a strategic element for the sustainability of the Company in economic-financial terms

Sustainable finance

Sustainable finance refers to the process of taking **environmental, social and governance (ESG) considerations** into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects.

Environmental considerations might include climate change mitigation and adaptation, as well as the environment more broadly, for instance the preservation of biodiversity, pollution prevention and the circular economy.

Social considerations could refer to issues of inequality, inclusiveness, working relations, investment in people and their skills and communities, as well as human rights issues.

The **governance** of public and private institutions – including management structures, employee relations and executive remuneration – plays a fundamental role in ensuring the inclusion of social and environmental considerations in the decision-making process.

A corporate strategy for sustainability

A strategy is based on a thorough understanding of the aspects of a business

- That condition
- That are conditioned by } its environmental footprint

There are many possible shared points between the levels of company knowledge needed to :

- Answer positively to regulatory requests
- Define your own sustainability strategy
- Improving market positioning

There are established instruments to help :

- Get to know the company and, at the same time implement some forms of sustainability actions

Tools for sustainability: Product Policies

Life Cycle Analysis (LCA)

LCA is an objective process of assessing the environmental burdens associated with a product, process or activity, through the identification and quantification of energy and materials used and wastes released to the environment, to evaluate the impact of these energy and materials uses and releases to the environment, and to assess and realize opportunities for environmental improvement. The assessment includes the entire life cycle of the product, process or activity, including the extraction and processing of

raw materials, manufacture, transportation, distribution, use, maintenance, reuse, recycling and final disposal” (SETAC, 1993).



Tools for sustainability: Product Policies



What is the Environmental Footprint?

The European Commission proposed the Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF) methods as a common way of measuring environmental performance ([EU Commission Recommendation 2021/2279](#)).

The PEF and OEF are the EU recommended Life Cycle Assessment (LCA) based methods to quantify the environmental impacts of products (goods or services) and organisations.

Tools for sustainability: Product Policies

What is the Environmental Footprint?



The overarching purpose of PEF and OEF information is to enable to reduce the environmental impacts of goods, services and organisations taking into account supply chain activities (from extraction of raw materials, through production and use to final waste management).



This purpose is achieved through the provision of detailed requirements for modelling the environmental impacts of the flows of material/energy and the emissions and waste streams associated with a product or an organisation throughout the life cycle.



https://green-business.ec.europa.eu/environmental-footprint-methods_en

Tools for sustainability: between management and communication.



Performance,
Credibility,
Transparency

Eco-Management and Audit Scheme
(EMAS)

Regulation (EC) No 1221/2009

the Regulation gives companies the opportunity to register in a special list established at the European Commission, following a stringent investigation (third-party verification and public verification) that the existence of precise requirements: existence of a valid EMS, regulatory compliance, validated Environmental Declaration.

Tools for sustainability: strategic tools.

[Corporate Sustainability Reporting](#) Directive (EU) 2022/2464

an obligation but also an opportunity

It is a document with which an organization relates to different categories of stakeholders to account for the results, effects and spillovers generated with its activities.

The rationale for this obligation is to provide analytical tools to define a sustainability strategy for the enterprise.

It modernises and strengthens the rules concerning the social and environmental information that companies have to report.

Today new approach in Europe and outside ????????

A Corporate strategy for sustainability: goals and results



- Implementation of principles of social responsibility
- Cost savings and internal efficiency through optimization of processes, especially energy, raw materials, waste disposal and workers.
- Competitive advantages, gaining or maintaining market share, including through product innovation aimed at environmental aspects, relationship with markets more sensitive to the “green market”.
- Improved relations with funding sources, thanks to increased credibility in markets and because of the perception of a long-term rationale (some lenders impose environmental certifications as a prerequisite for funding).
- Improved relations with regulators.
- Reduction of litigation with social actors.

Eco-innovation and circular economy

- The Circular Economy is provided for in Decision 1386/2013/EU of the European Parliament and Council of November 20, 2013, and the environmental regulatory framework is strongly directed toward its implementation.
- Privileged tools for the purposes of the Circular Economy are Ecolabel regulations, life cycle indicators, sustainable consumption and production, incentives and green certificates.
- Eco-innovation is closely linked with the Circular Economy in a mutual symbiotic relationship.



Eco-innovation and circular economy



The Circular Economy is based on a broad concept that emphasizes the need to attend to and care about the use of resources prior to the production of consumer goods, encouraging their recovery and subsequent re-entry into the same or another cycle of use, in order to make the best use of resources, decrease carbon emissions, and reduce reliance on landfilling.



Eco-innovation is defined as any innovation that results in significant progress toward the goal of sustainable development by reducing the impacts of our production methods on the environment, strengthening nature's resilience to environmental pressures, or enabling a more efficient and responsible use of natural resources

Eco- innovation

- Eco-innovation refers to all forms of innovation, technological and otherwise, that create business opportunities and benefit the environment by preventing or reducing its impact or optimizing the use of resources. Eco-innovation is closely related to the way we use natural resources and our production and consumption patterns, as well as to the concepts of eco-efficiency and eco-industries.
- It encourages the manufacturing industry to move away from “end-of-pipe” solutions in favor of “closed-loop” approaches that minimize material and energy flows through changes in products and production methods, resulting in competitive advantage in various sectors and business segments.

Eco-innovation and circular economy



- Through supporting new processes, technologies and services that enable businesses to be more environmentally friendly, eco-innovation contributes to the optimization of growth while responding to common challenges: climate change, resource scarcity, and biodiversity loss.
- Eco-innovation is also an opportunity for businesses because it leads to lower costs, helps to seize new growth opportunities, and improves corporate image in the eyes of consumers.

Legislation

- Today, legislation, even of European derivation, is often inadequate for the purpose of timely regulation of all application cases, and Authority finds itself having to take the most conservative positions possible in self-defense in the absence of clear indications of laws, to the detriment of the most innovative and perhaps virtuous recovery technologies.
- The regulatory gap, which lends itself well to contradictory case law rulings, can also generate distortions: matrices obtained from the same waste and virtually identical process, but subject to different regulatory regimes, are not obliged to guarantee the same standards of environmental protection.

Difficulties

Low trust of the population in those who check

Uneven approach of institutions in verification (in the interpretation and application of the standard)

Sometimes bureaucratic approach

Unclear regulations that favor neither those who operate nor those who check

Distrust of the waste sector and even recycling

Greenwashing



- The practice of giving a false impression of the environmental impact or benefits of a product, which can mislead consumers (*European Union*)
- Greenwashing presents a significant obstacle to tackling climate change. By [misleading the public to believe that a company or other entity is doing more to protect the environment than it is](#), greenwashing promotes false solutions to the climate crisis that distract from and delay concrete and credible action (*United Nations*).

Green washing

Greenwashing manifests itself in several ways:

- Claiming to be on track to reduce a company's polluting emissions to net zero when no credible plan is actually in place.
- Being purposely vague or non-specific about a company's operations or materials used.
- Applying intentionally misleading labels such as "green" or "eco-friendly," which do not have standard definitions and can be easily misinterpreted.
- Implying that a minor improvement has a major impact or promoting a product that meets the minimum regulatory requirements as if it is significantly better than the standard.
- Emphasizing a single environmental attribute while ignoring other impacts.
- Claiming to avoid illegal or non-standard practices that are irrelevant to a product.
- Communicating the sustainability attributes of a product in isolation of brand activities (and vice versa) – e.g. a garment made from recycled materials that is produced in a high-emitting factory that pollutes the air and nearby waterways.

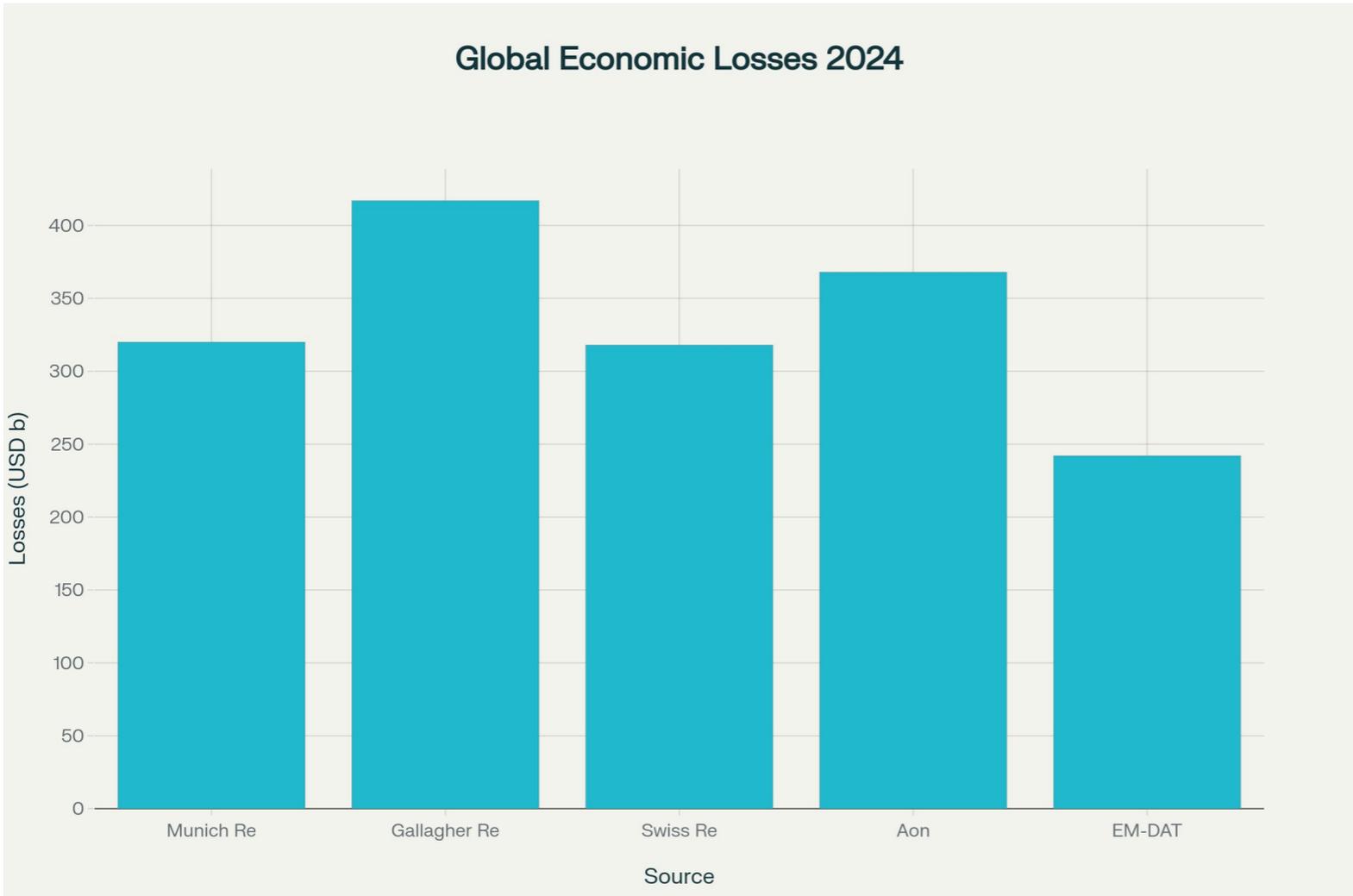
United Nations



Case study: Economic losses caused by weather extreme events

Economic Losses from Extreme Weather Events 2024

The year 2024 marked one of the most financially devastating years for natural disasters on record. Multiple leading reinsurance and catastrophe modeling organizations reported significant economic losses worldwide, with estimates varying based on methodology and data sources.

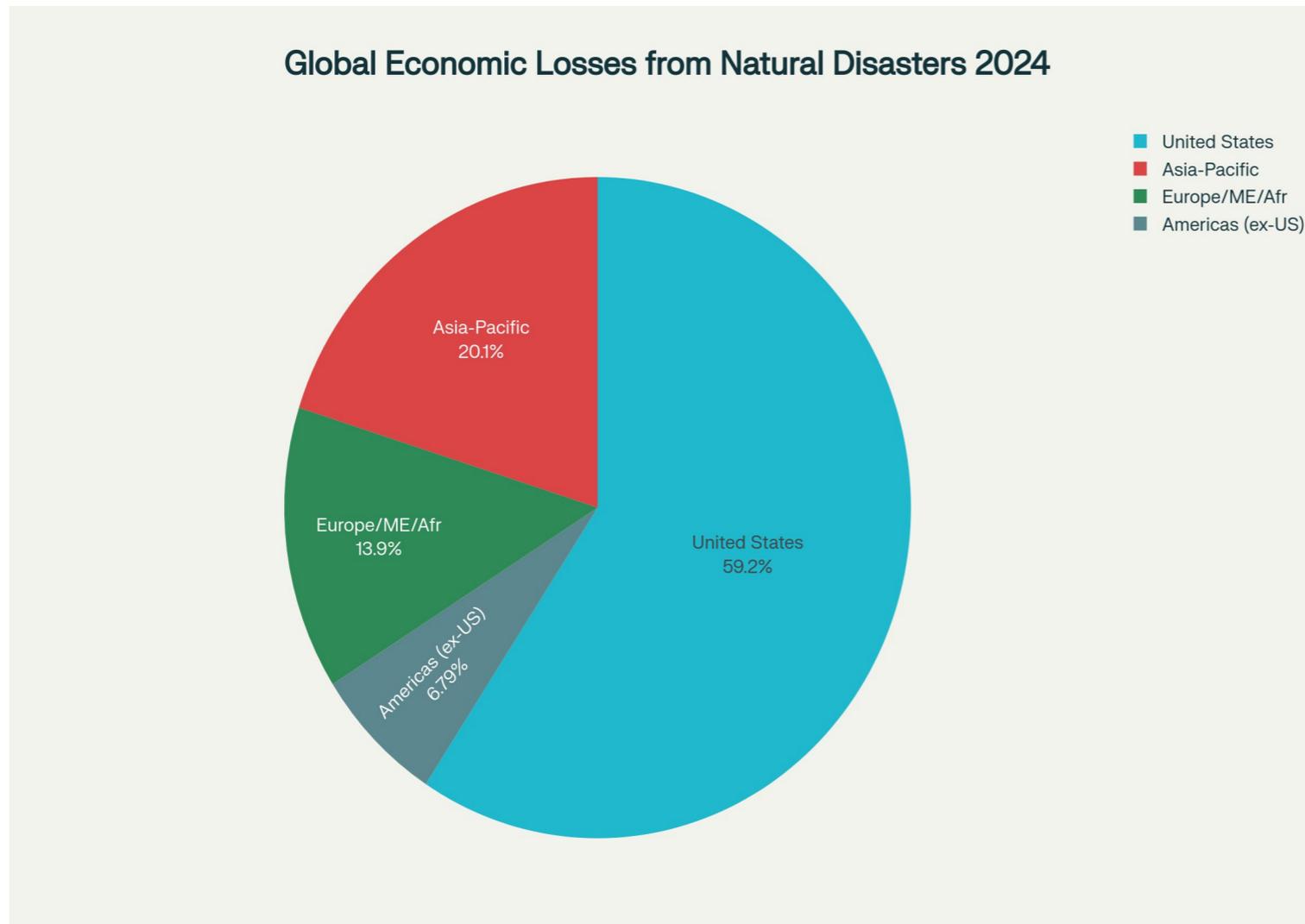


According to the most comprehensive estimates, **global economic losses from natural disasters in 2024 ranged from \$242 billion to \$417 billion.**

Global Economic Losses from Natural Disasters in 2024 by Different Sources

Regional Distribution of Global Losses

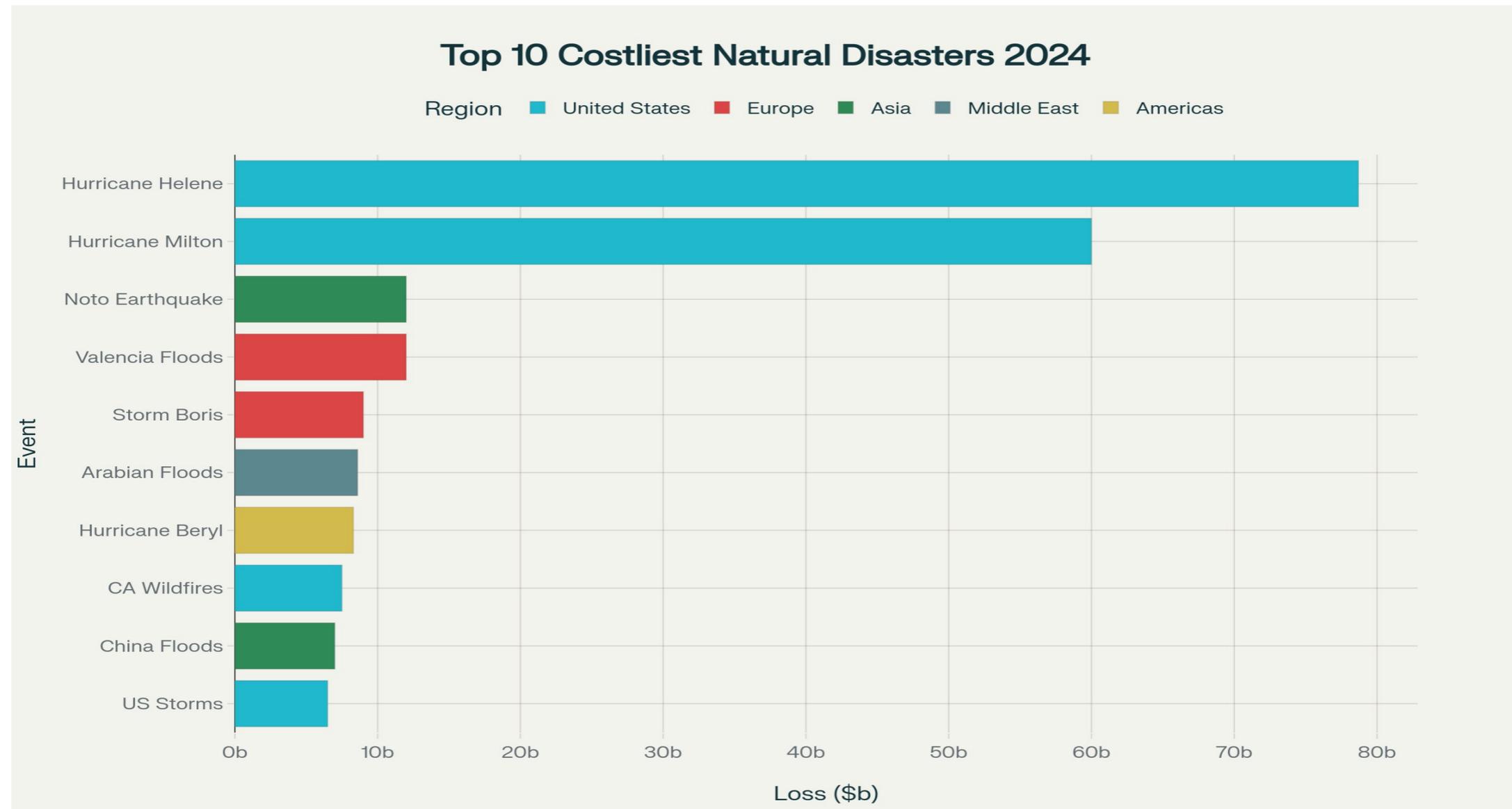
Insured losses reached approximately \$ 140-154 billion, representing only about 35-45% of total economic damage. This leaves a massive protection gap of \$180-263 billion in uninsured losses, highlighting the vulnerability of global economies to extreme weather events.



The United States dominated global disaster losses in 2024, accounting for **59.2% of worldwide economic damage** with \$218 billion in losses. This was primarily driven by devastating hurricanes, severe convective storms, and wildfires. Asia-Pacific followed with 20.1% (\$74 billion), while Europe, the Middle East, and Africa combined accounted for 13.9% (\$51 billion).

Global Distribution of Economic Losses from Natural Disasters by Region 2024

Most Devastating Events of 2024

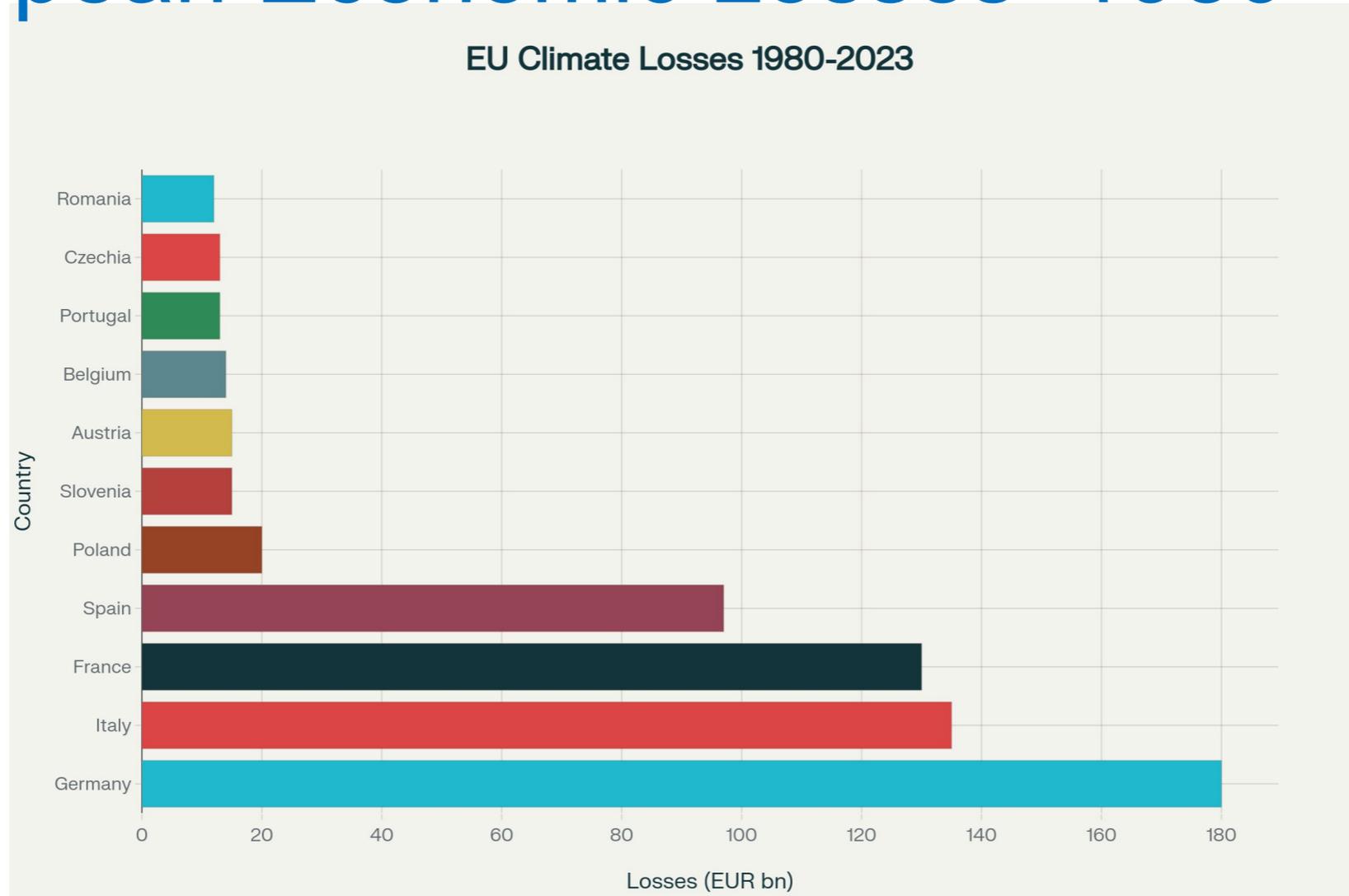


Hurricane Helene emerged as the single most costly disaster globally, causing \$78.7 billion in economic losses and marking the largest economic loss for any individual event in 2024.

Hurricane Milton followed with \$60 billion in damage.

European events featured prominently among the top disasters, with the Valencia floods in Spain causing \$12 billion in losses and Storm Boris affecting Central Europe with \$9 billion in damage.

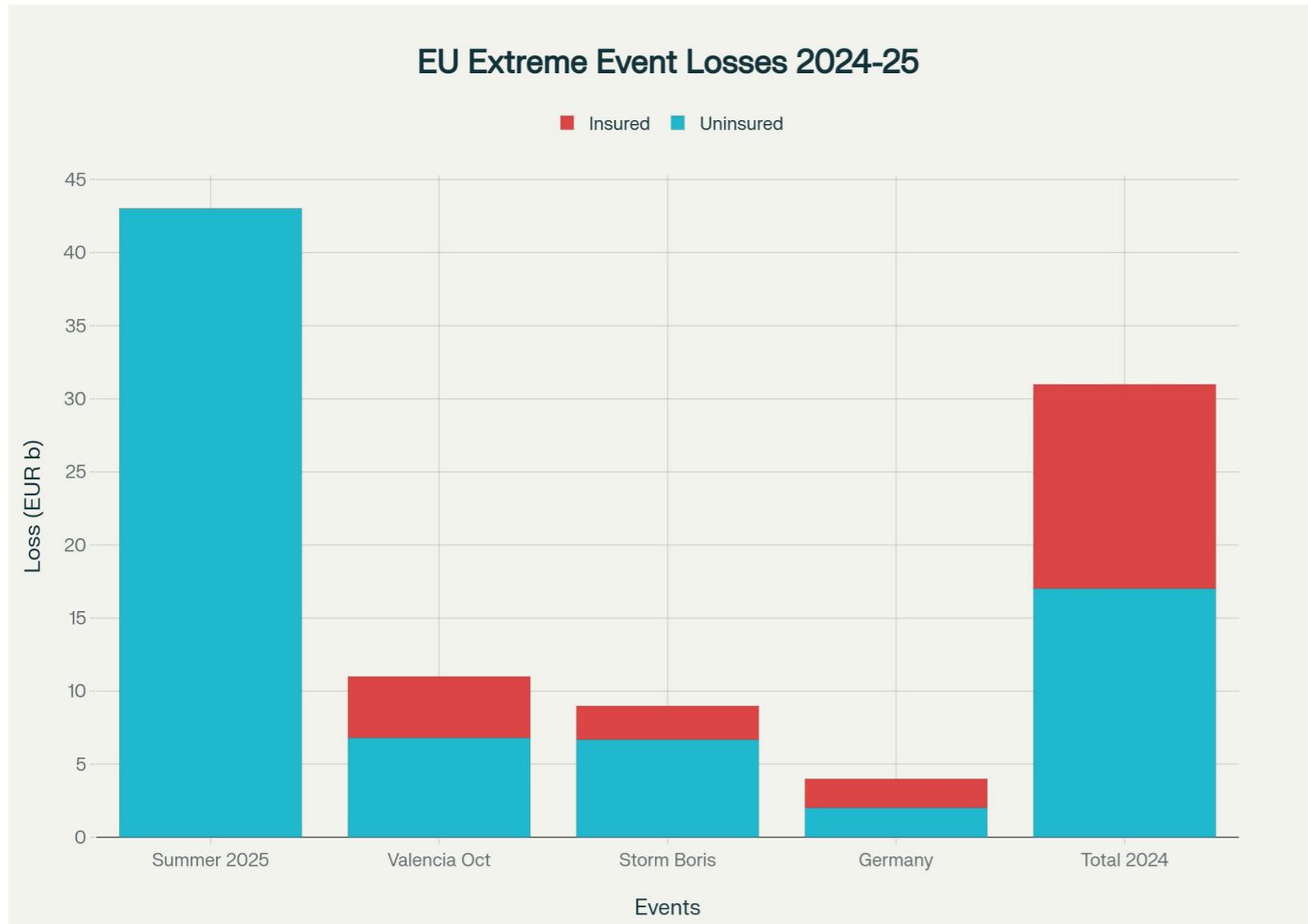
European Economic Losses 1980 -2023



European countries have experienced substantial cumulative losses from weather and climate-related extreme events over the past four decades. **Germany leads with €180 billion in total losses since 1980**, followed by Italy with €135 billion and France with €130 billion. These three countries account for nearly half of all European climate-related economic losses during this period.

Italy ranks second among European countries for climate-related economic losses. Remarkably, 85% of Italy's losses occurred in the 21st century, indicating an acceleration in climate impacts.

Recent European Losses 2024 2025

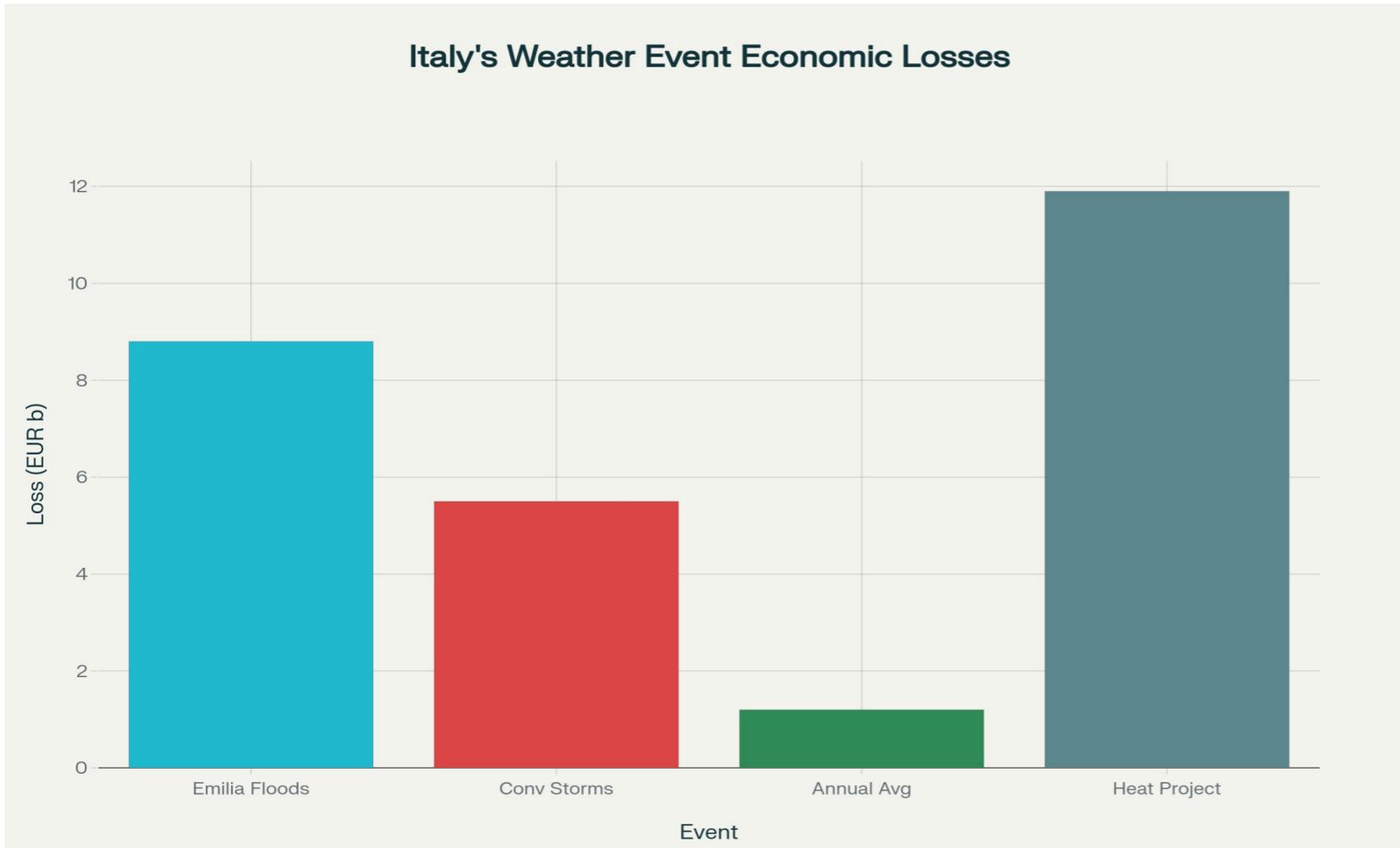


Europe faced severe economic impacts from extreme weather events in recent years. **Summer 2025 extreme weather events are projected to cause €43 billion in immediate losses**, with total costs potentially reaching €126 billion by 2029. This represents 0.26% of the EU's economic output.

In 2024, **European natural disasters caused approximately €31 billion in economic losses**, with only €14 billion covered by insurance. The most significant European event was the Valencia floods in October 2024, which caused €11 billion in economic damage and at least 200 fatalities.

Storm Boris, which affected nine Central European countries in September 2024, generated €9 billion in losses and was ranked as the world's eighth most expensive natural disaster of the year.

Italy's Economic Losses from Extreme Weather Events



Italy faces mounting economic pressures from climate change. **Between 1990-2023, climate-related extreme events caused €1.2 billion in annual average losses.** However, this figure significantly underestimates recent impacts, as losses have accelerated dramatically since 2016.

The **Emilia-Romagna floods in May 2023 caused €8.8-10 billion in economic damage**, making them the costliest weather catastrophe in Italian history. The floods affected 100 municipalities, displaced 36,000 people, and resulted in 17 fatalities.

However, due to low flood insurance penetration, **only €495 million of the total damage was covered by insurance**, representing less than 6% of total losses. This stark difference highlights Italy's significant insurance protection gap for natural disasters.

In the same year, **severe convective storms in northern Italy caused €5.5 billion in losses**, with €4.8 billion covered by insurance. This represents the highest ever recorded losses from severe convective storms in Europe.

Key Trends and Implications Accelerating Losses and Climate Change

The data reveals several alarming trends. **Global economic losses from natural disasters have been consistently exceeding \$100 billion annually for five consecutive years.**

Climate change is intensifying the frequency and severity of extreme events. The year 2024 was the first to clearly exceed 1.5°C above pre-industrial levels, contributing to more severe hurricanes, thunderstorms, and floods.

A massive protection gap exists globally, with **57 - 63% of natural disaster losses remaining uninsured.** This gap is particularly pronounced in Europe for certain perils.

Economic projections suggest worsening conditions ahead. **European climate-related losses could double by 2050 and triple by 2100.** In high warming scenarios, costs could reach 7% of EU GDP. For Italy specifically, the trend since 2016 shows economic losses increasing at a rate higher than the European average.

The mounting evidence indicates that **without enhanced climate action and adaptation measures, economic losses from extreme weather events will continue to escalate,** placing increasing strain on government finances, insurance systems, and economic development, particularly in vulnerable regions like Italy and southern Europe

Role of Geography in Weather Disaster

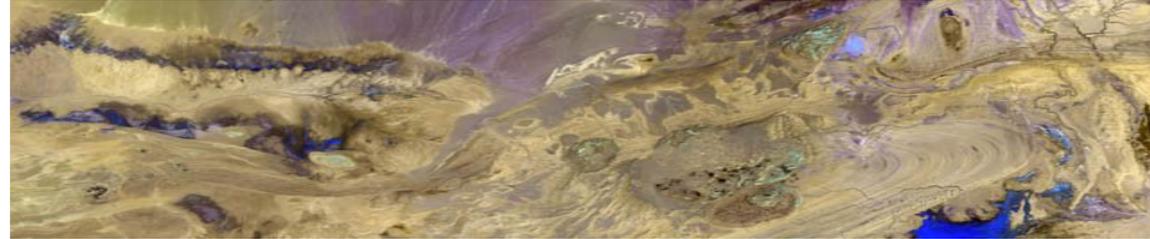
Geospatial disaster learning, which integrates spatial data collection and analysis with disaster education, significantly improves preparedness by increasing knowledge about natural disasters, their types, impacts, and management.

This spatial knowledge fosters quick, precise responses to disasters and enhances awareness and attitudes towards disaster risks in communities.

For example, people trained with geospatial technologies can better recognize environmental characteristics and effectively prepare for local disasters.



Use of Geospatial Technologies in Disaster Management



The application of GIS, remote sensing, and geographic information supports the entire disaster risk reduction cycle.

These technologies facilitate real-time data collection, hazard mapping, impact assessment, and coordination during crises.

They enhance decision-making for emergency management by providing precise spatial information about hazards and affected populations.

Geography studies provide essential tools and frameworks to analyze, predict, prepare for, and respond to extreme weather disasters, thereby reducing risks and improving community resilience.

Geography and extreme weather events

Geography studies play a crucial role in addressing disasters caused by extreme weather events by enhancing disaster preparedness, response strategies, and risk management through spatial knowledge and geospatial technologies.

Geography helps understand the spatial distribution and characteristics of natural disasters, enabling better planning and community resilience.

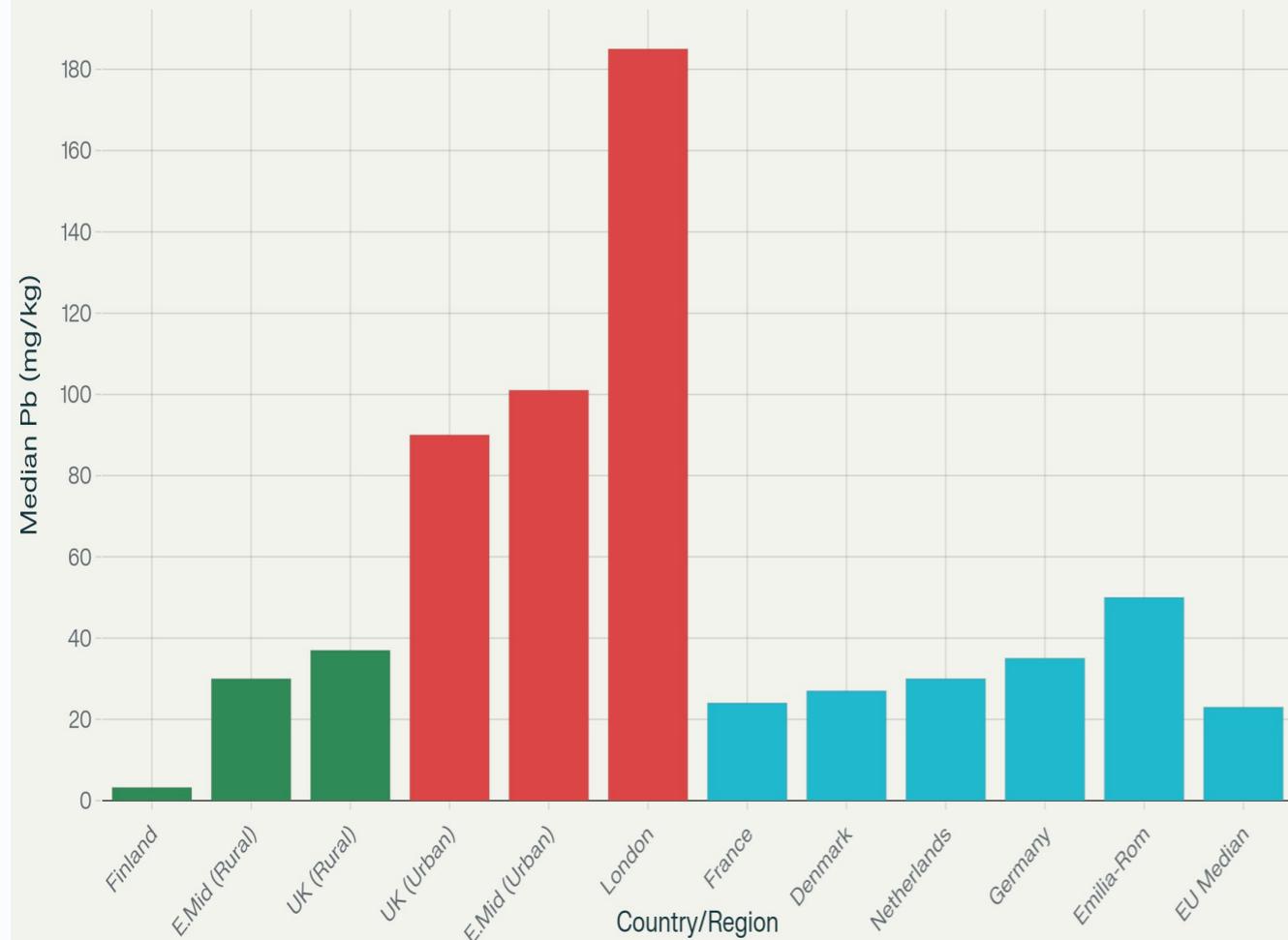


Case study: Proposed lead ban

Current Lead Concentrations in soils

Pb Concentrations in European Soils

■ Rural ■ Urban ■ National ■ Continental



23

Agricultural Soils

Median lead concentration (mg/kg) across European agricultural soils

185

Urban Peak

Maximum concentrations (mg/kg) in London urban areas

3.2

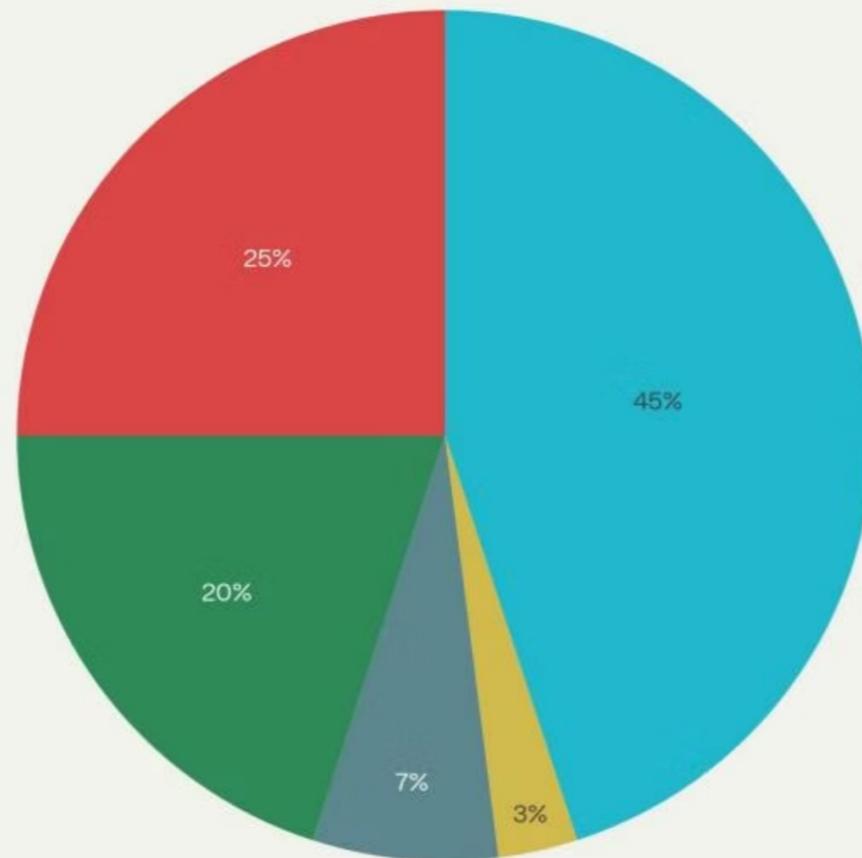
Cleanest Soils

Lowest concentrations (mg/kg) in Finnish glacial till soils

Sources of Lead Contamination

EU Soil Lead Contamination Sources

■ Hist. Gasoline ■ Lead Paint ■ Industrial ■ Hunting Ammo ■ Agricultural



Leaded Gasoline

45% of total contamination - phased out by 2021 after releasing 4-5 million metric tons across EU territory

Lead-Based Paint

25% of contamination - creates localized hotspots exceeding 10,000 mg/kg near pre-1950 buildings

Industrial Emissions

15% of contamination - oldest source with 5,600 years of continuous pollution evidence

Hunting Ammunition

4% of contamination - ongoing source releasing 44,000 tonnes annually across EU

Health Impact: Blood Lead Decline

1

Peak Contamination

1980s: 5 ng/m³ atmospheric lead in Central Europe from gasoline emissions

2

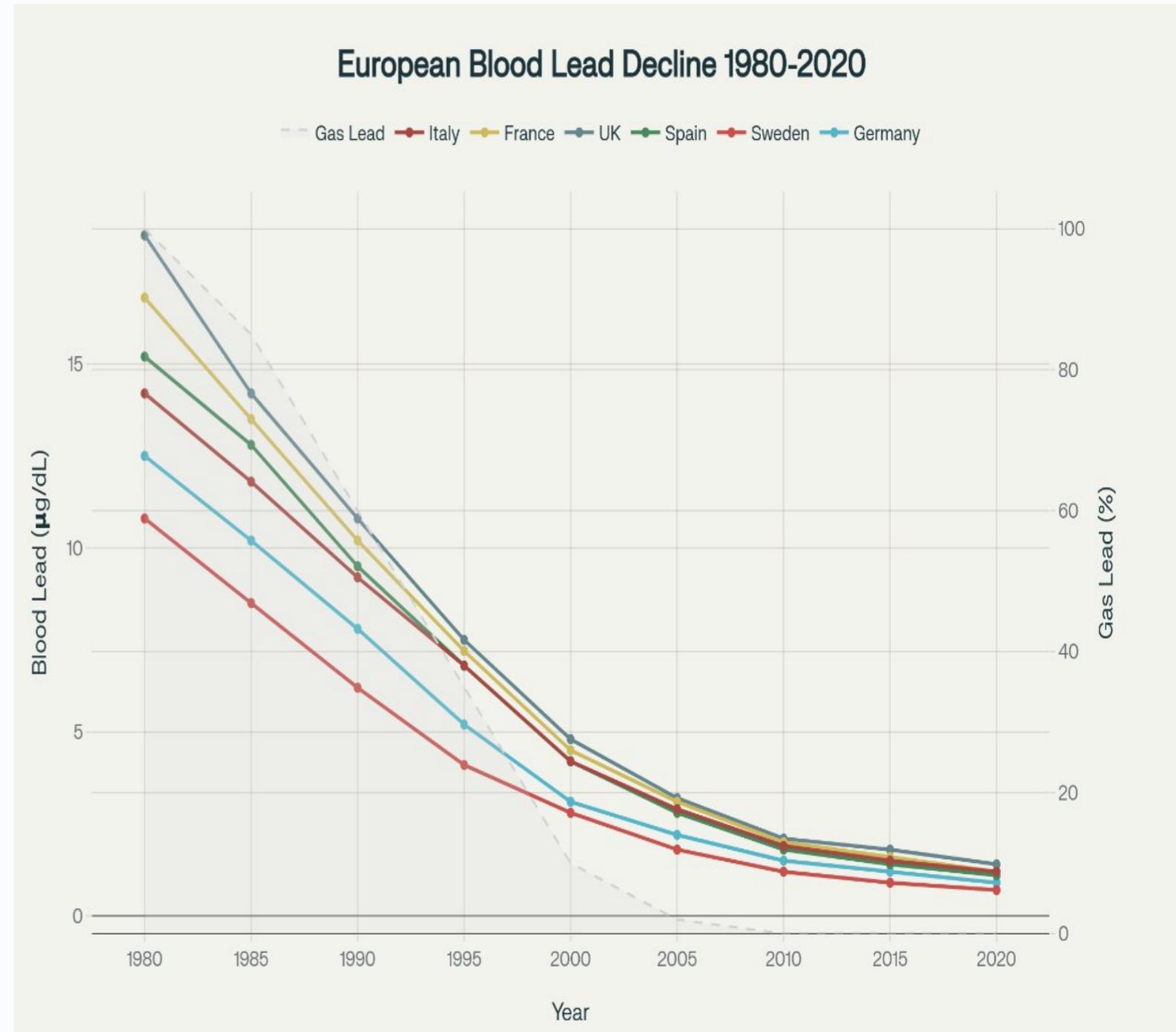
Gasoline Phase-Out

Algeria became last country to ban leaded gasoline in 2021

3

Health Recovery

77-93% decline in blood lead levels across all European countries studied



Blood lead level trends in European countries showing decline after leaded gasoline phase-out

Lead Use in European Manufacturing

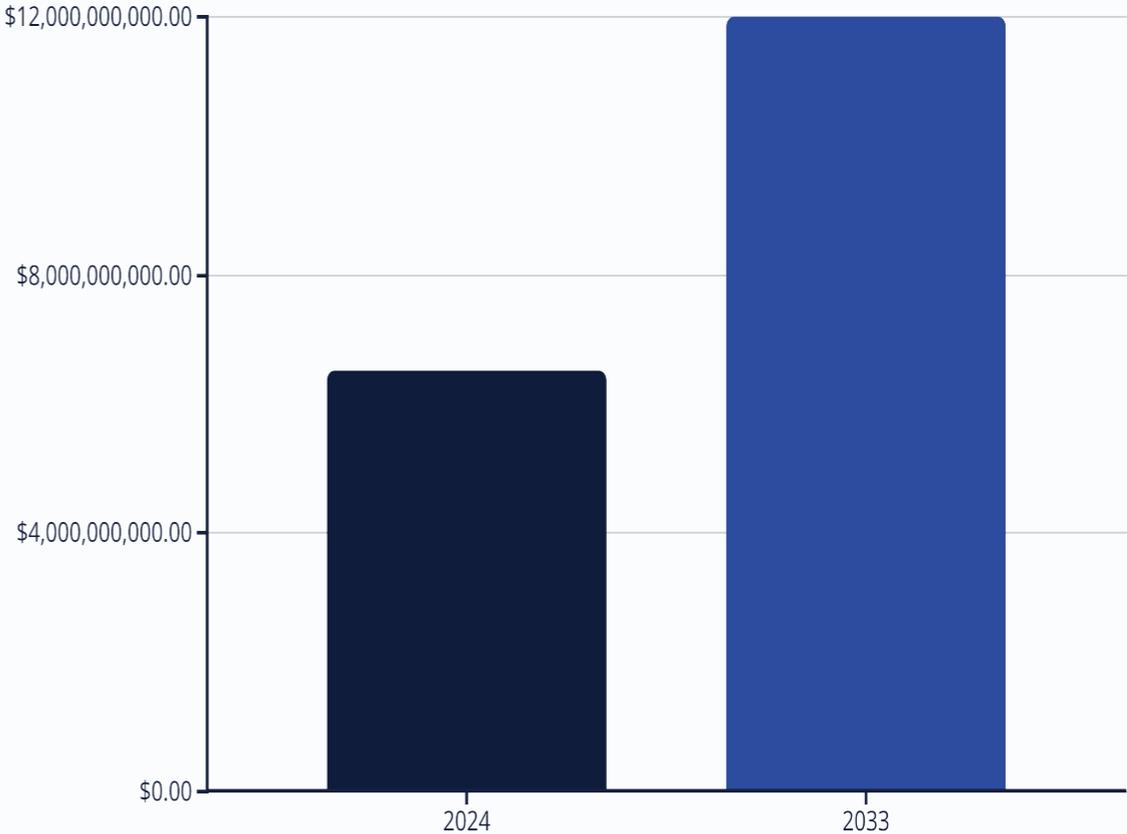
Automotive Batteries

€4.87 billion production value, 13.8 million employees, 80% recycled materials in lead-acid batteries

Ammunition Industry

€6.5 billion market growing to €12.0 billion by 2033 at 7.01% CAGR

Ammunition Market Growth



Consequences of Lead Ammunition Ban in Europe



Environmental Benefit (ECHA Report)

Human Health Benefits

- Lead is highly toxic with no safe exposure level, causing neurodegenerative, cardiovascular, renal, reproductive effects, and developmental neurotoxicity particularly in children.
- An estimated 1,000,000 children across Europe are currently at risk of lead exposure from ammunition.
- The ban would reduce lead contamination in game meat consumed by hunters and their families, thereby reducing lead ingestion risks.
- Lead exposure affects neuromotor function, academic achievement, behavior, attention, and executive function in children.

Environmental Benefit (ECHA Report)

Environmental and Wildlife Benefits

- Approximately 44,000 tonnes of lead ammunition and fishing weights enter the European environment annually, causing poisoning in wildlife, contaminating water, soil and food chains.
- The ban would prevent the death of around 1 million birds annually from lead poisoning **in wetlands**.
- Recovery of populations such as the mute swan in the UK was observed following lead fishing gear bans.
- Reduces contamination risks for animals, pets, livestock, soil and water bodies.

Environmental Benefit (ECHA Report)

Economic and Social Benefits

- Scientific assessments show switching to non-lead alternatives would not significantly affect profits for commercial fishers and represent a small cost for recreational fishing.
- Hunters and fishers also benefit from improved food safety and sustainability.
- Non-toxic alternatives open guaranteed markets for compliant products and reduce health risks from exposure through inhalation and ingestion.

Massive Economic Losses (Other studies)

€ 5.7B

Annual Hunting Losses

Direct economic losses from reduced hunting activity across EU-27 countries

€ 14.5B

Firearm Replacement

One-off costs for modifying millions of existing firearms incompatible with alternatives

€ 4B

Industry Revenue Loss

Annual losses to ammunition and firearms industry across European Economic Area

Based on European Shooting Sports Forum study of over 18,000 hunter responses.

Infrastructure and Employment Crisis

Shooting Range Upgrades

Independent analysis reveals €5.5-6.2 billion needed for compliance - nearly 6x higher than ECHA's €1.094 billion estimate.

Range Closures

Most shooting ranges face closure due to inability to meet massive compliance requirements and upgrade costs.

16,000+ Direct Job Losses

Immediate employment impact across ammunition and firearms industry with €1.4 billion in associated welfare costs.

20% Business Closures

Small and medium-sized manufacturers particularly vulnerable, with half the European industry facing serious setbacks.

Supply Chain Collapse

Impact extends to 200 distributors, 14,000 retailers, and over 300,000 collectors dependent on hunting markets.

Critical Supply Chain Dependencies



Chinese Dominance

China controls 90% of global tungsten production and significant bismuth supply chains



Strategic Vulnerability

European ammunition supply vulnerable to geopolitical tensions and export restrictions



Supply Security Risk

Alternative materials largely imported from outside European Economic Area



Consequences of Lead Ammunition Ban in Europe

- Lead is highly toxic with no safe exposure level.
- Reduction of contamination of hunting grounds.
- Decrease in diseases caused by ingestion of meat contaminated with lead.
- Death of around 1 million birds annually from lead poisoning.
- Reduces contamination risks for animals, pets, livestock, soil, and water bodies.

- Massive economic losses.
- Compliance and infrastructure costs.
- Socioeconomic impacts.
- Critical raw material supply vulnerabilities.
- Technical and Environmental Challenges of Alternative Ammunition.
- Manufacturing and Performance Limitations of Alternatives.

A recent analysis of the University of Urbino estimated (calculating the induced economic and employment effects) that the total value of the European civilian firearms and ammunition sector, amount to € 180B and about 1,1M employees.

Role of Geography in Evaluating Lead Ban

Geography studies can play a role in evaluating the outcomes—both positive and negative—of the ban on lead ammunition in Europe by analyzing spatial patterns of environmental contaminants, wildlife exposure, and human health risks.

Positive Consequences Evaluated Through Geography

Geography helps map contamination hotspots where lead ammunition is used, such as wetlands and hunting grounds, showing where lead poisoning impacts wildlife populations (e.g., waterbirds, vultures) most severely.

Spatial data illustrate declines in lead exposure where bans are enacted, such as Denmark's total ban reducing lead levels in game meat.

Geographic analysis aids assessment of human health risks correlated with lead exposure from game meat consumption regionally, especially for vulnerable groups like children and pregnant women.

It supports targeted public health interventions and awareness campaigns.

Role of Geography in Evaluating Lead Ban

Negative Consequences and Spatial Considerations

Geography uncovers regional variations in compliance, enforcement and economic impacts of bans, including potential concerns raised by some EU countries regarding defence readiness and local economic activities like fishing and hunting.

Mapping illegal use and spatial temporal trends can identify areas where further enforcement or education is needed.

It also highlights ecosystems or species at risk due to residual contamination or delayed full phase-out effects.

Studies can observe variations at the rural level, identifying degradation and abandonment of land and villages.

Thank you for your attention