

Mitigation and adaptation policies are urgently needed to avoid hundreds of thousands of deaths due to heat and cold extremes across Europe.



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Temperature-related mortality will strongly increase in Europe over the 21st century, though most of the deaths can be avoided by mitigating greenhouse gas emissions and adaptation policies

The current climate change trajectory could result in an almost 50% increase in temperature-related mortality linked to climate change across European urban areas by the end of the century. It was estimated that the total burden could reach more than two million deaths over the century under the Regional rivalry scenario (SSP3), while it can be contained under 700,000 deaths under the Sustainability scenario (SSP1).

The increase in deaths is linked to a surge in heat-related deaths that will outnumber a mild decrease in cold-related deaths for all considered scenarios. This net increase is expected to be far higher under more extreme climate change pathways, whereby the death rates associated with heat could rise ninefold by the end of the century.

There are strong geographical differences across Europe, with the net effect of climate change on temperature-related deaths projected to be particularly strong along the Mediterranean and Adriatic coasts, as well as in eastern European countries such as Romania and Bulgaria.

Adaptation measures through urban planning interventions aiming at decreasing urban heat, for instance through the increase in green areas and the reduction of urban heat island effects, can play a role in attenuating the health impacts.



Prague in spring. Photo: Gunnell E. Sandanger

## ! Research findings

Researchers in EXHAUSTION estimate that climate change will result in a clear-cut increase in temperature-related deaths in Europe across all climate change and socio-economic scenarios, from the mildest to the strongest. The increase is linked to a shift of the temperature distribution towards hotter values, resulting in a dramatic surge in heat-related deaths, largely offsetting an expected decrease in cold-related deaths. Projections by the researchers indicate that this increase will happen on top of a concurrent increase in vulnerability linked to population ageing.

The impact of climate change on temperature-related deaths will be particularly exacerbated in the Mediterranean region, where cold-related mortality is already low, as well as in the more vulnerable eastern part of Europe. Results indicate that Northern countries such as the British Isles or Norway could be spared by this increase, although the trend reverses under the most extreme warming scenarios.

## The potential role of adaptation policies

The comparison performed between various climate change scenarios suggests that mitigation is paramount to avoiding hundreds of thousands of temperature-related deaths. Adaptation policies that focus on reducing urban temperature and the urban heat island effect can play a role in reducing the mortality burden of climate change.

Further analyses show that increasing tree coverage by 30% across European urban areas could reduce summer mortality by almost 2%, while reducing urban heat island effects in cities could avoid several deaths each summer.

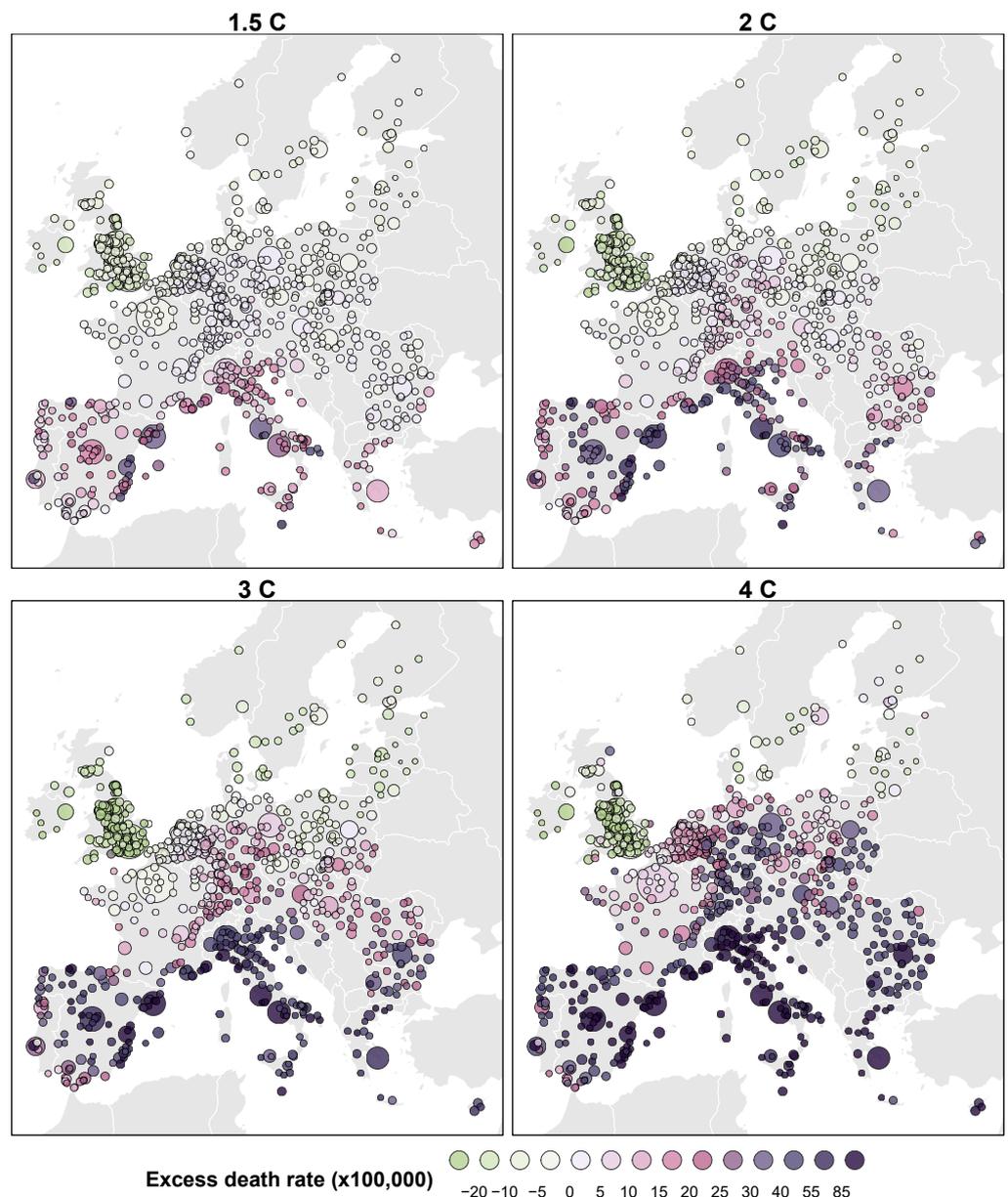


Figure 1: Excess deaths per 100,000 persons in 854 cities in Europe, under scenarios of increase in global mean temperature from 1.5°C to 4°C.

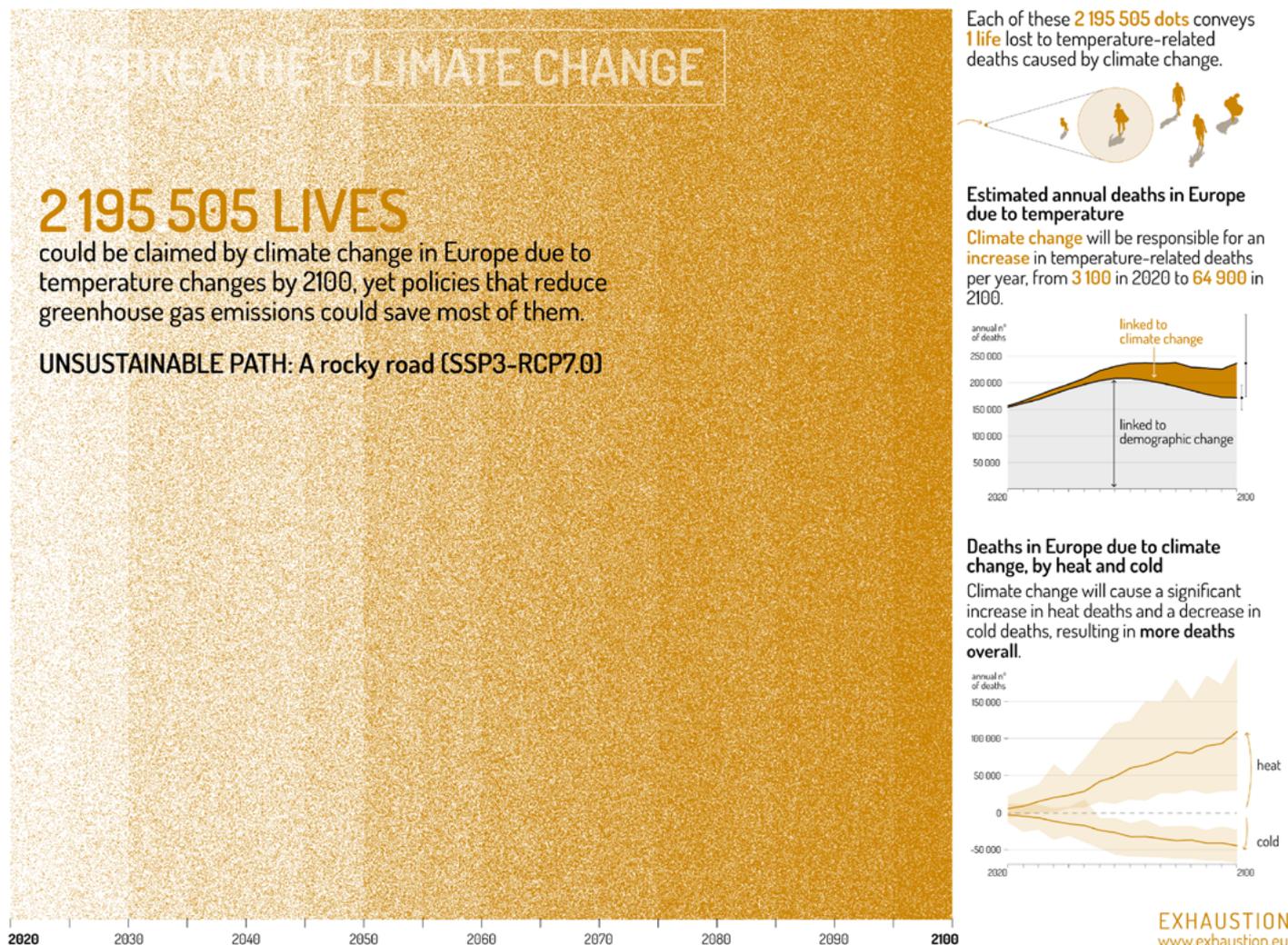


Figure 2: Data visualization by the EXHAUSTION project.

## Case study: Net effect of Climate Change in Italy

Among the 30 countries featured in the EXHAUSTION projections, Italy emerges as the country with the most dramatic climate change-related burden.

Mortality due to heat and cold extremes could increase by at least 3,000 annual deaths at a global warming level of 1.5°C above preindustrial levels and potentially up to 17,000 annual deaths if the 4°C mark is reached.

These numbers correspond to 18 additional deaths per 100,000 persons at 1.5°C and more than 120 additional deaths per 100,000 persons each year at 4°C. This increase is more than three times higher than the European average, and double the historical Italian toll of 100 deaths per 100,000 persons.





## Key policy recommendations

- Mitigation policies are the key to reduce temperature-related mortality. Policies focusing on rapidly reducing greenhouse gas emissions should be prioritised. Each passing year increases the death toll of climate change.
- Prioritise the most affected areas. Identification of cities with the highest vulnerabilities, and working with local stakeholders to understand how to provide support to the local population.
- Urban planning. There is evidence that planting trees would cool cities, decrease air pollution levels, and provide shade for the local populations. This and other policies should be considered to adapt our cities to a more extreme climate.



## Key research recommendations

- More research on the role of adaptation factors and policies. Vulnerability to heat and cold is very variable between locations, but little empirical evidence exists about the specific factors driving these differences in vulnerability.
- Rural population still represents around 40% of the European population and evidence is still limited on the association between temperature and mortality in rural areas.
- Understanding local vulnerabilities necessitates high-definition and standardised datasets on various local environmental, topological and socio-economic characteristics. Creating and facilitating the sharing of such resources is paramount to understanding how to protect the European population.

Publication date	First author	Last author	Title	Journal
16/03/2023	Pierre Masselot	Antonio Gasparrini	Excess mortality attributed to heat and cold: a health impact assessment study in 854 cities in Europe	The Lancet Planetary health
31/01/2023	Tamara Iungman	Mark Nieuwenhuijsen	Cooling cities through urban green infrastructure: a health impact assessment of European cities	The Lancet Planetary Health
17/11/2023	Wan Ting Katy Huang	Gabriele Manoli	Economic valuation of temperature-related mortality attributed to urban heat islands in European cities	Nature Communications

