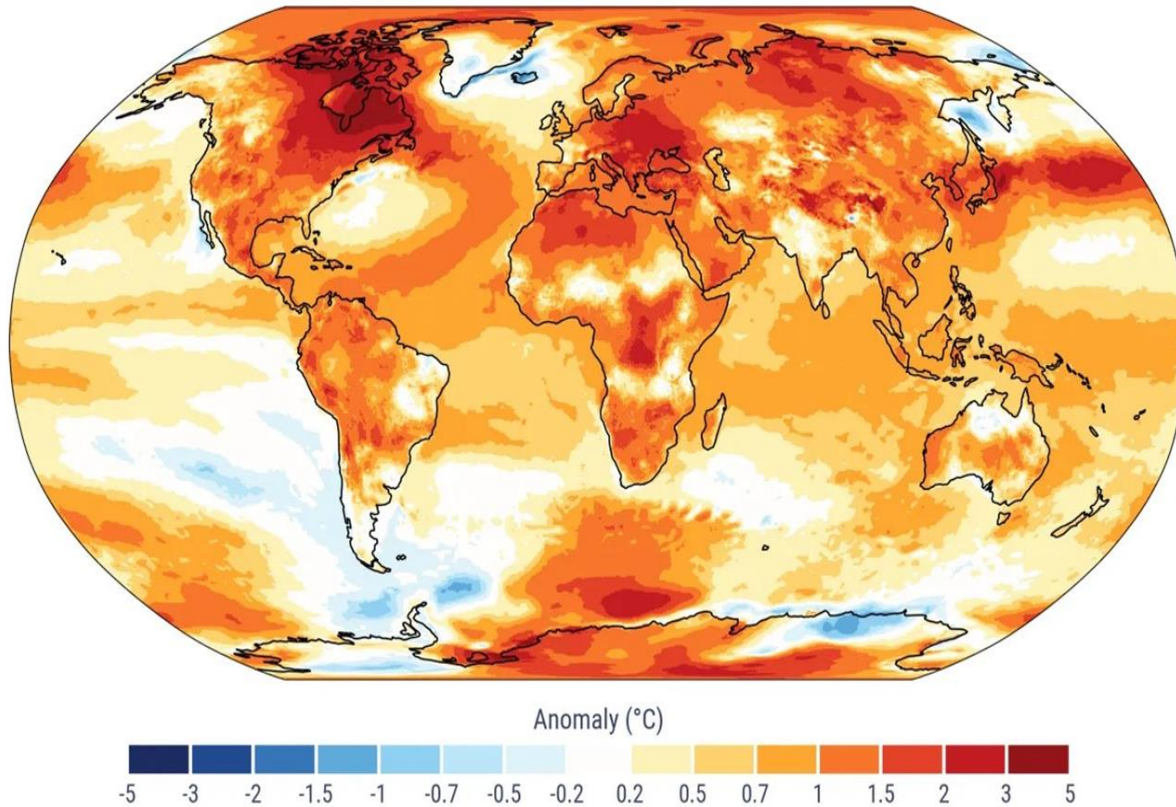


Climate change and health in 2026 and beyond



Surface air temperature anomalies in 2024

Data: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF



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MEDICINE



Climate Change
& Planetary
Health



[Ishtm.ac.uk/planetaryhealth](https://www.lshtm.ac.uk/planetaryhealth)

@LSHTM_Planet

Annual global mean temperature anomalies (°C) relative to 1850–1900 average



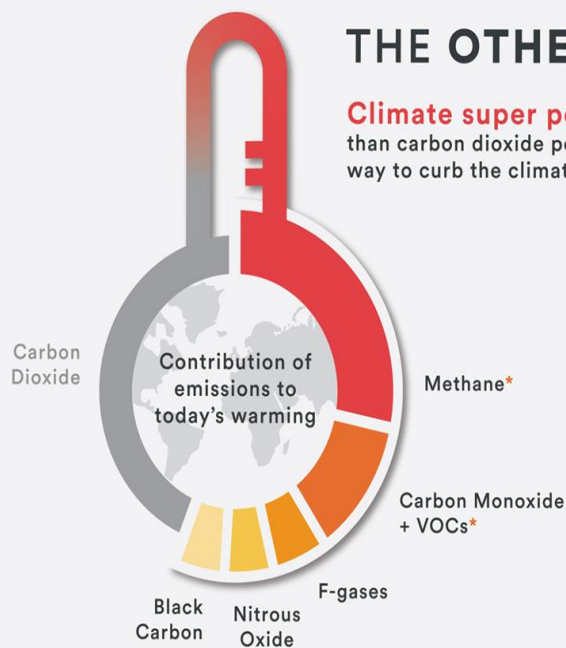
World Meteorological Organization. (2024). *State of the Global Climate 2023* (WMO-No. 1347). Geneva: World Meteorological Organization. ISBN 978-92-63-11347-4. <https://library.wmo.int/idurl/4/68576>

Andy Haines with thanks to many colleagues

Sources of Greenhouse Gases and Super Pollutants

THE OTHER HALF OF WARMING

Climate super pollutants are warming agents far more potent than carbon dioxide per ton—reducing their emissions is the quickest way to curb the climate crisis and it greatly improves air quality



*Leads to the formation of tropospheric ozone (warming agent + air pollutant)

Global average temperature change from 1850-1900 to 2010-2019. Data from IPCC AR6 WGI SPM Fig. 2c (2021)

<https://www.ccacoalition.org/news/super-pollutants>

Sources and scale of impact

Human-derived sources

Lifetime in atmosphere

Impacts

LOCAL REGIONAL GLOBAL

Black carbon (BC)



Days



Methane (CH₄)



12 years



Hydrofluorocarbons (HFCs)



15 years*

*(weighted by usage)



Tropospheric ozone (O₃)



Weeks



CO₂



N₂O



This graph has been updated with permission from CCAC.

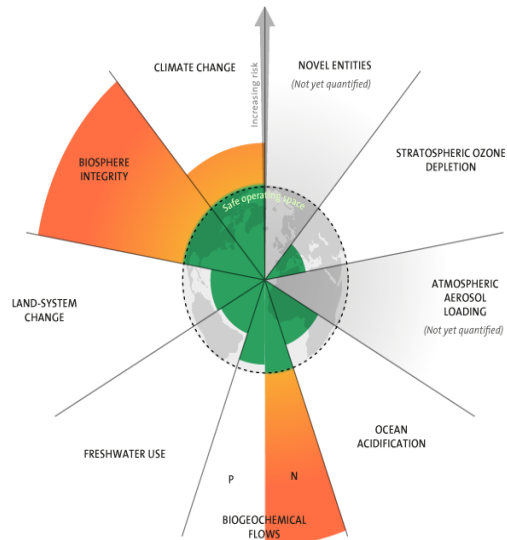


<https://www.carbonbrief.org/guest-post-how-super-pollutants-harm-human-health-and-worsen-climate-change/>



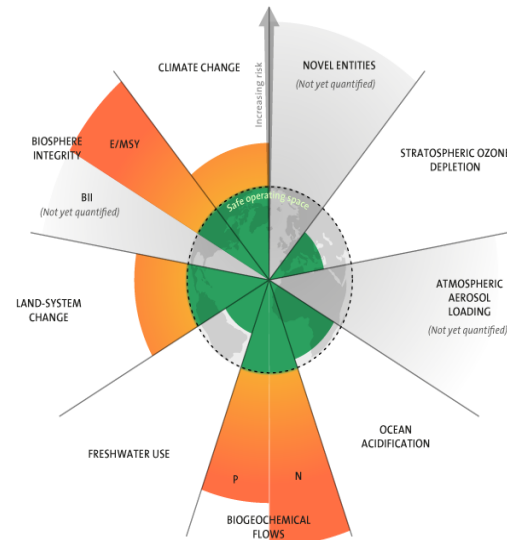
The evolution of the planetary boundaries framework

2009



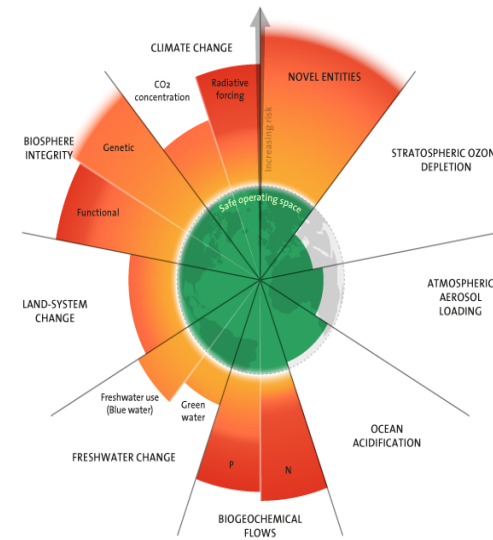
7 boundaries assessed,
3 crossed

2015



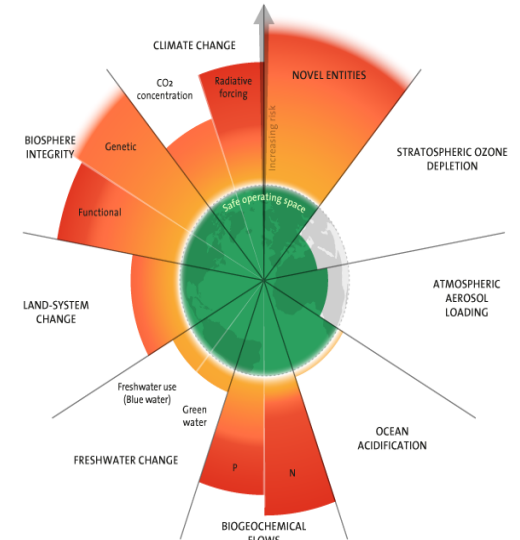
7 boundaries assessed,
4 crossed

2023



9 boundaries assessed,
6 crossed

2025

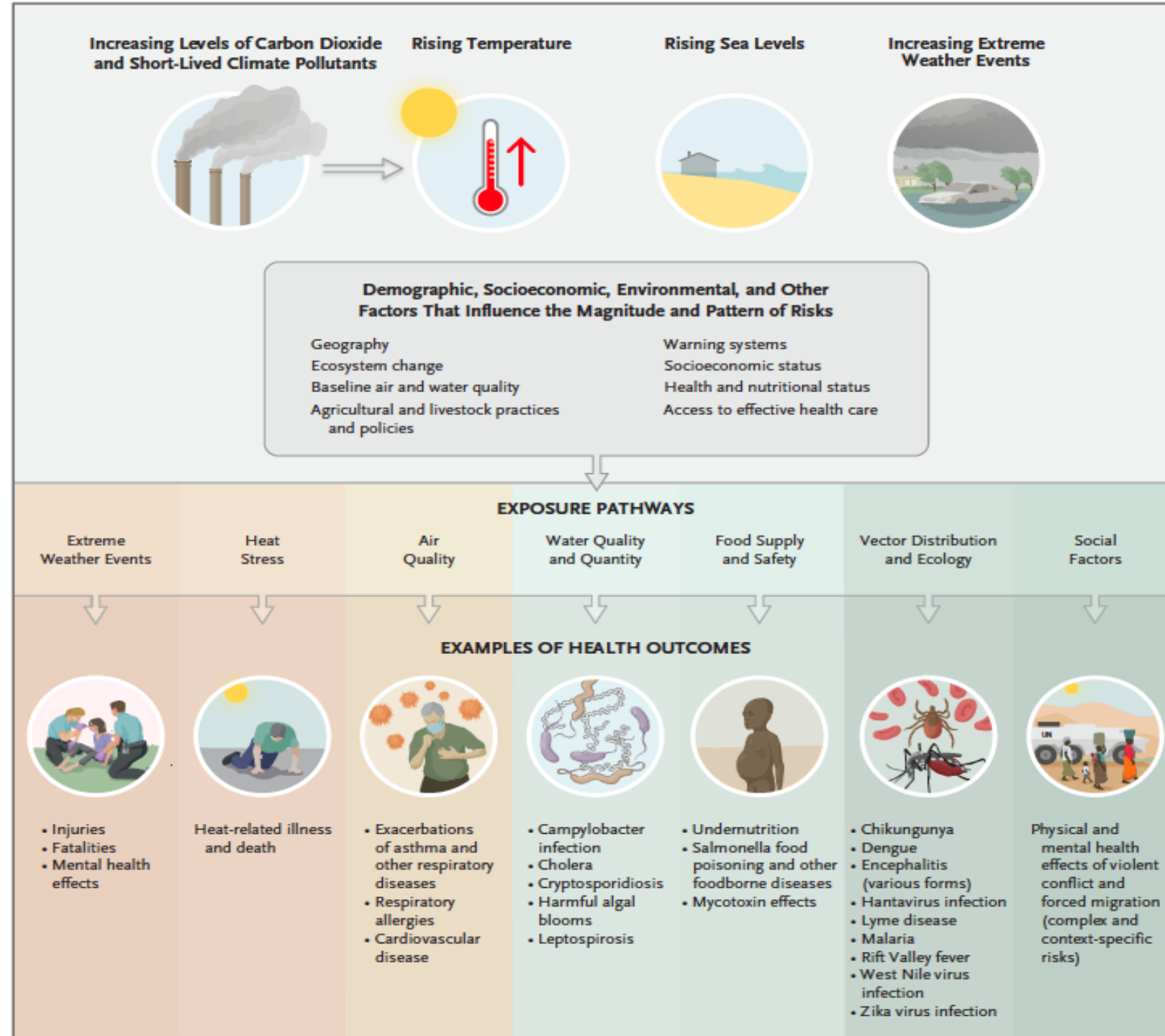


9 boundaries assessed,
7 crossed

**GHG emissions
concentrated in high-
income and emerging
economies**

**Impacts concentrated in
low- and middle-income
countries**

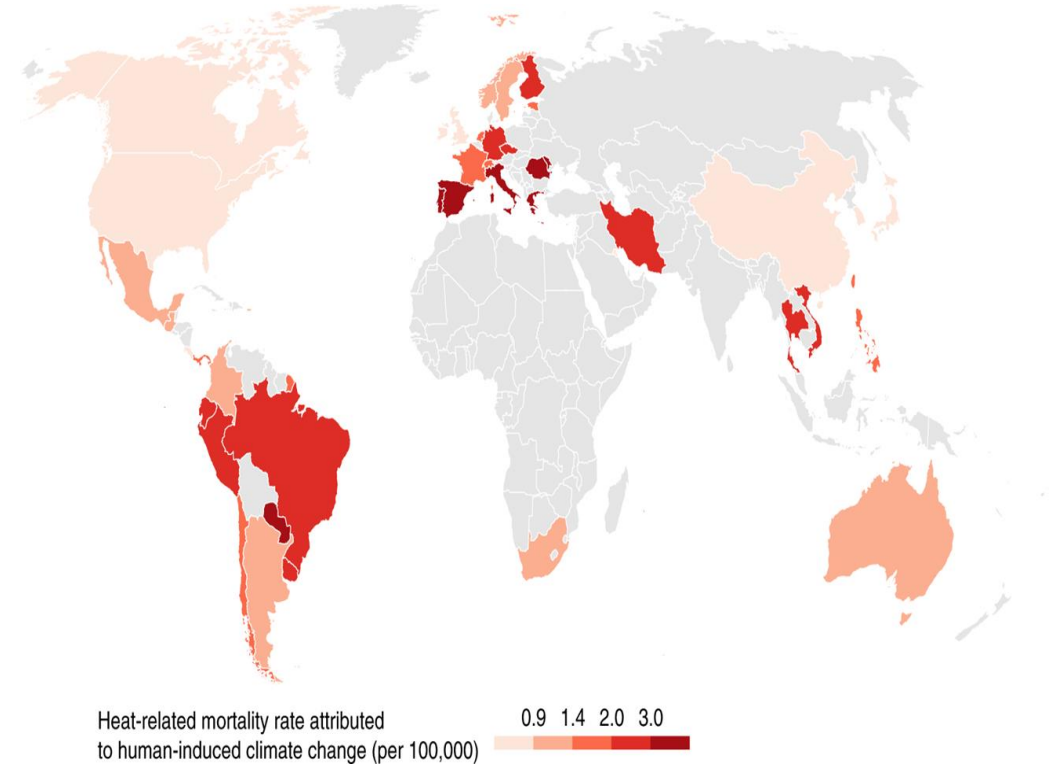
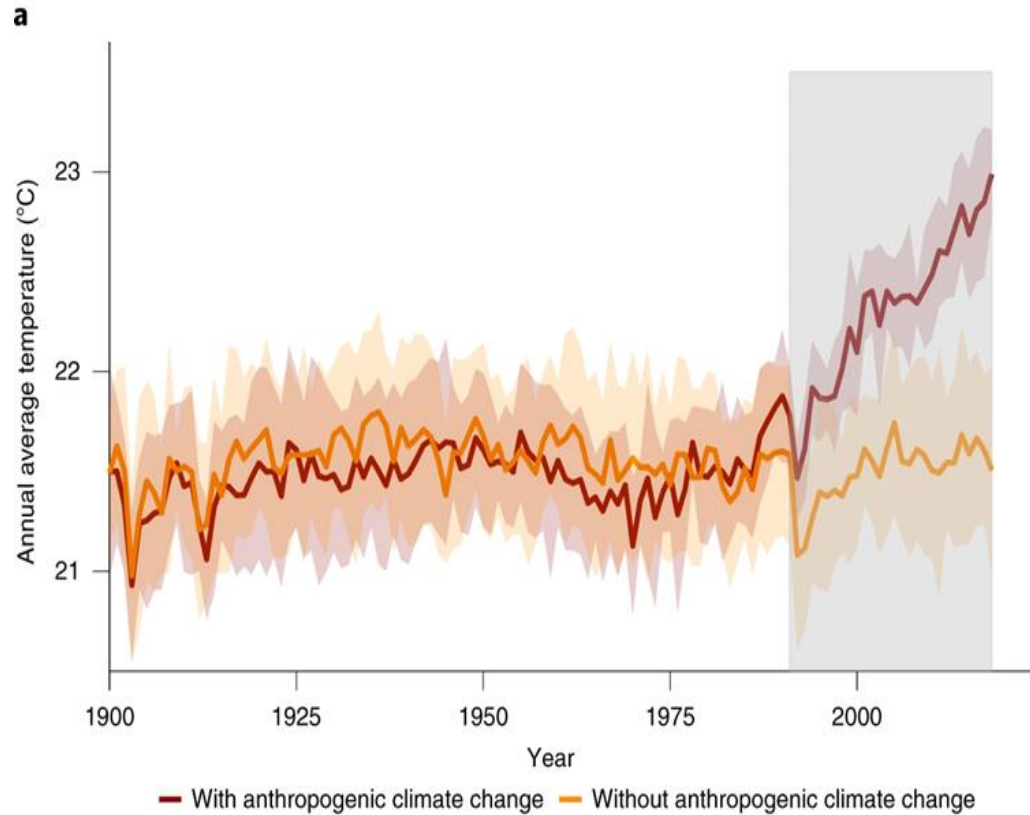
(Haines and Ebi NEJM 2019)



Detecting and attributing health impacts to climate change.

More than 35% of the total heat deaths from 1990-2018 attributed to human-induced climate change using data from 732 sites in 43 countries. No data for much of Africa and Asia

(Vicedo-Cabrera et al Nature Climate Change 2021).

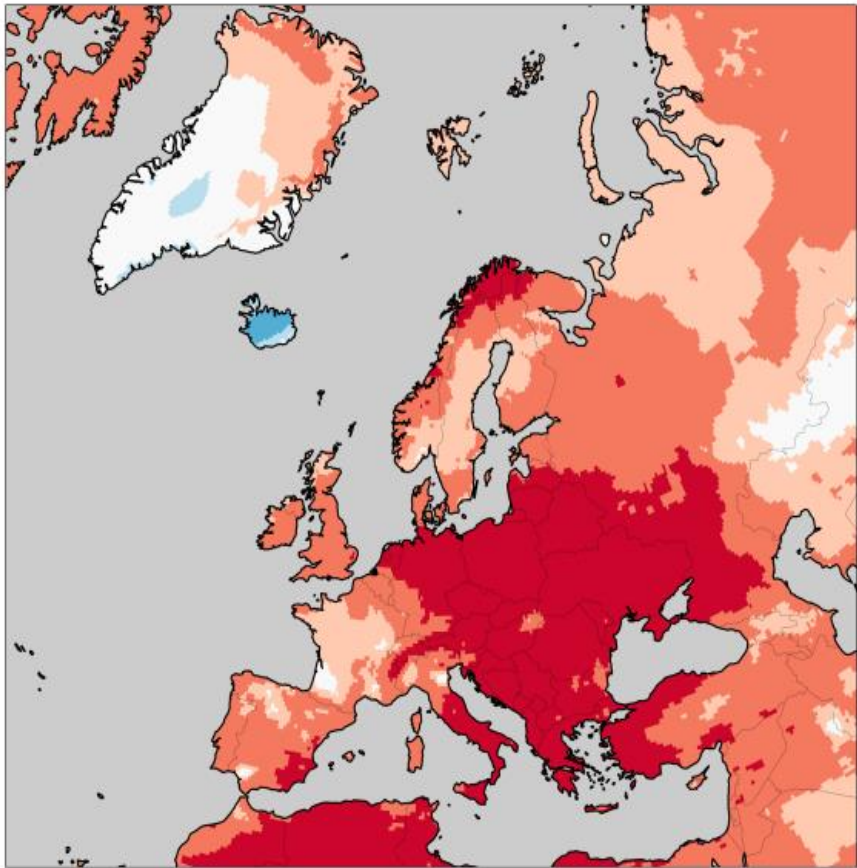


The attribution of human health outcomes to climate change: a transdisciplinary guidance document Ebi, Haines et al Clim. Change. 2025 doi: 10.1007/s10584-025-03976-7.

Europe is the most rapidly heating world region

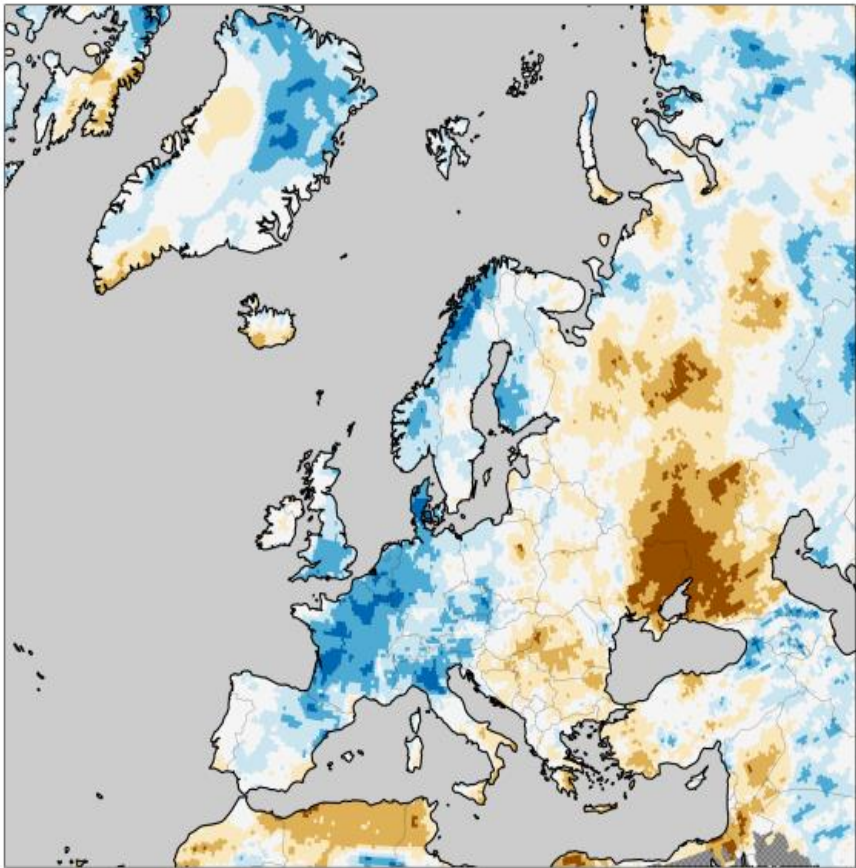
Anomalies and extremes in surface air temperature in 2024

Data: ERA5 (1979–2024) • Reference period: 1991–2020 • Credit: C3S/ECMWF



Anomalies and extremes in annual precipitation in 2024

Data: ERA5 (1979–2024) • Reference period: 1991–2020 • Credit: C3S/ECMWF



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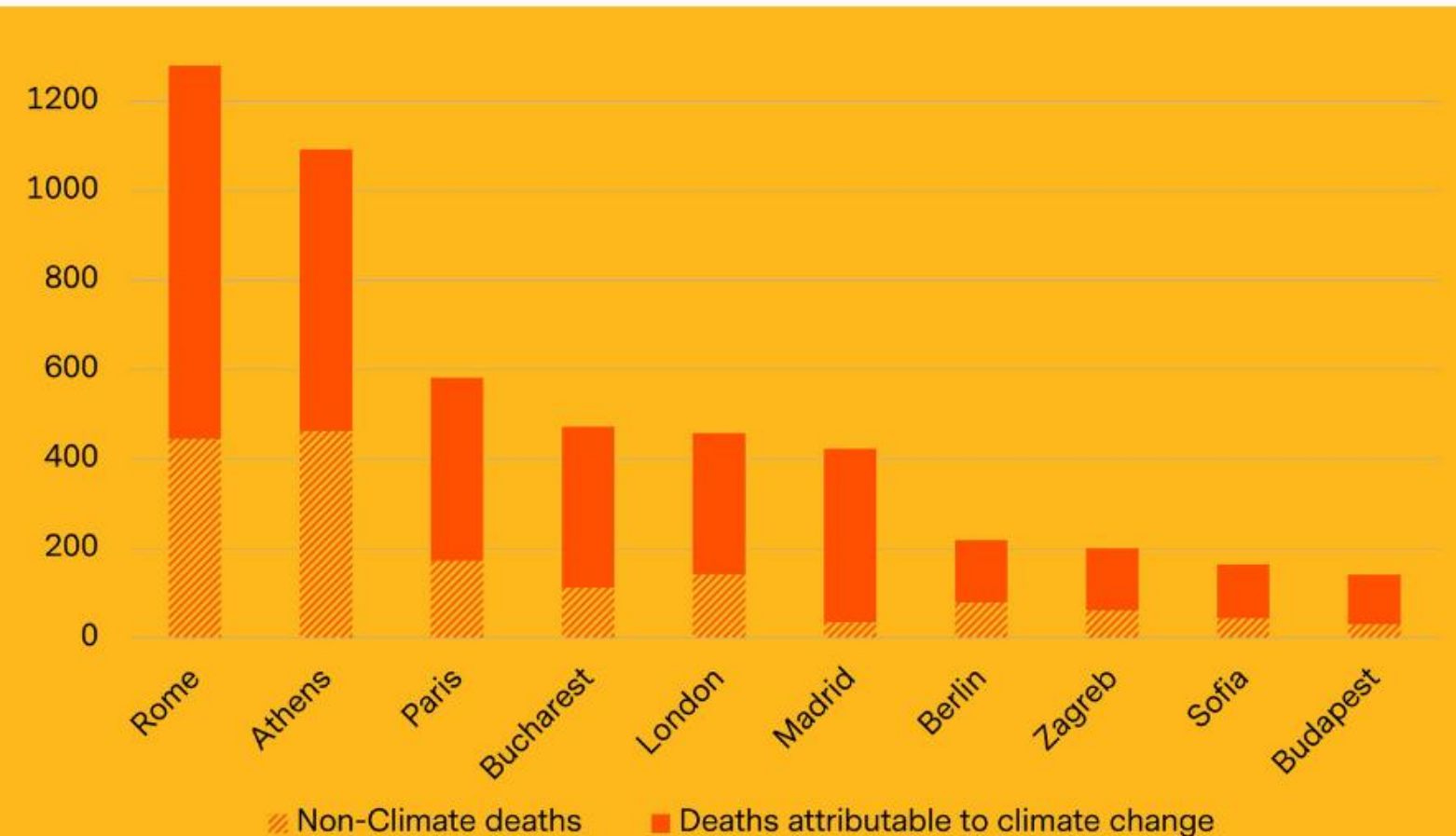
IMPLEMENTED BY



In 854 European cities, climate change was responsible for 68% of the 24,400 estimated heat deaths during summer 2025

<https://spiral.imperial.ac.uk/bitstreams/4d5b1a8a-c5ed-47fd-894c-f05ae31ae69d/download>

Estimated excess heat-related deaths in European capital cities in Summer 2025



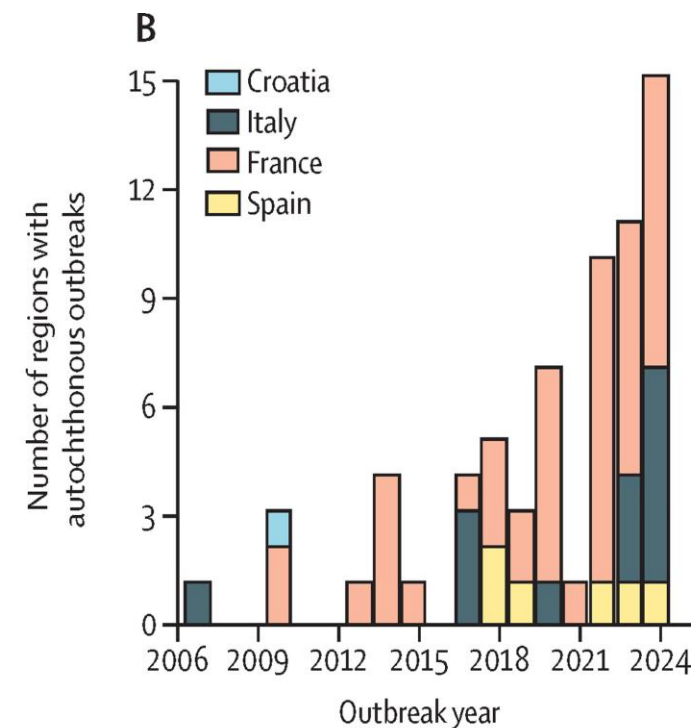
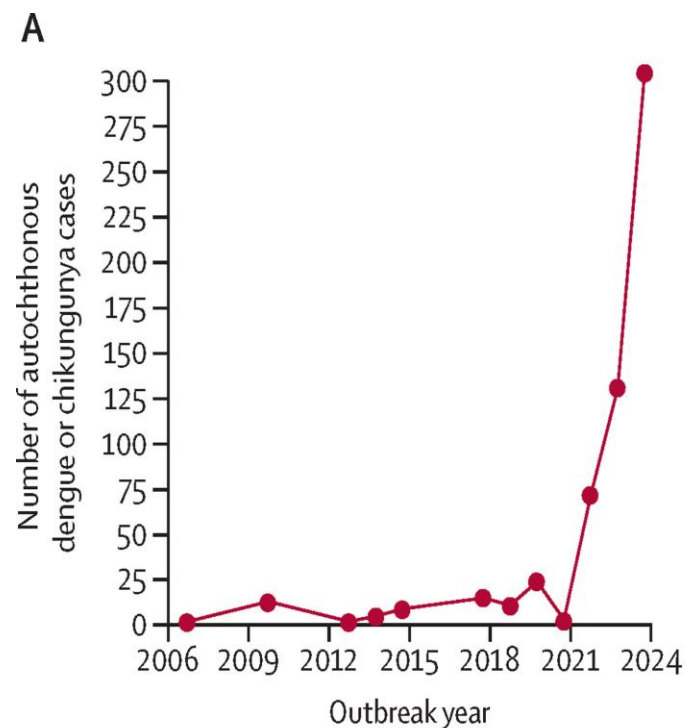
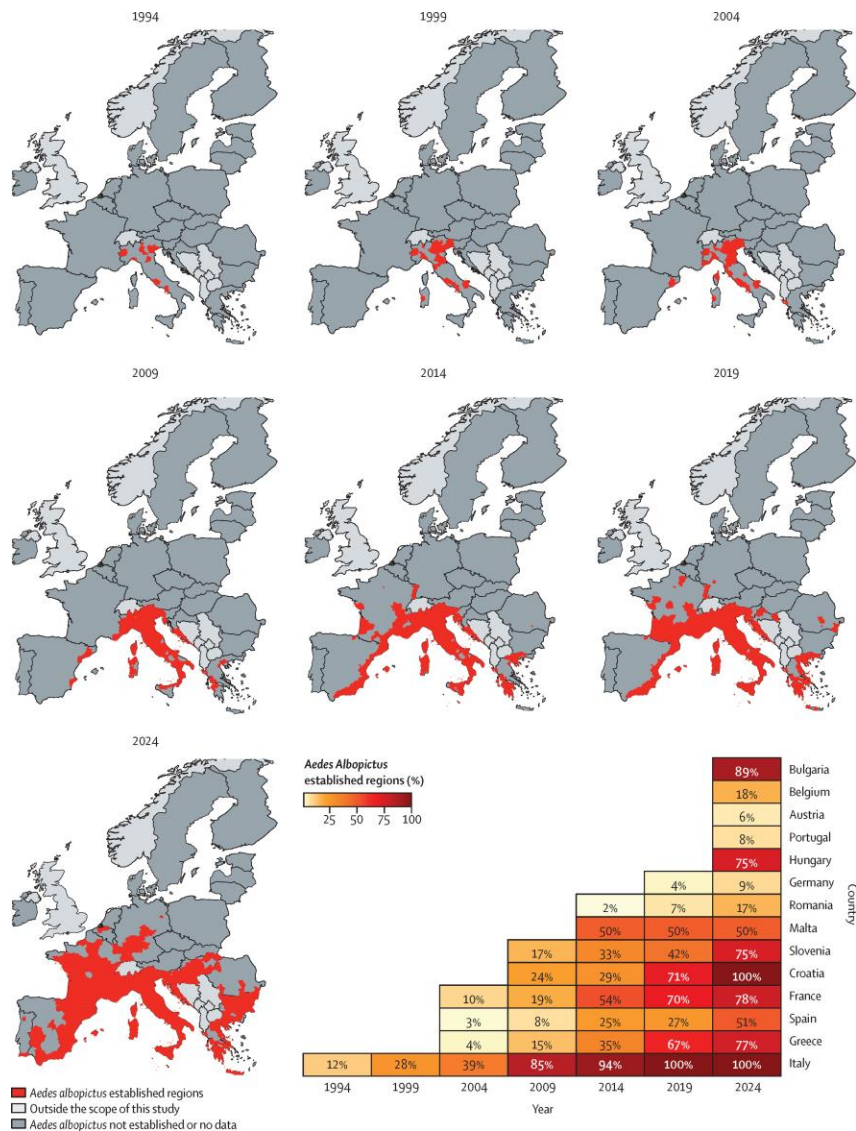
Over 2.3 million additional temperature-related deaths projected in these cities by 2099. Up to 70% of these deaths could be prevented with rapid action .(Masselot P et al Nature Medicine 2025)



<https://eu-mayors.ec.europa.eu/en/news/extreme-heat-threatens-european-cities>
-new-campaign-mobilises-local-action

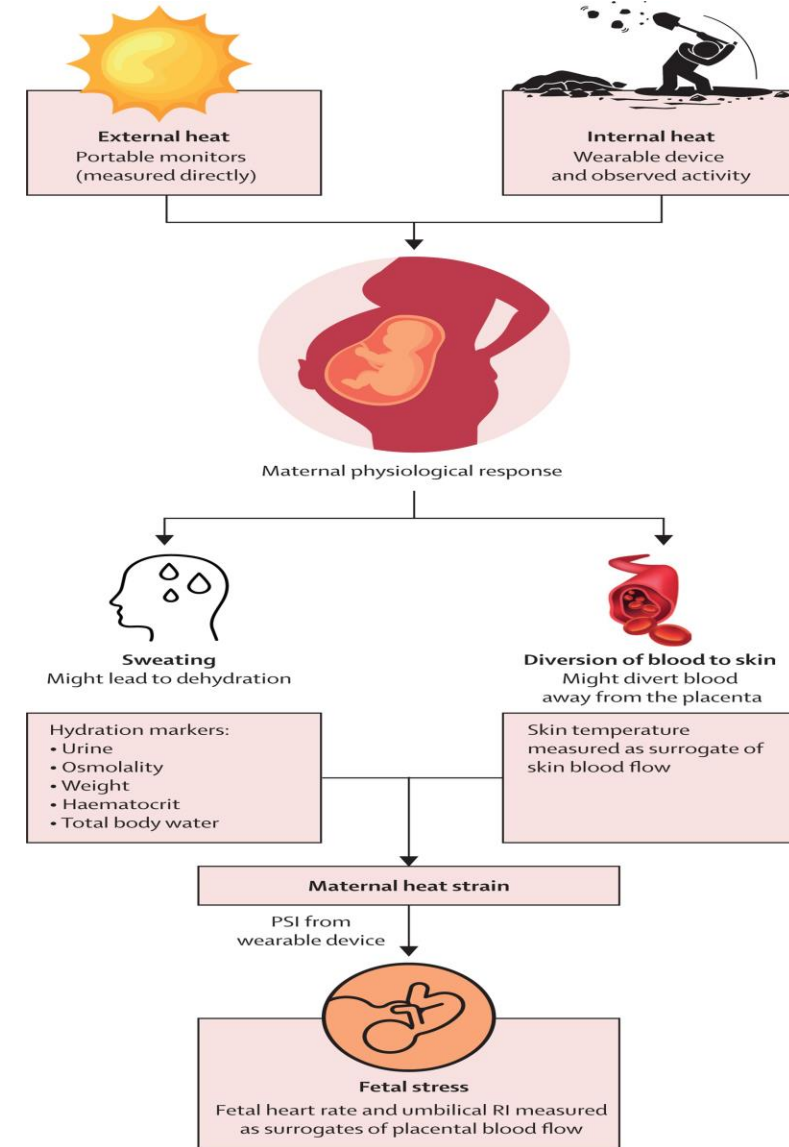
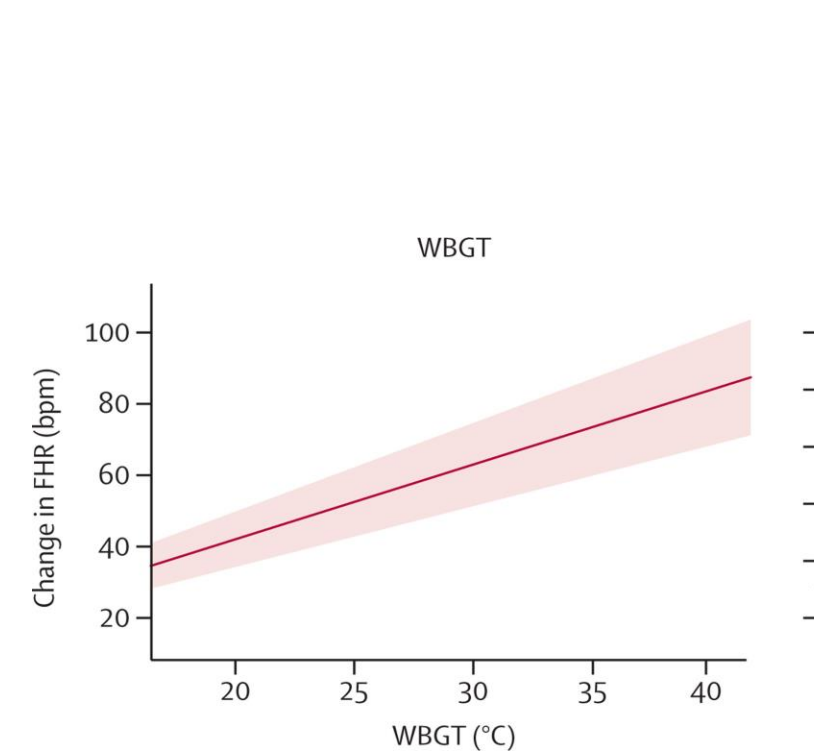
Rapid spread of vector mosquito for chikungunya and dengue Farooq et al

[https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(25\)00059-2/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(25)00059-2/fulltext)



Extreme heat exposure in pregnant women subsistence farmers in The Gambia

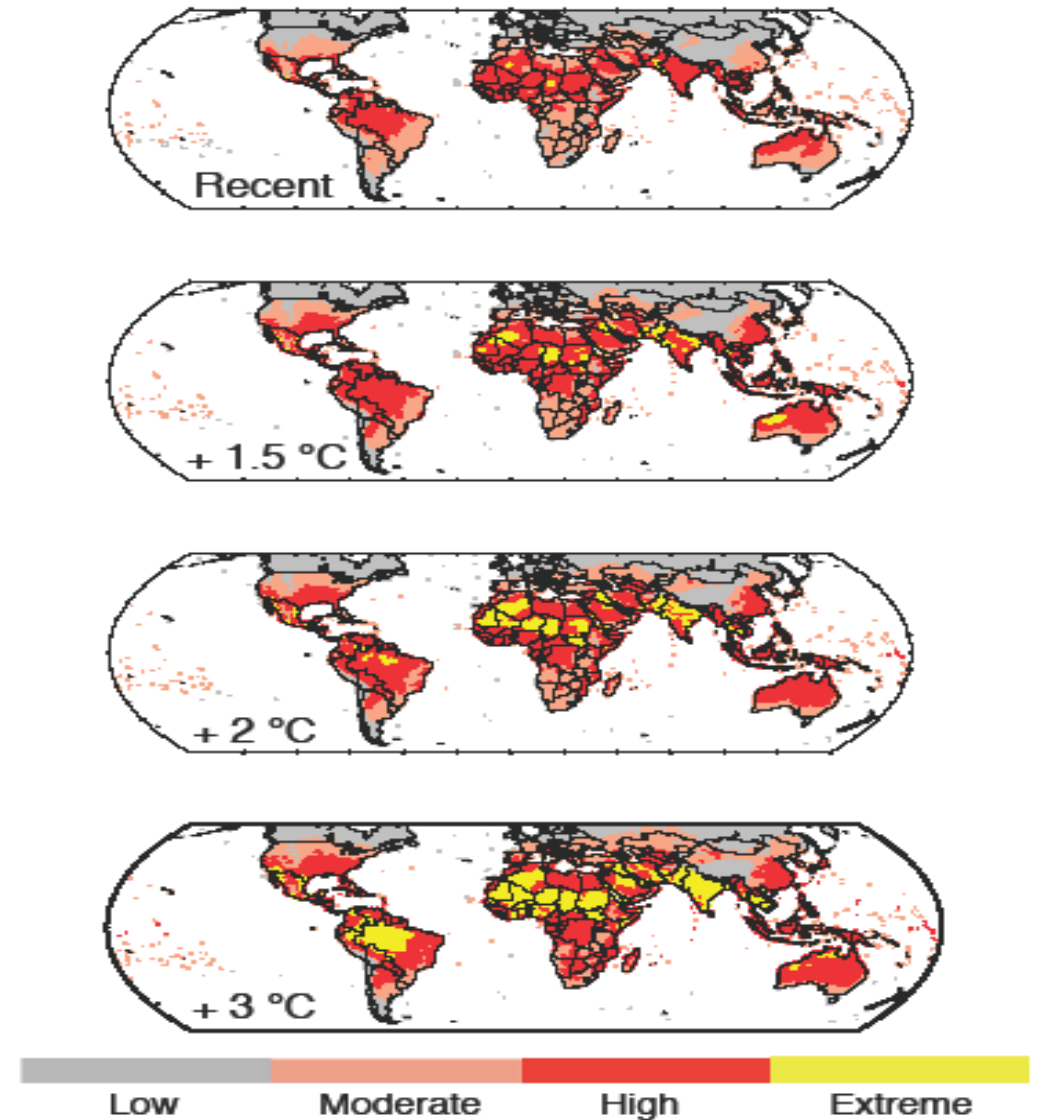
(Ana Bonell et al Lancet Planetary Health 2022)



~1 billion people exposed to extreme heat preventing moderate physical labour in the hottest month after global temperature >2.5°C above pre-industrial levels.

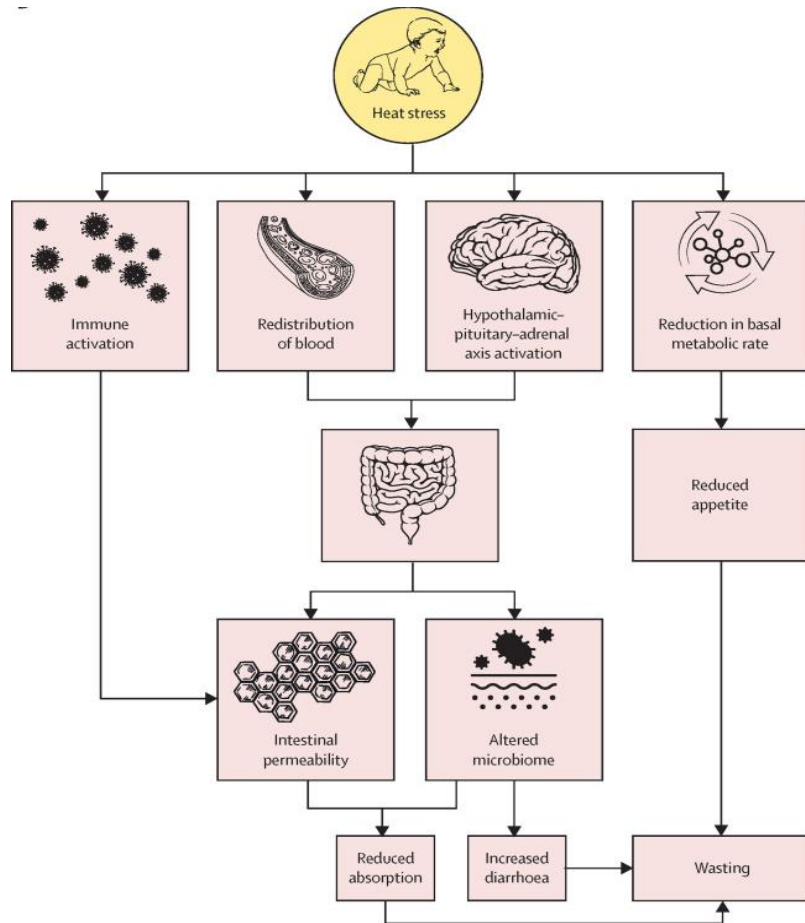


(Andrews et al 2018 Lancet Planetary Health)

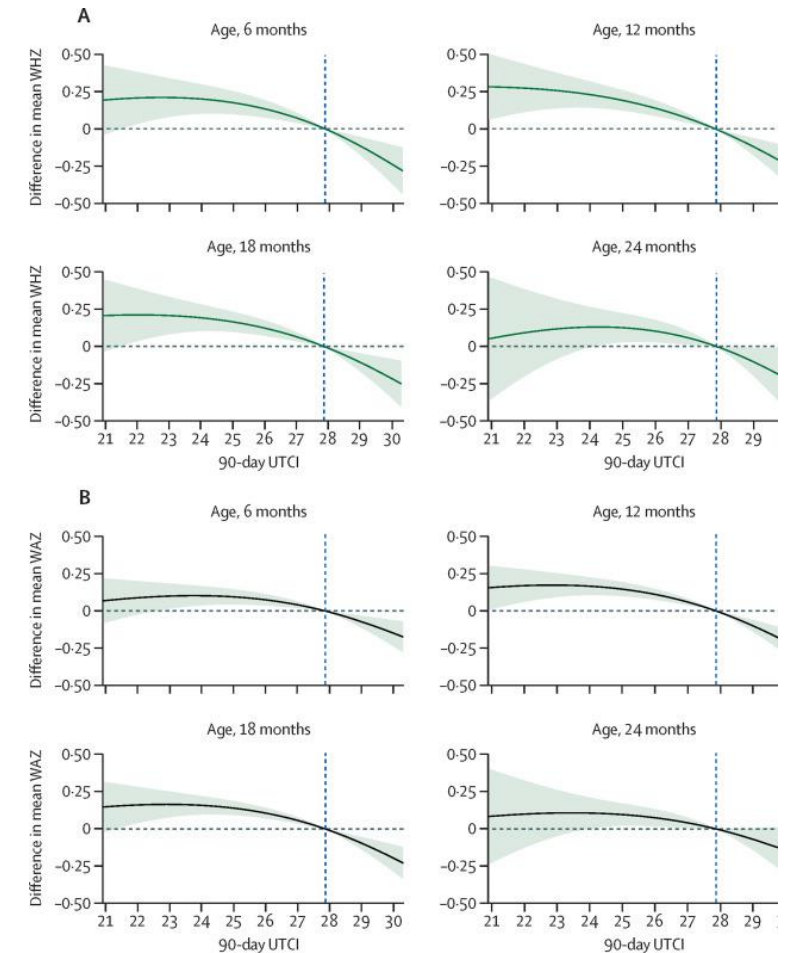


Effect of heat stress in the first 1000 days of life on fetal and infant growth: a secondary analysis of the ENID randomised controlled trial

Bonell, Ana et al. The Lancet Planetary Health, 2024 Volume 8, Issue 10, e734 – e743



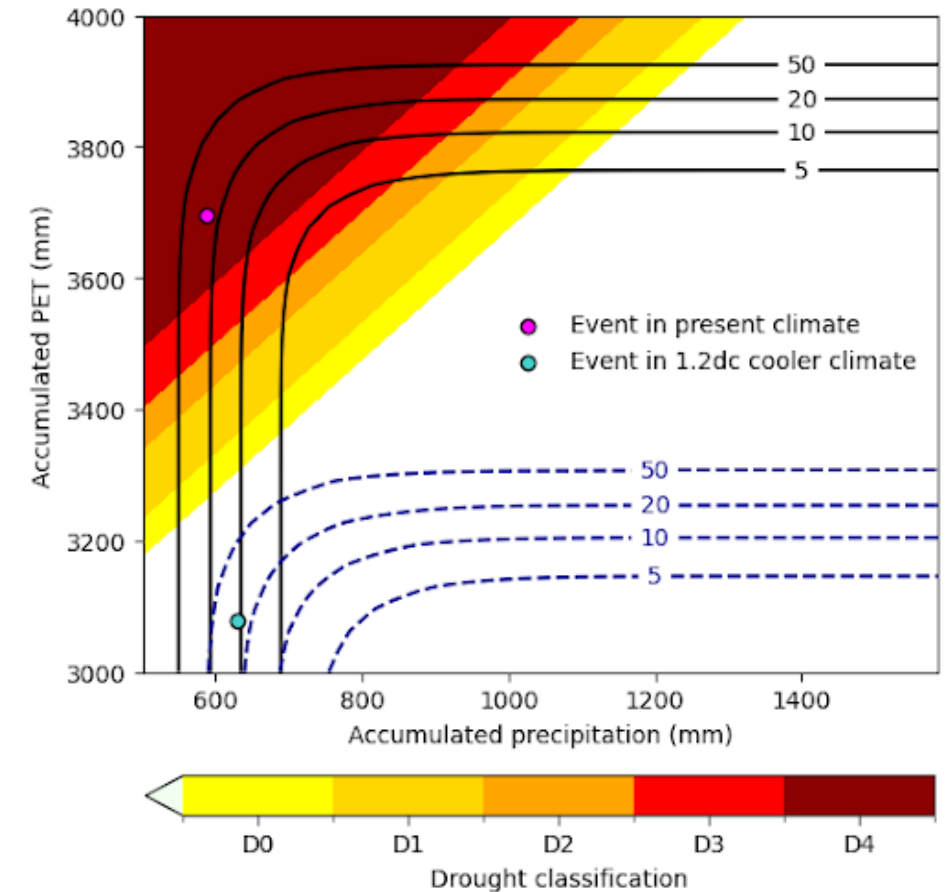
The heat stress effect was largest in infants aged 6–18 months, n=645. Significant reductions in weight for height (WHZ) and weight for age (WAZ)



Human-induced climate change increased drought severity in Horn of Africa

<https://www.worldweatherattribution.org/human-induced-climate-change-increased-drought-severity-in-southern-horn-of-africa/>

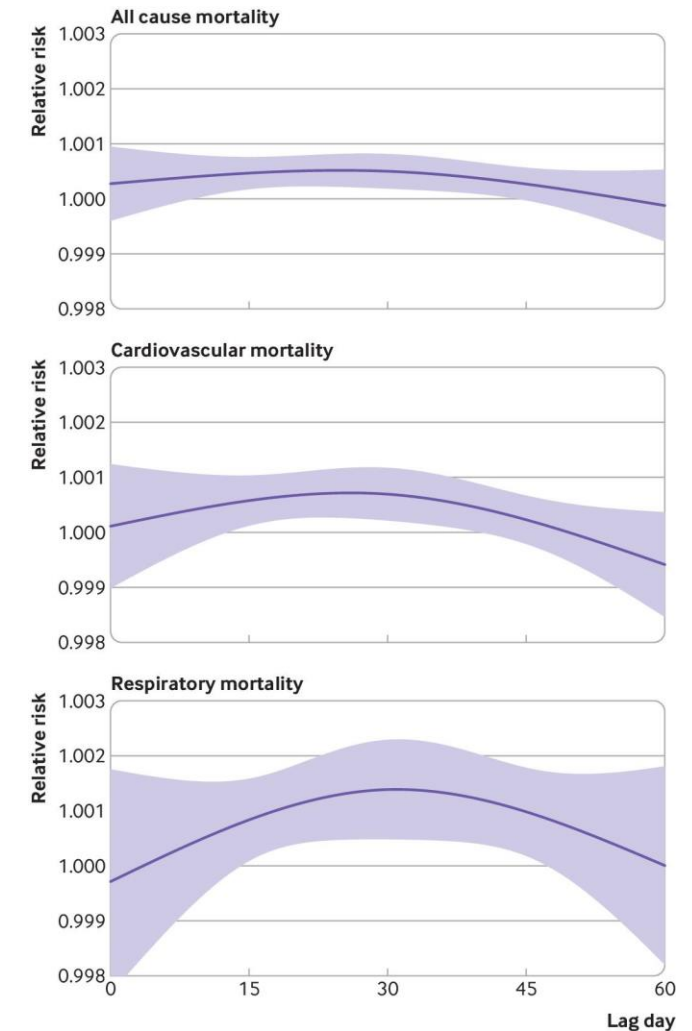
A conservative estimate is that such droughts have become about 100 times more likely due to climate change .



4.35 million people in need of humanitarian assistance ([NDMA, 2022](#)).



Relative risks of mortality associated with exposure to floods during lag 0-60 days in 761 communities from 35 countries or territories.



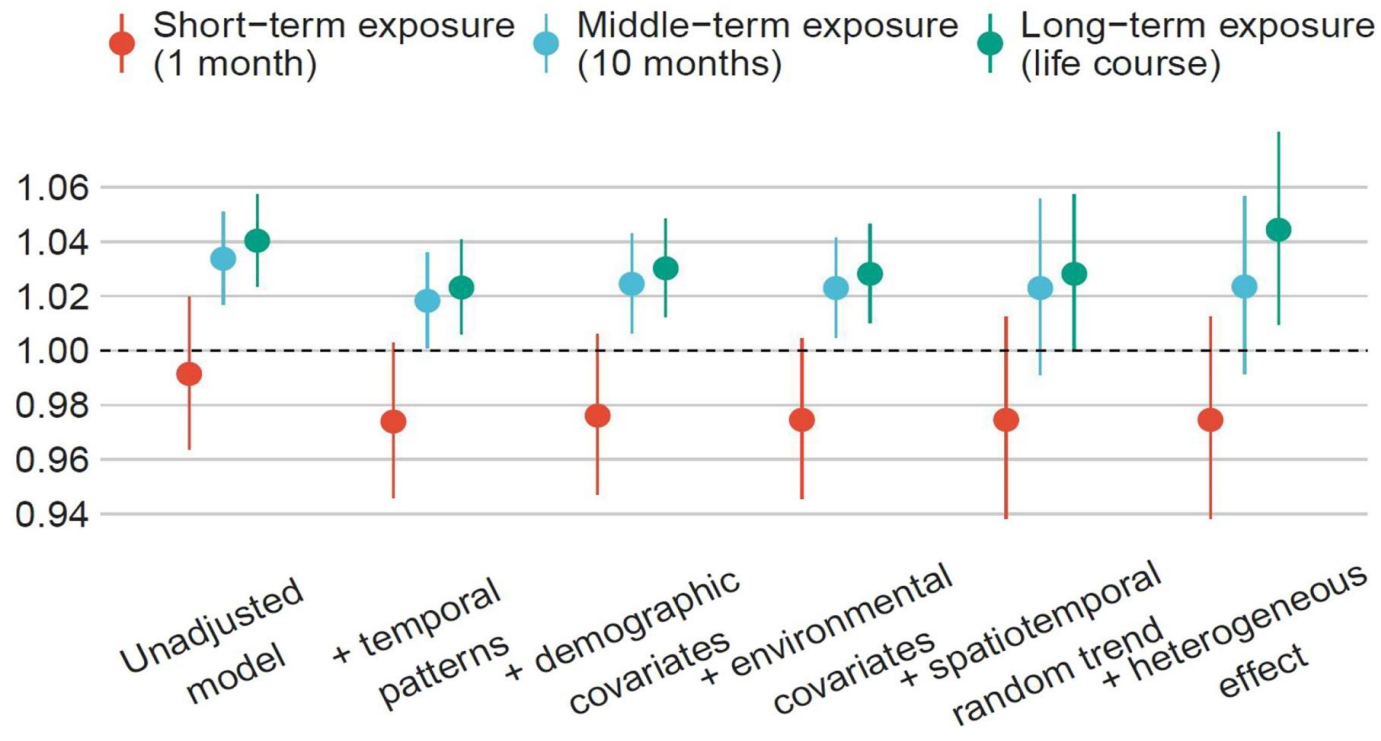
Zhengyu Yang et al. BMJ 2023;383:bmj-2023-075081



Effects of log-term flood exposure on child deaths in low –middle-income countries

Li, P. et al . (2025). *One Earth*, 8(5). <https://doi.org/10.1016/j.oneear.2025.101305>

A
Odds ratio of child death for flood exposure



https://www.who.int/health-topics/floods#tab=tab_1

Number of Climate Disasters to Triple for New Generation

Frequency of climate disasters experienced in a lifetime for a person born in 2020 compared to one born in 1960



All climate disasters
~3 times as many

Based on NDC scenario (following Paris Agreement) of 2.7 °C/4.9 °F warming until 2100

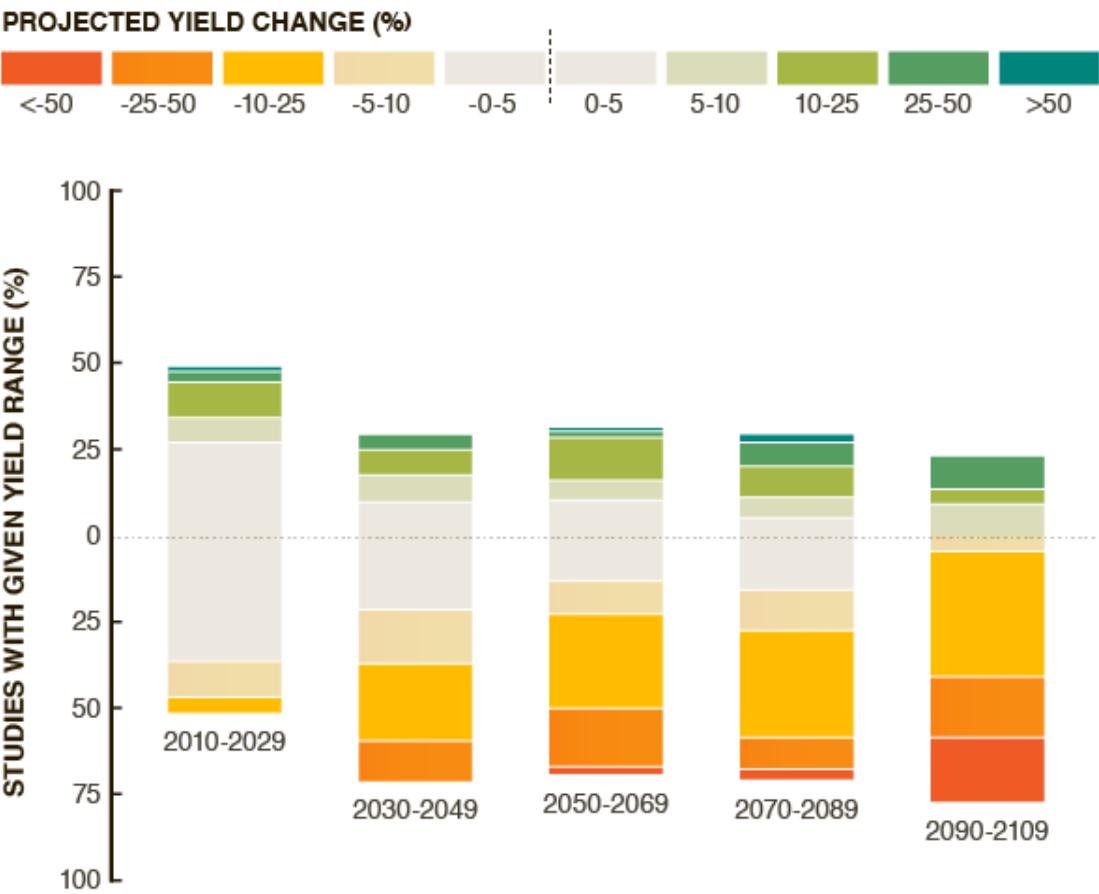
Source: Thiery et al. Intergenerational Inequities in Exposure to Climate Change.

Science (2021) via media reports

Intergenerational inequities in exposure to climate extremes. Science. 2021 Oct 8;374(6564):158-160. doi: 10.1126/science.abi7339. Epub 2021 Sep 26. PMID: 34565177.



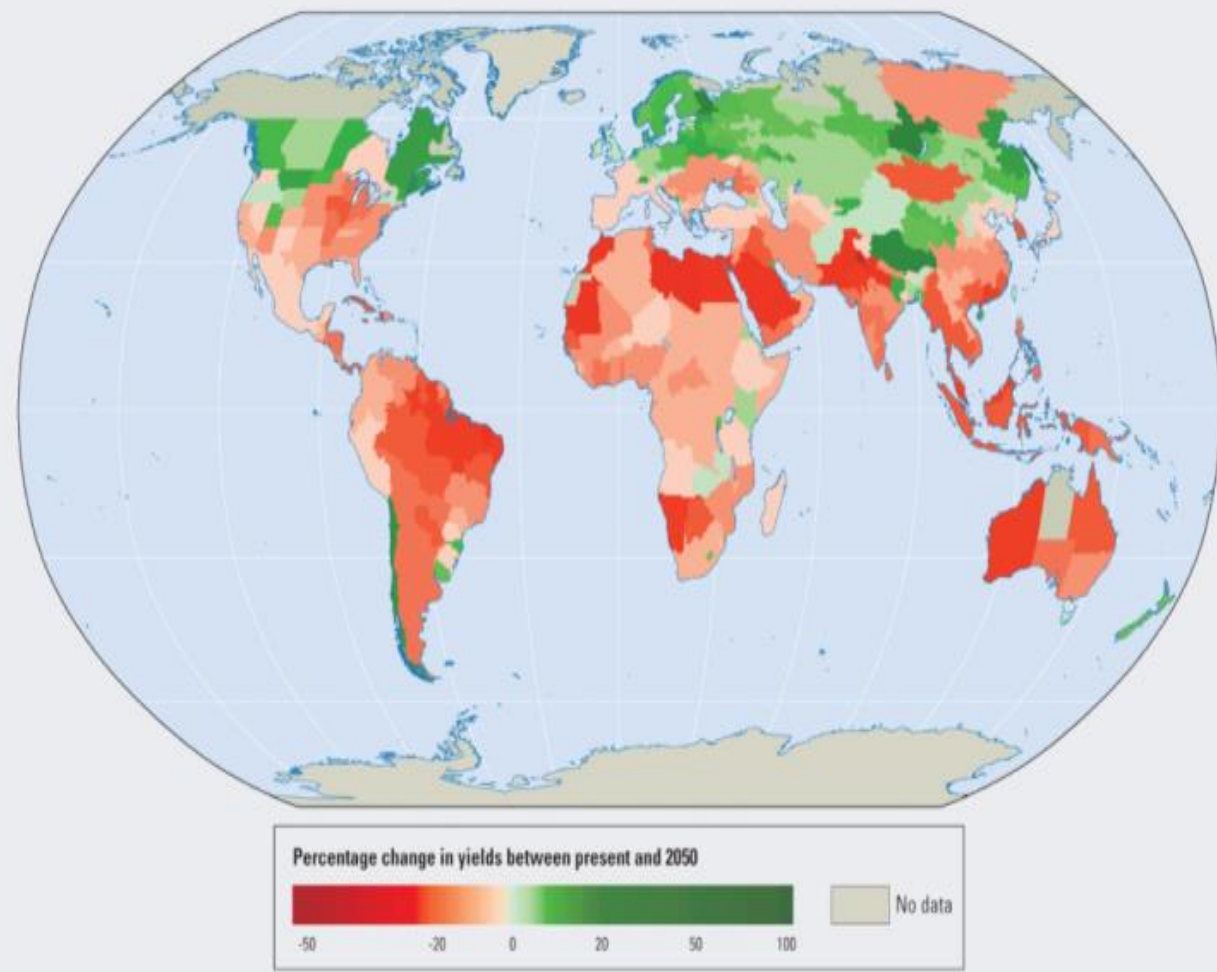
The majority of modeling studies agree that climate change impacts on crop yields will be negative from the 2030s onwards. Nearly half of projections beyond 2050 indicate yield **DECREASES GREATER THAN 10%.**



Source: Challionor et al. 2014

Impacts of climate change on the productivity of food crops in 2050

World Bank Publishers
World bank Development report 2010
<http://wdronline.worldbank.org/>



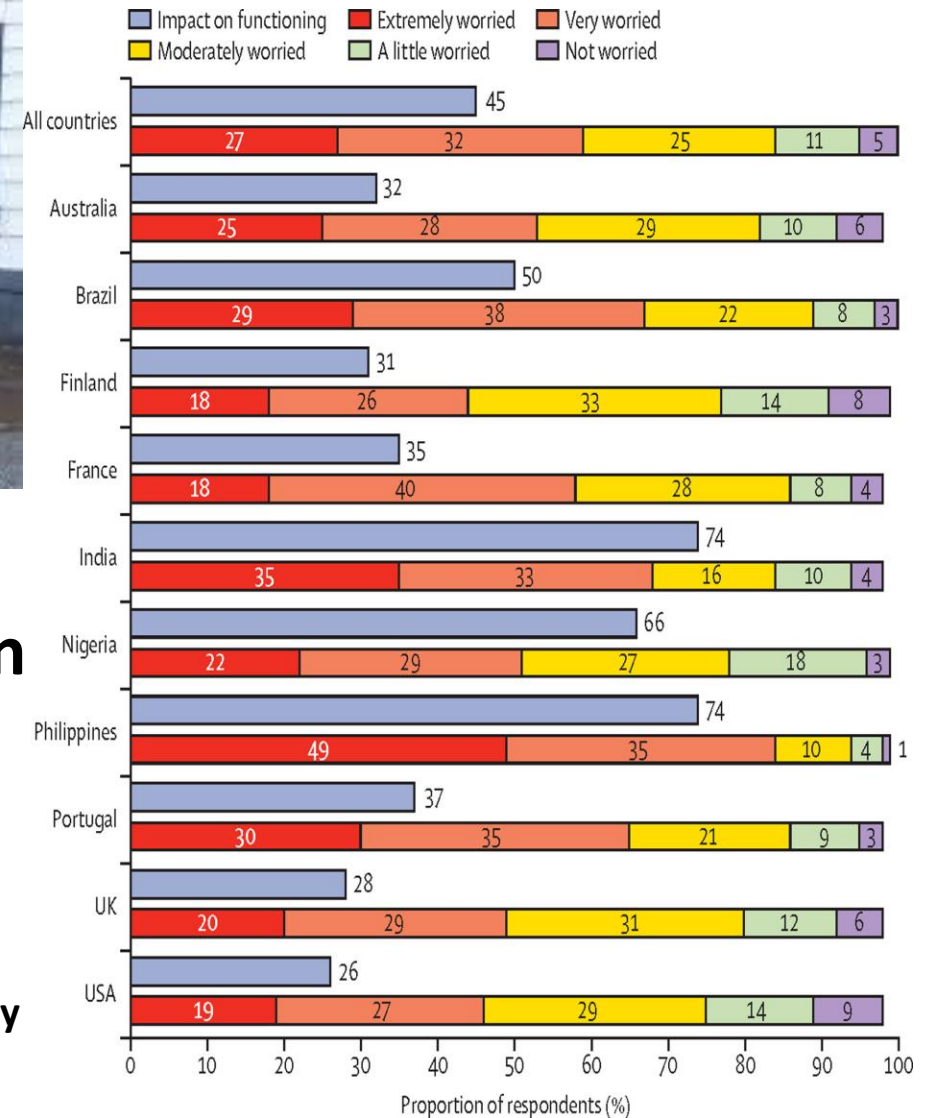
Mental health effects of climate change (e.g. increases in common mental disorders after extreme events, solastalgia and climate anxiety)



(Photo by Pedro Paulo Xerente for the Fundação Nacional do Índio, Brazil)



<https://www.hud.ac.uk/news/2025/september/flooding-mental-health-research-survey/>



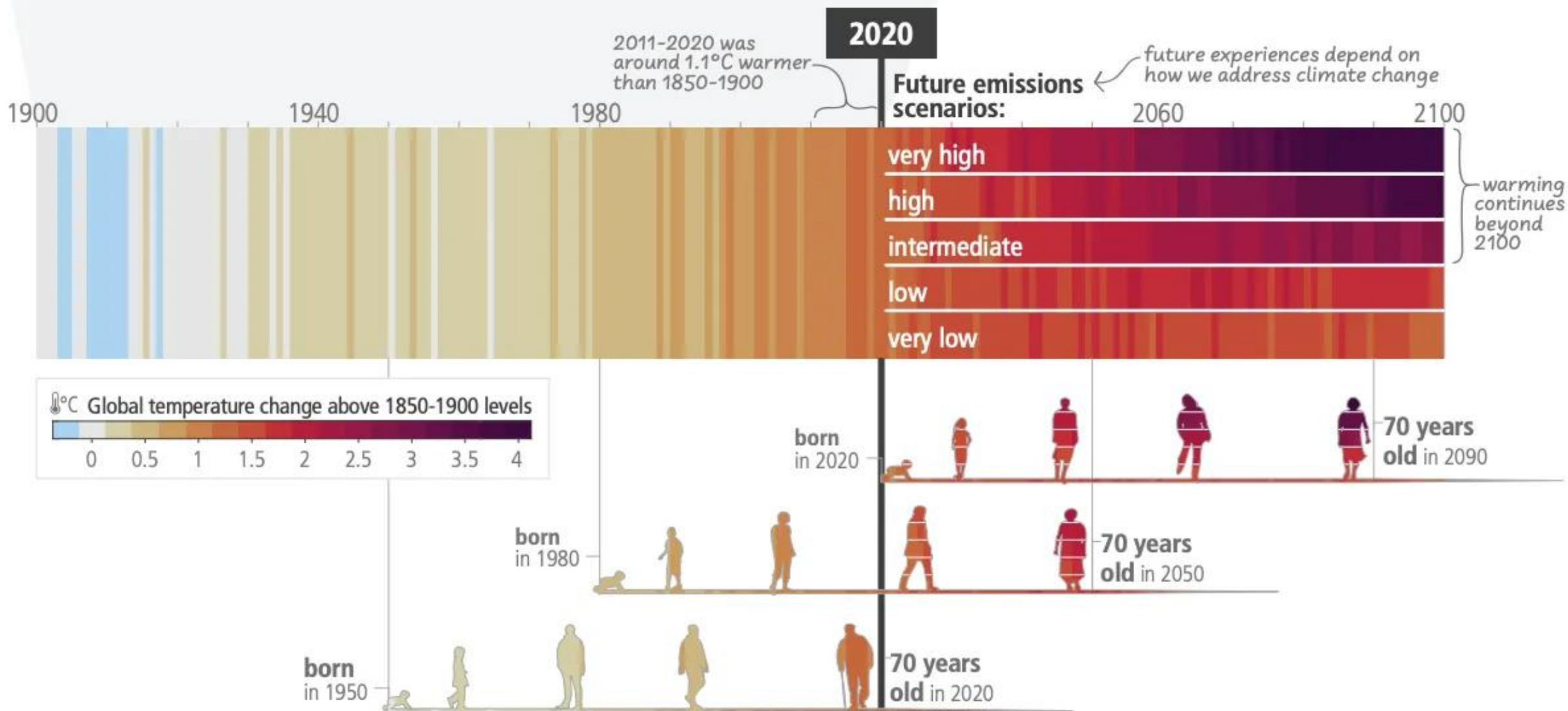
Climate anxiety in children and young people

Hickman et al Lancet Planetary Health 2021



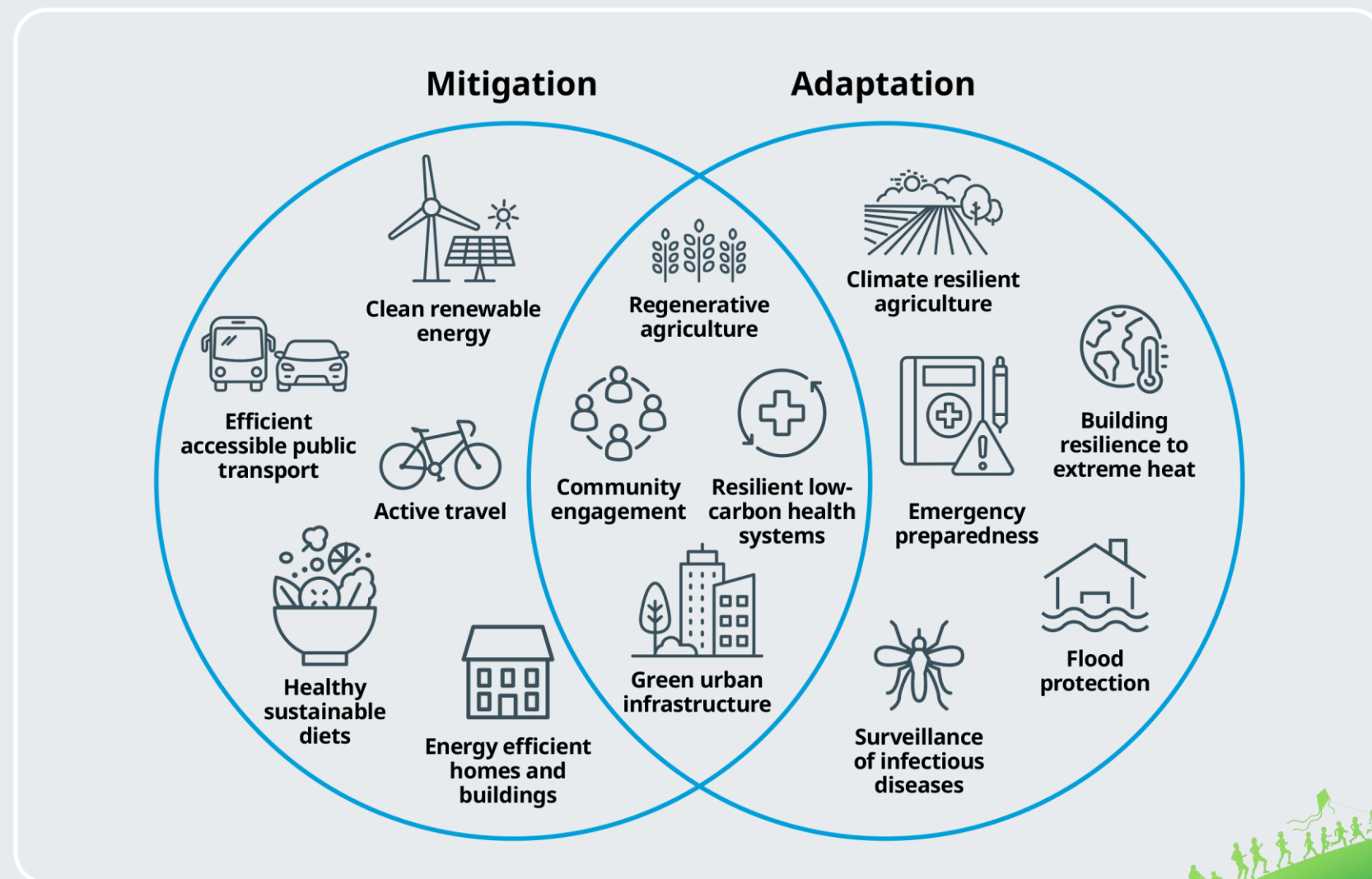
RACGP (Image: David Mariuz)

c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near term



Integrating climate mitigation and adaptation

Integrating climate mitigation and adaptation actions is crucial to accelerating a just transition and maximising health benefits



Source: Pathfinder Initiative. Reproduced under CC-BY 4.0 (<https://creativecommons.org/licenses/by/4.0/deed.en>).



The scale of the opportunity



Well-designed climate mitigation actions across sectors could **prevent millions of premature deaths** worldwide each year (~90% modelled evidence- dearth of evaluated implemented actions)

AIR POLLUTION



Over 5 million deaths
per year caused by air
pollution from fossil fuel
burning*

PHYSICAL ACTIVITY



Over 5 million deaths per
year linked to physical
inactivity**

DIET



Around 15 million
deaths per year could be
prevented by shifting to
healthier diets over
coming decades***

*Lelieveld J, Haines A, Burnett R et al. BMJ 2023; 383 :e077784

** Lee IM, Shiroma EJ, Lobelo F, et al. Lancet 2012; 380: 219–29.

***Rockström J, Thilsted S H., Willett W C., et al. Lancet 2025.

Why measurement matters – what works?

Case study:

Urban road pricing in Europe - London, Stockholm and Milan



■ Impacts

- ↓ PM₁₀ 13–15% (all three cities)
- ↓ NO_x 13% (London)
- ↓ CO₂ 16% (London)
13% (Stockholm).
Not measured in Milan
- ↓ Traffic injuries:
9% (London, first year);
21% (Milan, 2011 vs 2007);
No change, Stockholm
- + Revenues
€176–289M/year (London, 2012);
€83.2M in Stockholm;
€12M (2008) → €5.9M (2011) Milan.

Why measurement matters – at what scale?



Scale: Local



Action:

The Victorian Healthy Homes Program (RCT) upgraded 1000 low-income households in Victoria, Australia

Impacts:



5,778 tonnes of CO₂eq emissions from gas and electricity were avoided in winter, amounting to a reduction of **11,151 tonnes of CO₂eq** in a year



Upgrades led to warmer homes, reduced breathlessness, better mental health and reduced healthcare costs

Original publication: Victorian Healthy Homes Program. Sustainability Victoria, 2022



Nature Based Solutions

can provide substantial cost-effective climate mitigation and adaptation

Meeting the WHO recommendation of access to green space in European cities in 31 countries could prevent ~43000 deaths annually Barboza et al 2021 Lancet PH

WHO recommends that green spaces (of at least 0.5 hectares) should be accessible within a 300 m linear distance of residences.



Interventions to increase or improve urban green space can deliver positive health, social and environmental outcomes for all population groups, particularly among lower socioeconomic status groups. There are very few, if any, other public health interventions that can achieve all of this.

WHO Report 2017
Urban Green Space Interventions and Health

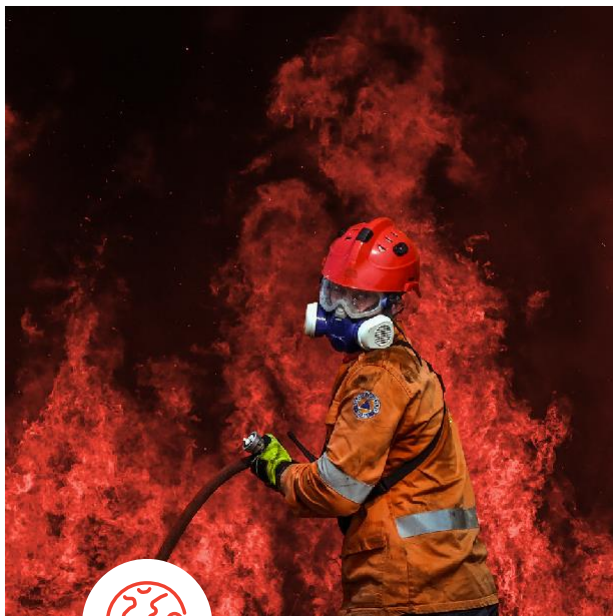
UNIVERSITY OF
EXETER | MEDICAL SCHOOL

European Centre for
Environment & Human Health

NIHR | Health Protection Research Unit in
Environmental Change and Health at London
School of Hygiene and Tropical Medicine

sweep

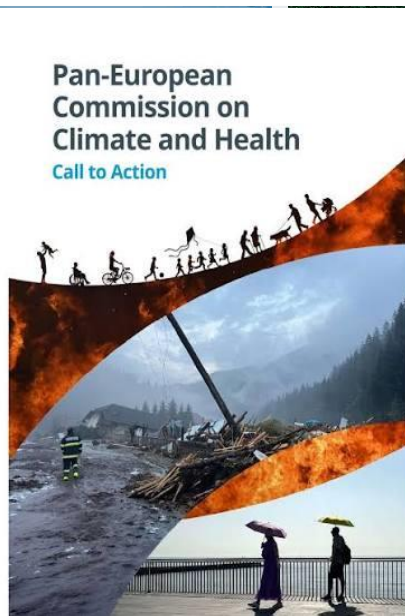
BlueHealth



**1. Confronting
climate change
as a catastrophic
threat to human
health, security
and social stability**



**2. Transforming health
systems for people
and climate**



**3. Scaling up local,
community-based
solutions for
climate and health**



**4. Reforming
economic, financial
and regulatory
systems to drive
climate–health
progress**



Building climate-resilient & low-carbon health systems



Image: <https://savinglivesustainably.org/knowledge-practice/contribution/hcwh-webinar-health-care-s-climate-footprint/581>

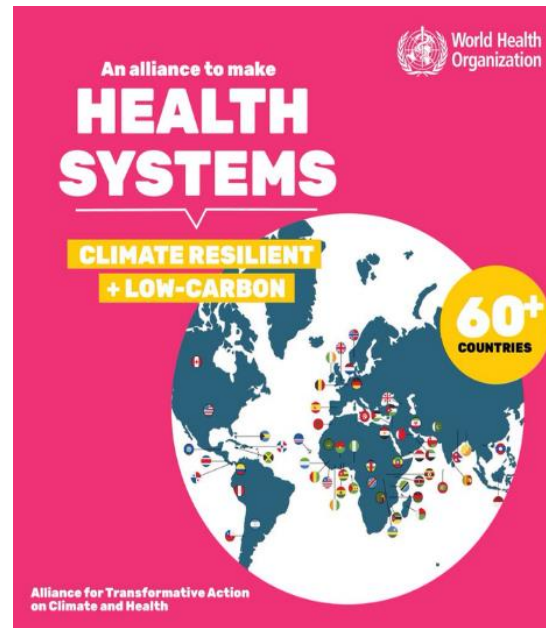
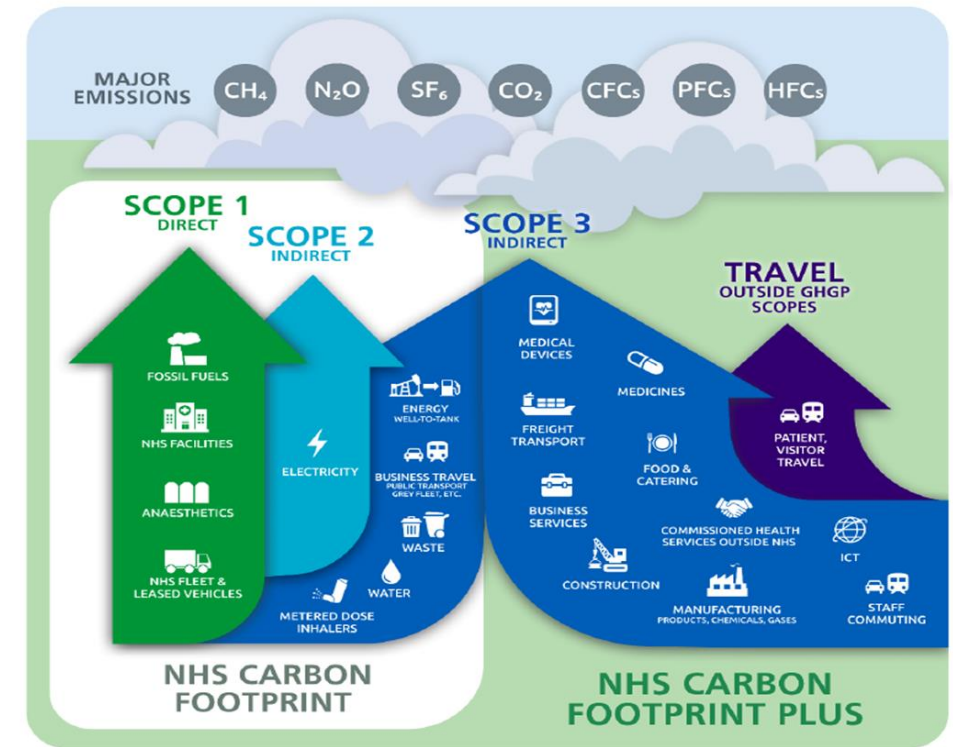


Figure 1: GHGP scopes in the context of the NHS



climate-change/cc-info-gr-at-ach.png?sfvrsn=728cdd93_3

100 countries committed to building health systems, which can withstand the impacts of climate change, and which are low carbon and sustainable.

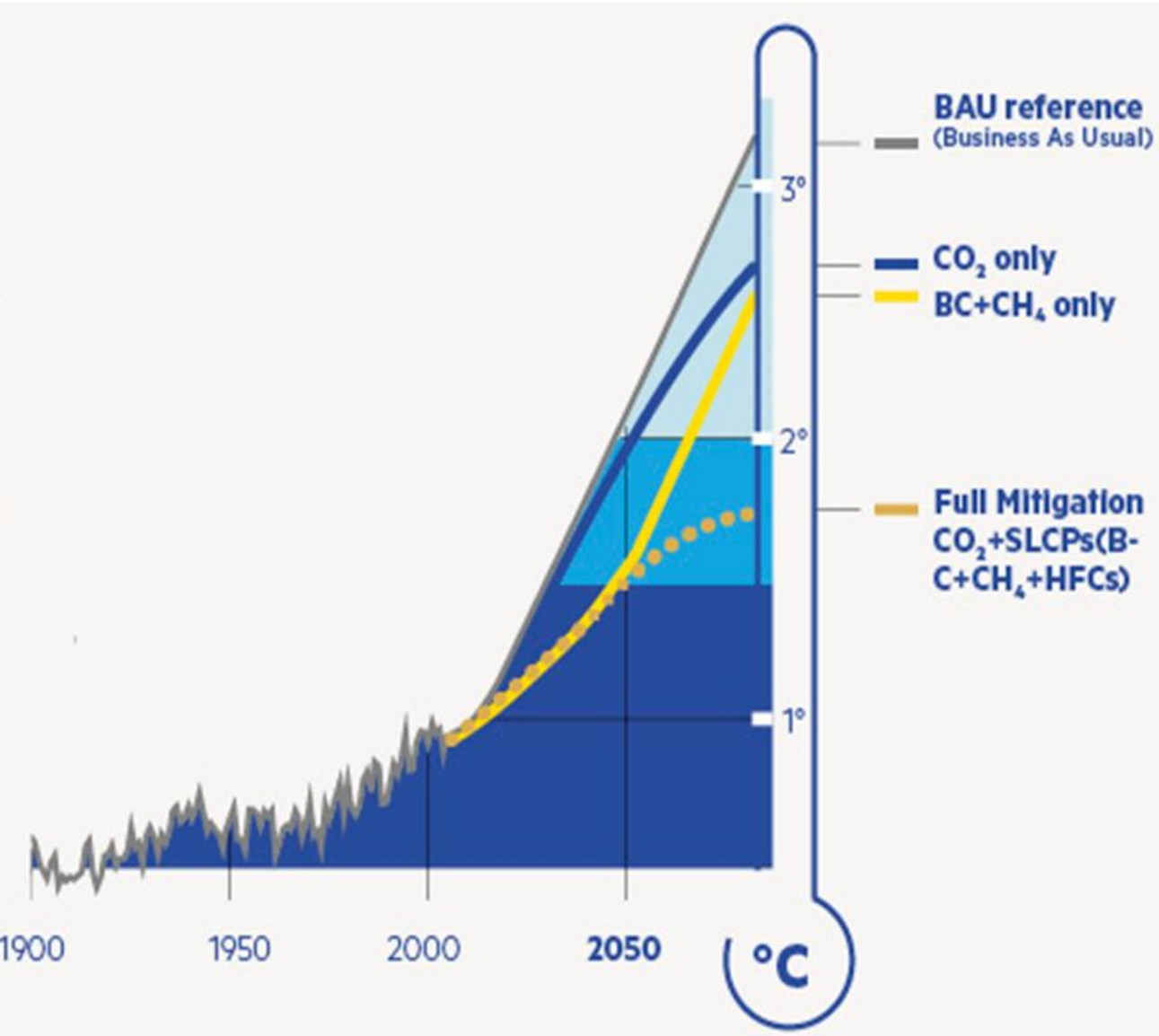
38 countries have set a deadline of 2050 or earlier, by which their health system will reach **Net Zero** emissions. **WHO Alliance** for Transformative Action for Climate and Health

Multiple benefits of climate mitigation- health, agriculture, poverty, employment and the climate

LONDON
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HYGIENE
& TROPICAL
MEDICINE



Pathfinder
Initiative



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& TROPICAL
MEDICINE

Pathfinder
Initiative

Climate & Health Evidence Bank

Finding the best evidence for what works to
achieve a healthy net-zero future

climatehealthevidence.org

