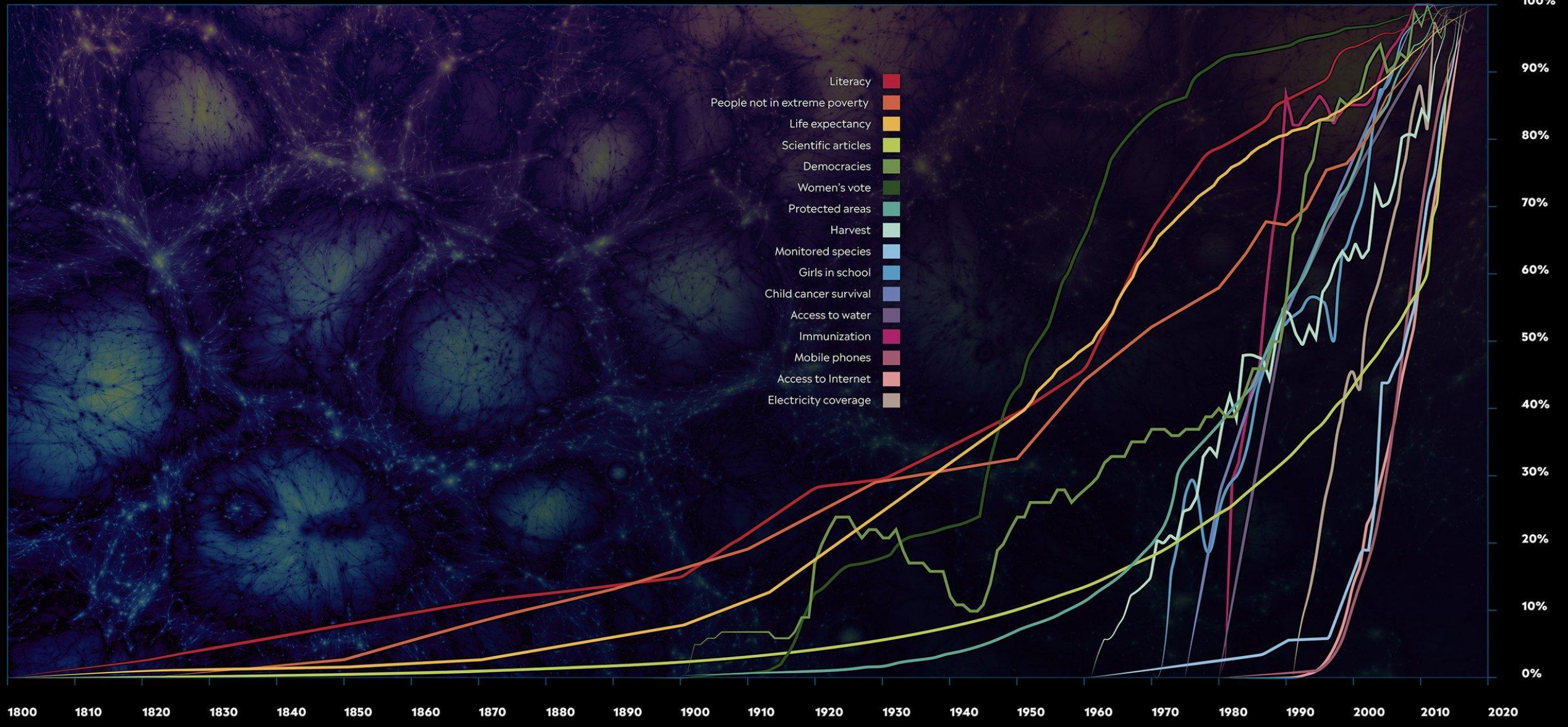
Planetary Stewardship

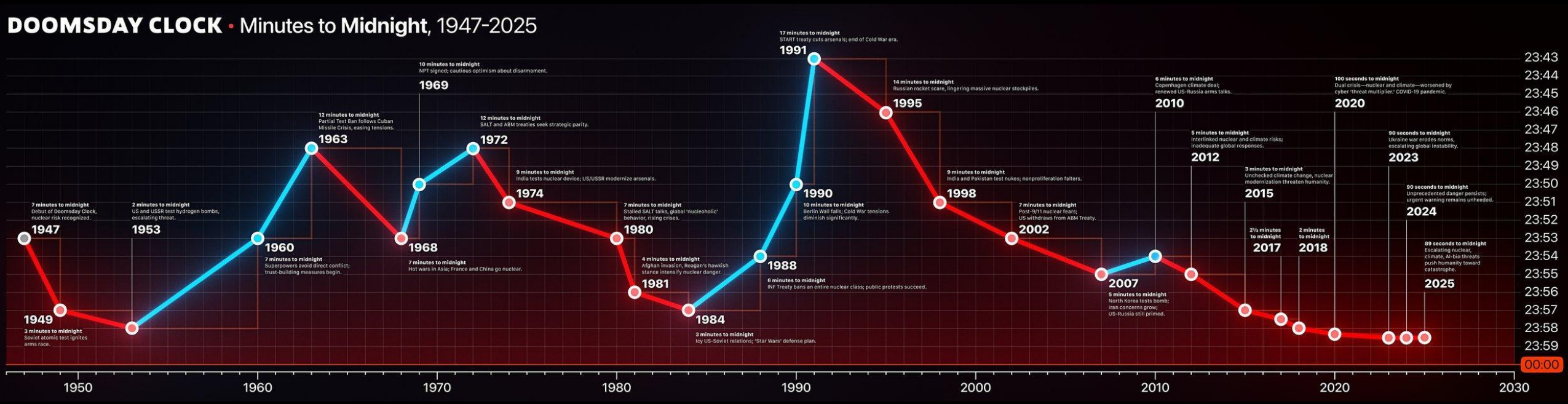
United Nations, Geneva, 2 April 2025

Owen Gaffney

Earth4All, Nobel Prize Outreach

Look back at what we have achieved




DOOMSDAY CLOCK • Minutes to Midnight, 1947-2025
1947
7 minutes to midnight
Debut of Doomsday Clock, nuclear risk recognized.
1949
3 minutes to midnight
Soviet atomic test ignites arms race.
1953
2 minutes to midnight
US and USSR test hydrogen bombs, escalating threat.
1960
7 minutes to midnight
Superpowers avoid direct conflict; trust-building measures begin.
1963
12 minutes to midnight
Partial Test Ban follows Cuban Missile Crisis, easing tensions.
1968
7 minutes to midnight
Hot wars in Asia; France and China go nuclear.
1969
10 minutes to midnight
NPT signed; cautious optimism about disarmament.
1972
12 minutes to midnight
SALT and ABM treaties seek strategic parity.
1974
9 minutes to midnight
India tests nuclear device; US/USSR modernize arsenals.
1980
7 minutes to midnight
Stalled SALT talks, global 'nucleoholic' behavior, rising crises.
1981
4 minutes to midnight
Afghan invasion, Reagan's hawkish stance intensify nuclear danger.
1984
3 minutes to midnight
Icy US-Soviet relations; 'Star Wars' defense plan.
1988
6 minutes to midnight
INF Treaty bans an entire nuclear class; public protests succeed.
1990
10 minutes to midnight
Berlin Wall falls; Cold War tensions diminish significantly.
1991
17 minutes to midnight
START treaty cuts arsenals; end of Cold War era.
1995
14 minutes to midnight
Russian rocket scare, lingering massive nuclear stockpiles.
1998
9 minutes to midnight
India and Pakistan test nukes; nonproliferation falters.
2002
7 minutes to midnight
Post-9/11 nuclear fears; US withdraws from ABM Treaty.
2007
5 minutes to midnight
North Korea tests bomb; Iran concerns grow; US-Russia still primed.
2010
6 minutes to midnight
Copenhagen climate deal; renewed US-Russia arms talks.
2012
5 minutes to midnight
Interlinked nuclear and climate risks; inadequate global responses.
2015
3 minutes to midnight
Unchecked climate change, nuclear modernization threaten humanity.
2017
2½ minutes to midnight
2018
2 minutes to midnight
2020
100 seconds to midnight
Dual crisis—nuclear and climate—worsened by cyber 'threat multiplier.' COVID-19 pandemic.
2023
90 seconds to midnight
Ukraine war erodes norms, escalating global instability.
2024
90 seconds to midnight
Unprecedented danger persists; urgent warning remains unheeded.
2025
89 seconds to midnight
Escalating nuclear, climate, AI-bio threats push humanity toward catastrophe.
23:43
23:44
23:45
23:46
23:47
23:48
23:49
23:50
23:51
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1950
1960
1970
1980
1990
2000
2010
2020
2030

The Principle of Earth Alignment for Artificial Intelligence

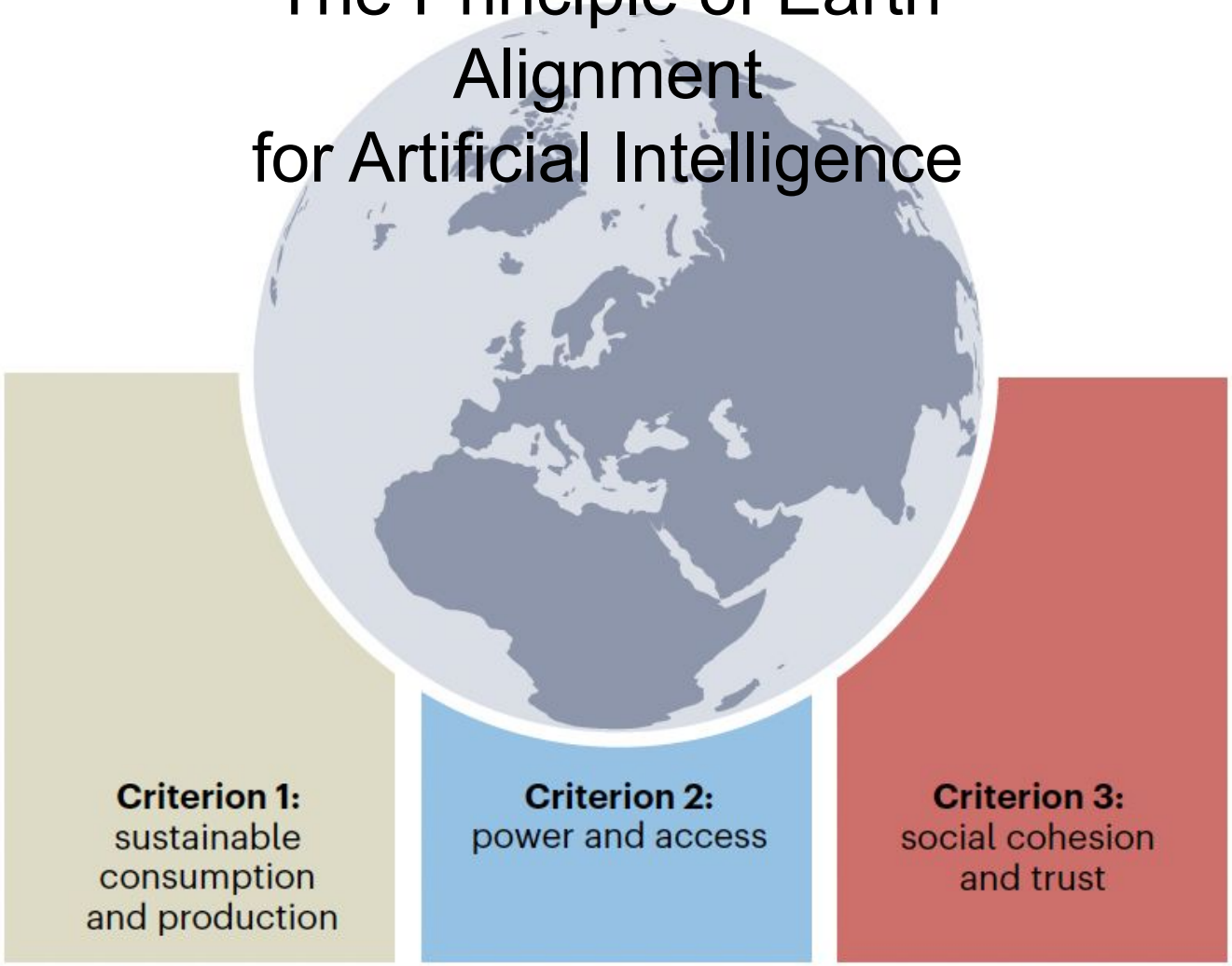
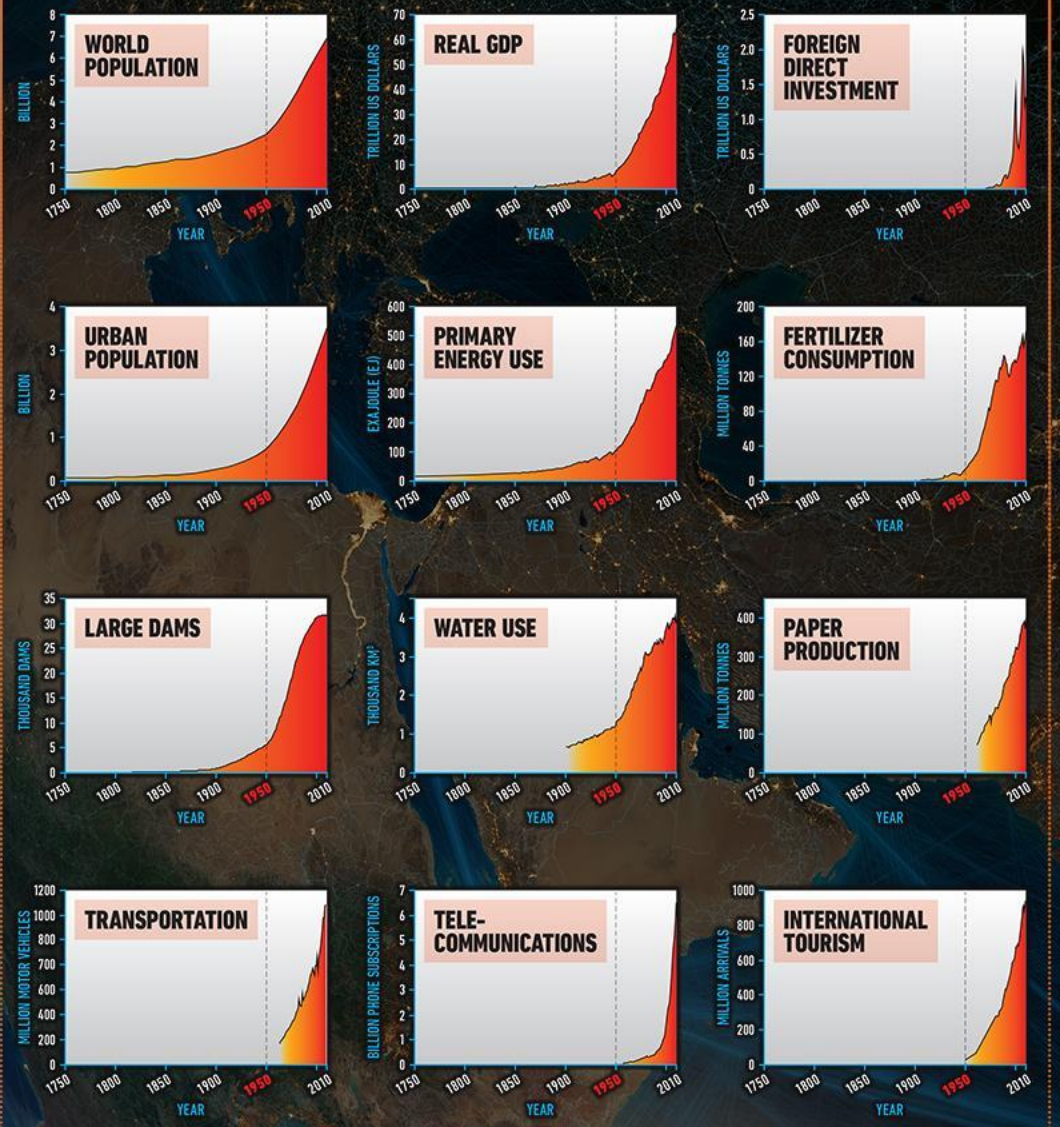


Fig. 1 | Achieving strong Earth alignment requires taking account of three criteria simultaneously. AI's transformative impact demands a systemic stewardship approach that goes beyond direct environmental impacts to encompass trajectories of economies and societies.

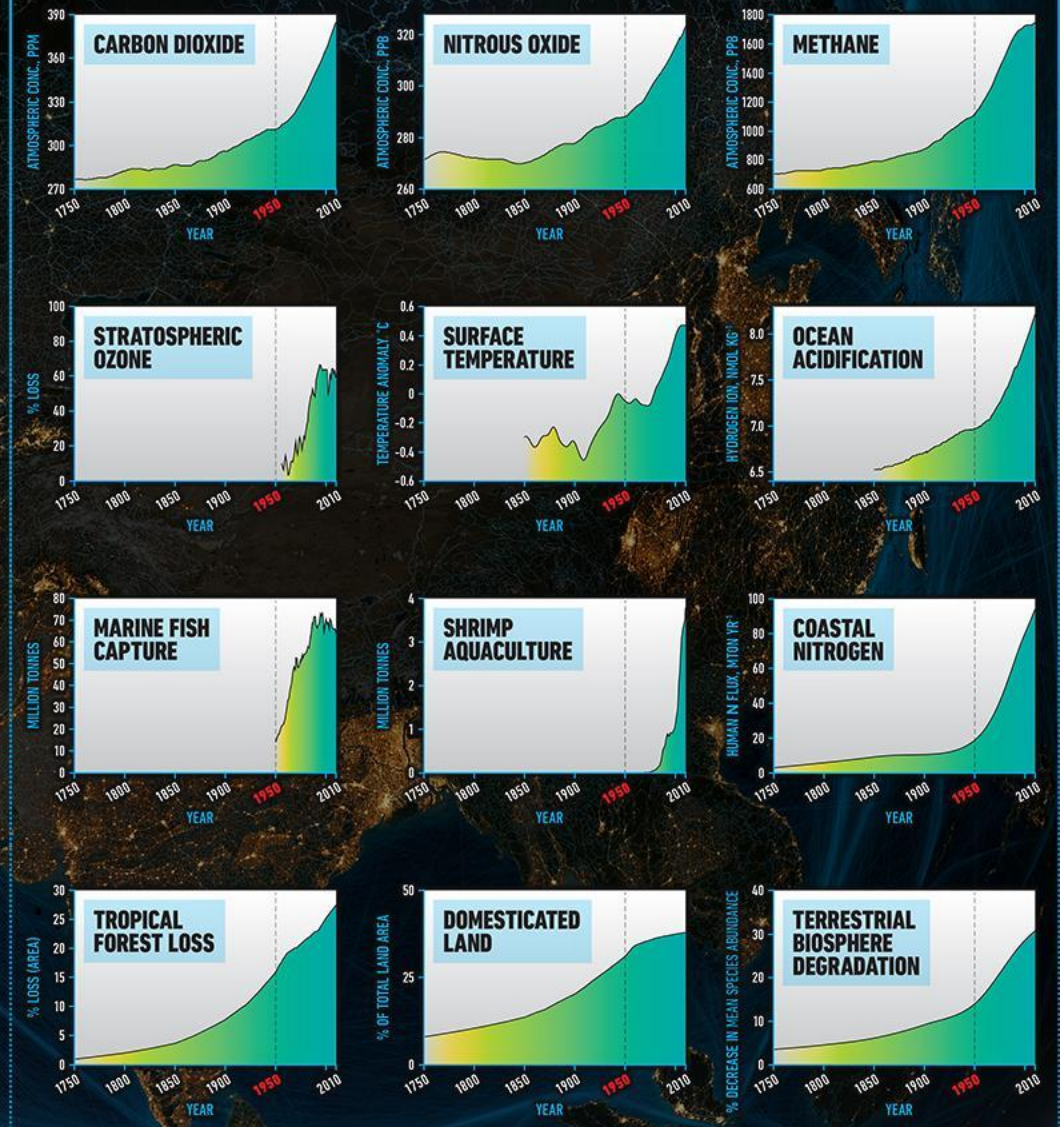
Gaffney *et al.* 2025. *Nature*

THE GREAT ACCELERATION

SOCIO-ECONOMIC TRENDS



EARTH SYSTEM TRENDS

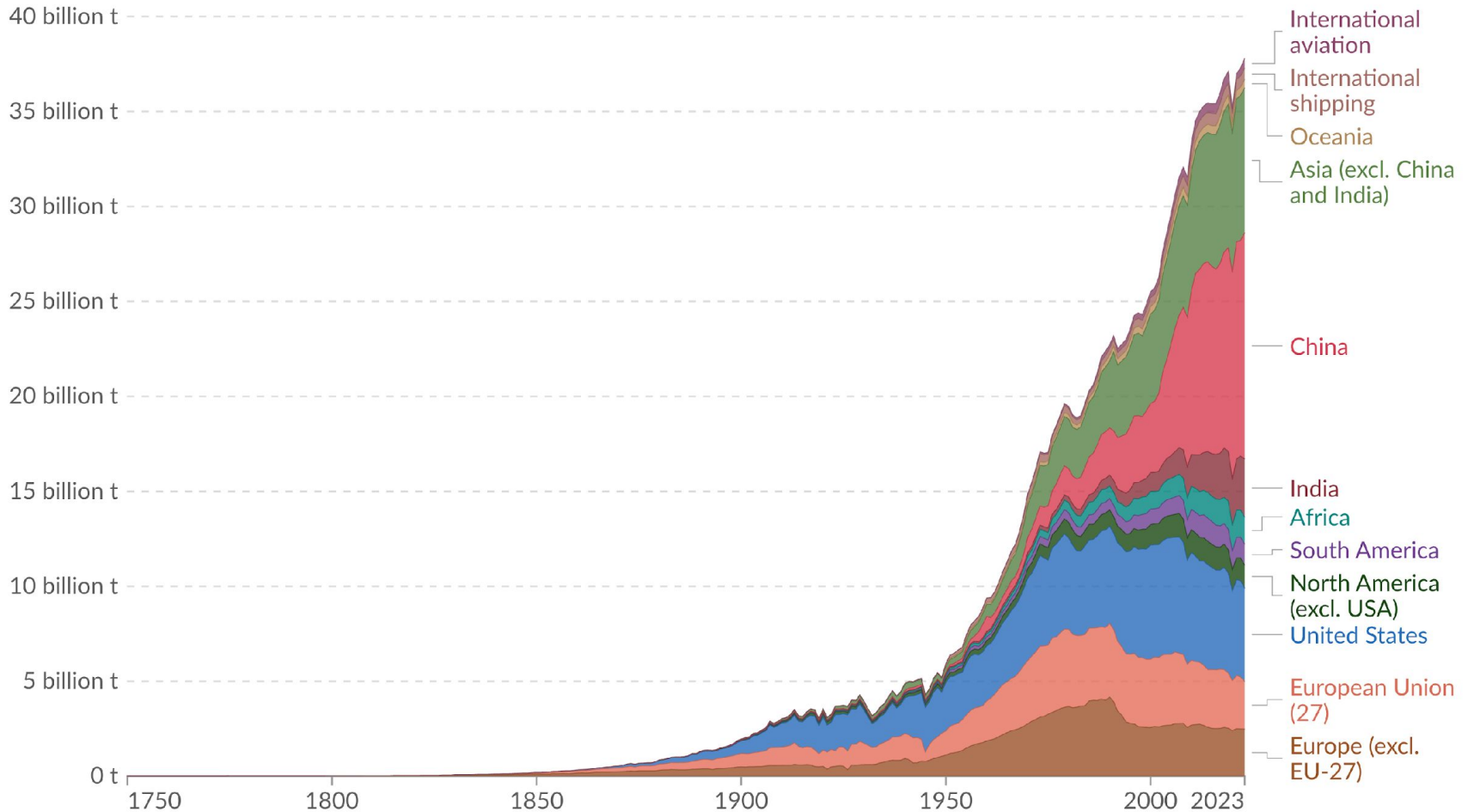


REFERENCE: Steffen, W., W. Broadgate, L. Deutsch, O. Gaffney and C. Ludwig, The Trajectory of the Anthropocene: the Great Acceleration, *The Anthropocene Review*, 16 January 2015.
MAP & DESIGN: Félix Pharand-Deschênes / Globaïa

Annual CO_2 emissions by world region

Our World in Data

Emissions from fossil fuels and industry[1] are included, but not land-use change emissions. International aviation and shipping are included as separate entities, as they are not included in any country's emissions.



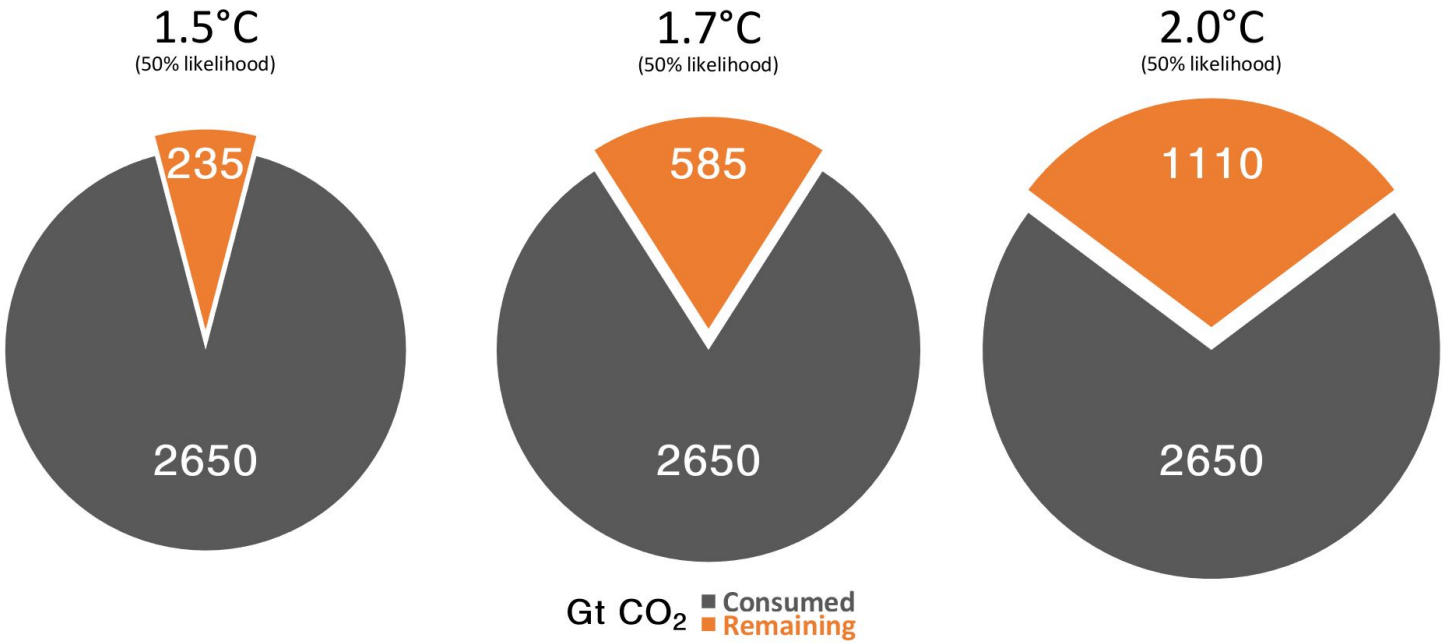
Data source: Global Carbon Budget (2024)

OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO_2) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO_2 includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

Remaining carbon budget

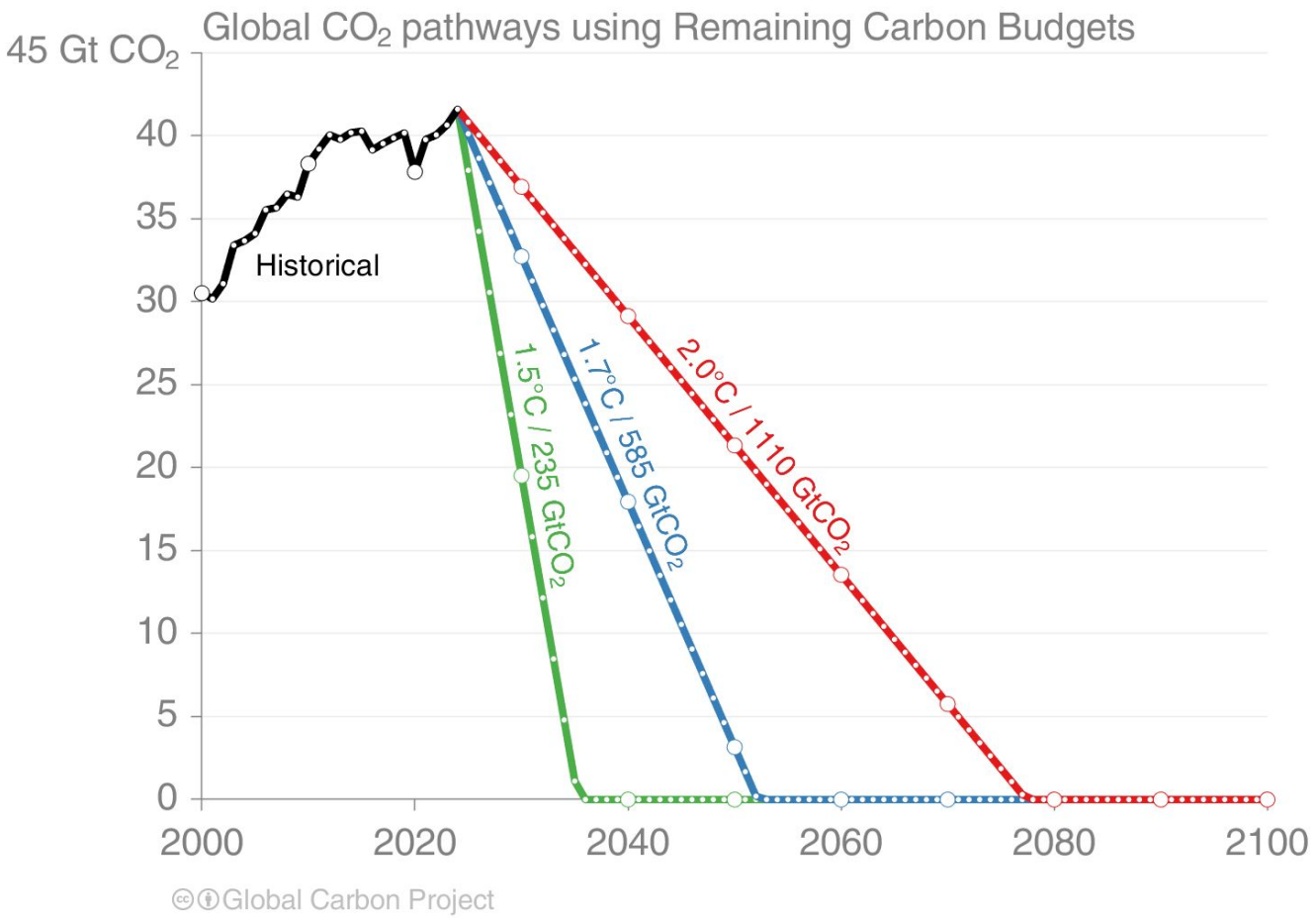
The remaining carbon budget to limit global warming to 1.5°C , 1.7°C and 2°C is 235 $GtCO_2$, 585 $GtCO_2$, and 1110 $GtCO_2$ respectively, equivalent to 6, 14 and 27 years from 2025. 2650 $GtCO_2$ have been emitted since 1850



The remaining carbon budgets are the average of two estimates (IPCC AR6 and Forster et al., 2023), both updated by removing the most recent emissions.
Quantities are subject to additional uncertainties e.g., future mitigation choices of non-CO_2 emissions
Source: IPCC AR6 WG1; Forster et al., 2023; Friedlingstein et al 2024; Global Carbon Project 2024

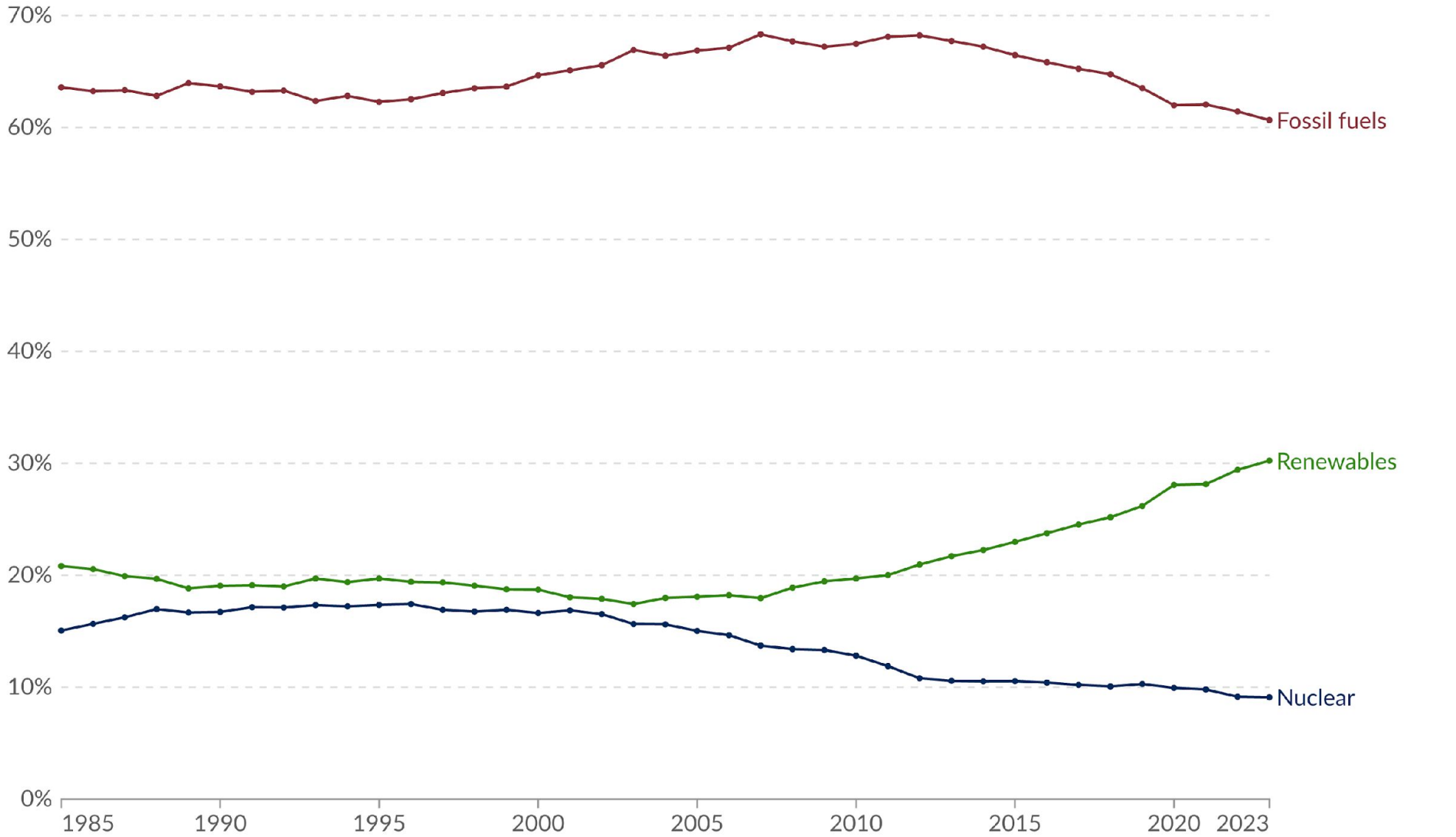
Remaining carbon budget

Global CO_2 emissions must reach zero to limit global warming



Source: Friedlingstein et al 2024; Global Carbon Project 2024

Share of electricity generation from fossil fuels, renewables and nuclear, World

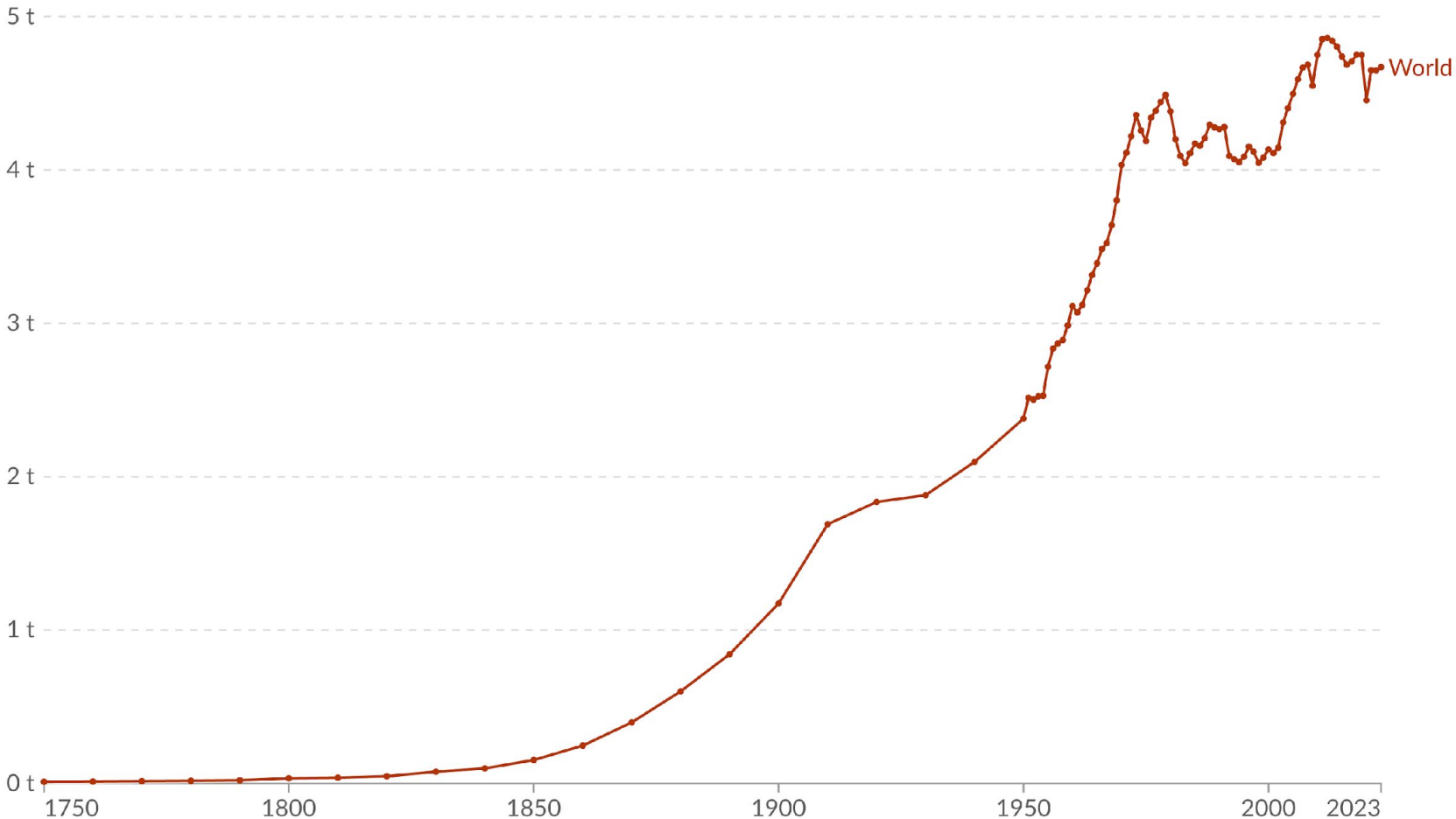


Data source: Ember (2024); Energy Institute - Statistical Review of World Energy (2024)

OurWorldinData.org/energy | CC BY

Per capita CO_2 emissions

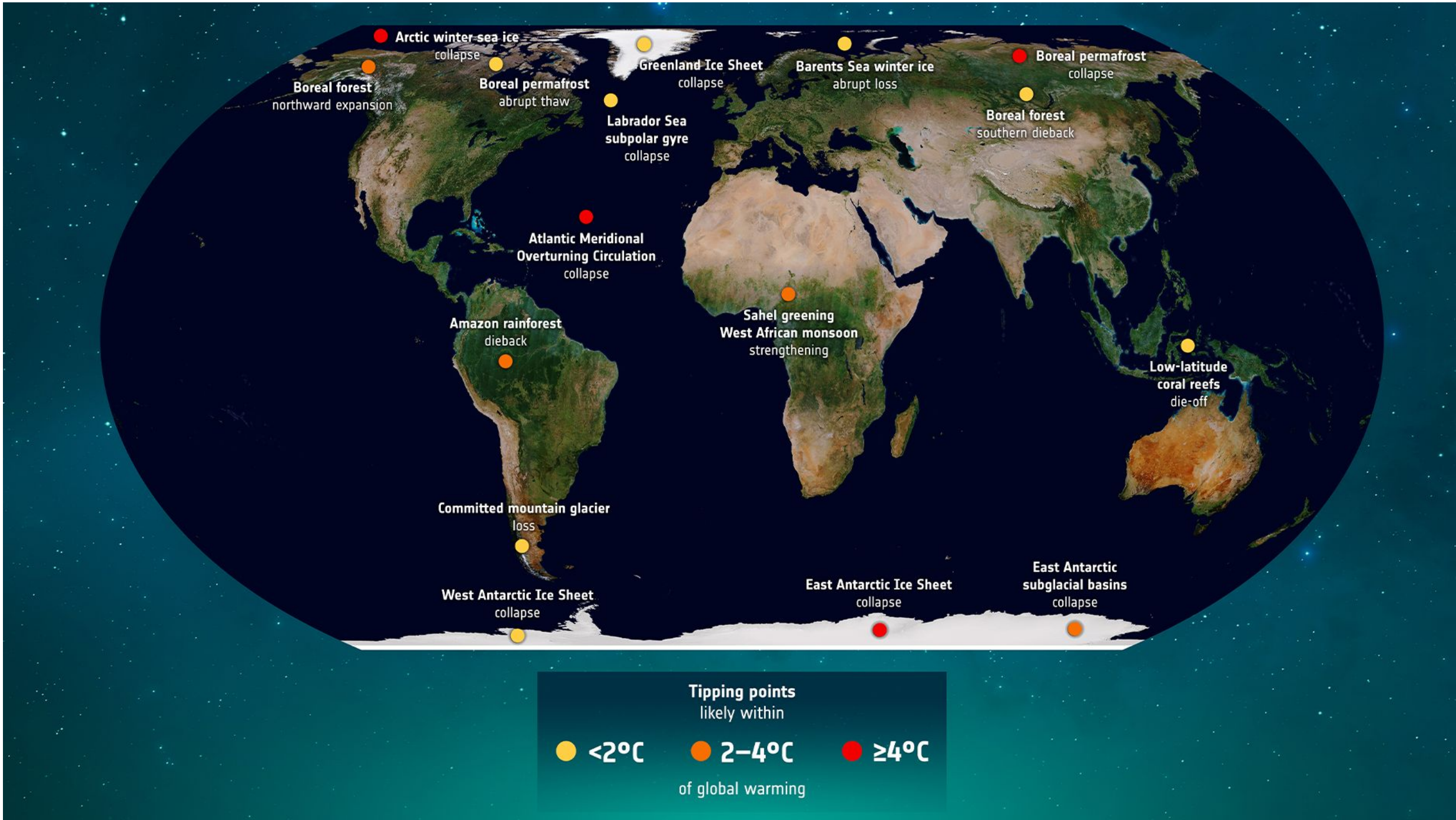
Carbon dioxide (CO_2) emissions from fossil fuels and industry[1]. Land-use change is not included.



Data source: Global Carbon Budget (2024); Population based on various sources (2024)

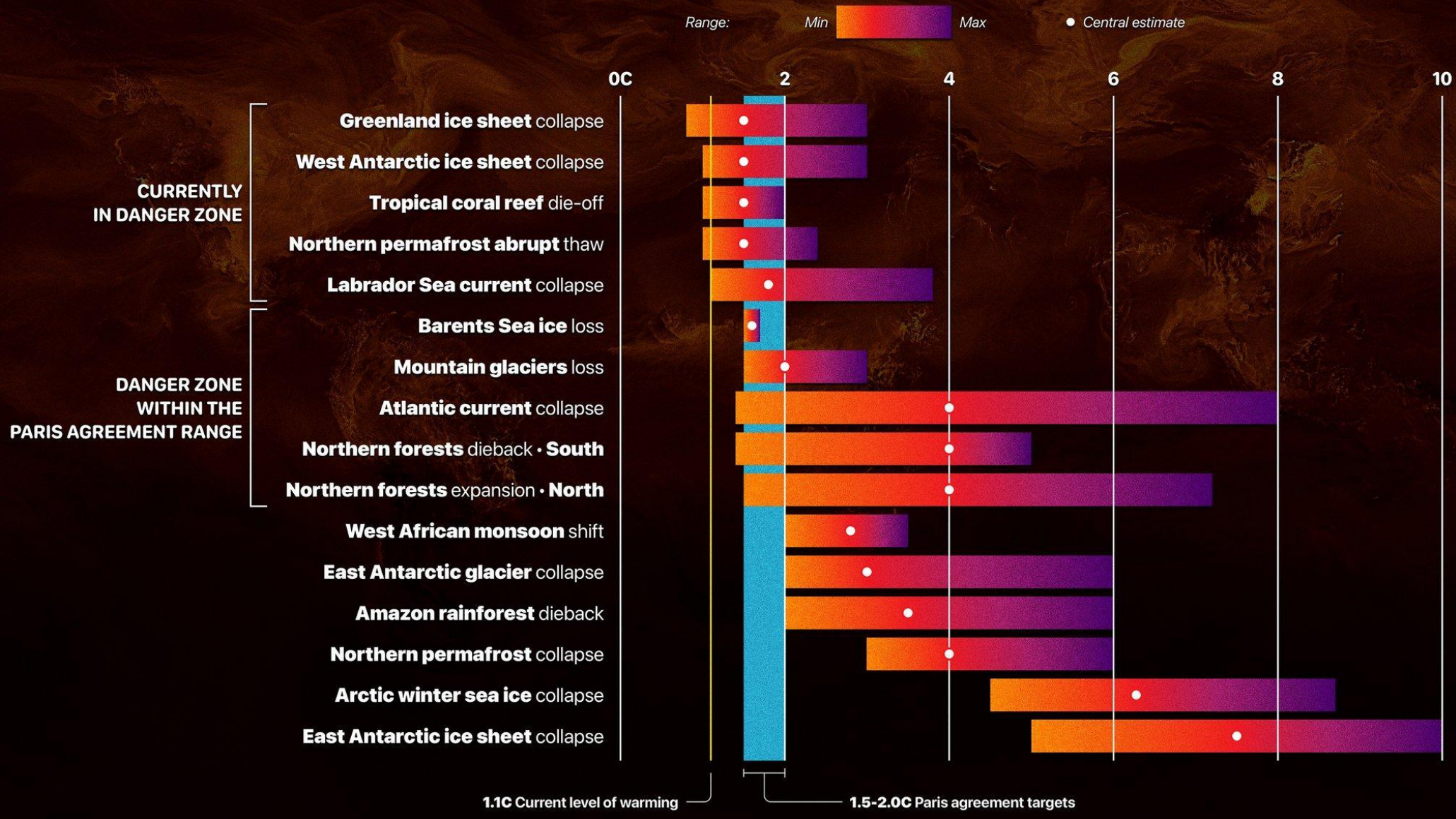
OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO_2) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO_2 includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

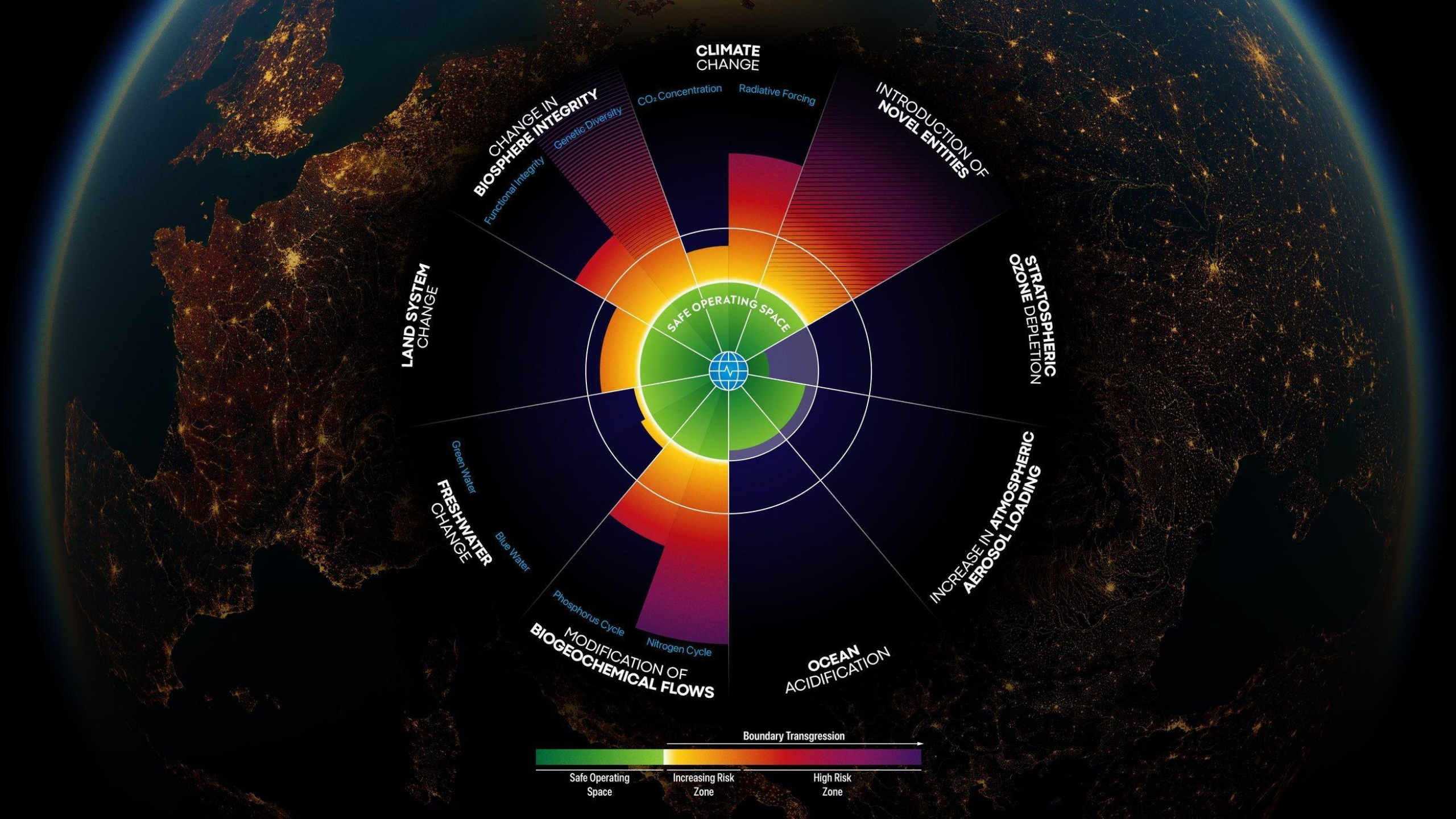

Arctic winter sea ice
collapse
Boreal forest
northward expansion
Boreal permafrost
abrupt thaw
Greenland Ice Sheet
collapse
Labrador Sea
subpolar gyre
collapse
Barents Sea winter ice
abrupt loss
Boreal permafrost
collapse
Boreal forest
southern dieback
Atlantic Meridional
Overturning Circulation
collapse
Amazon rainforest
dieback
Sahel greening
West African monsoon
strengthening
Low-latitude
coral reefs
die-off
Committed mountain glacier
loss
West Antarctic Ice Sheet
collapse
East Antarctic Ice Sheet
collapse
East Antarctic
subglacial basins
collapse
Tipping points
likely within
<2°C
2–4°C
≥4°C
of global warming

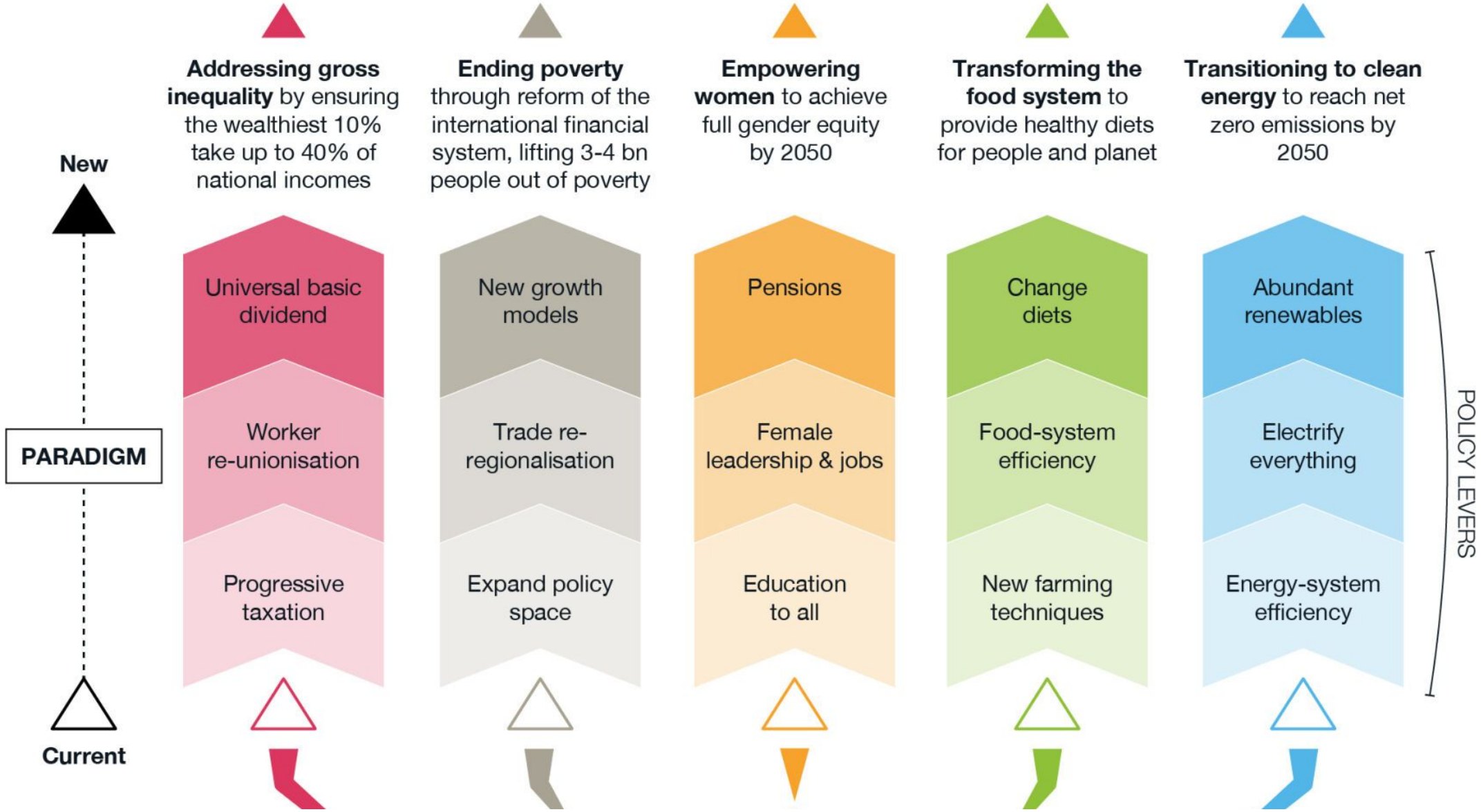
The risk of climate tipping points is rising rapidly as the world heats up

Estimated range of global heating needed to pass tipping point temperature



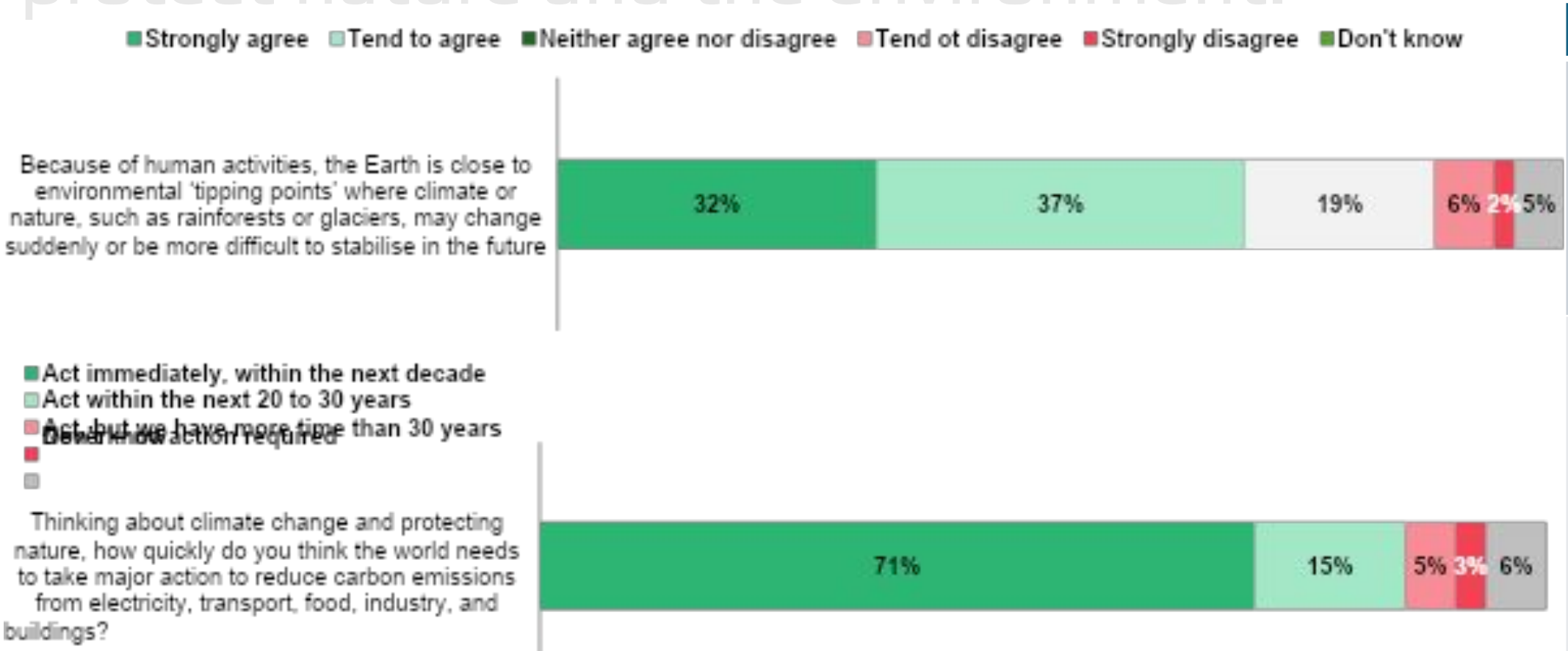
Source: McKay et al., Science, 2022.


CLIMATE CHANGE
CO_2 Concentration
Radiative Forcing
INTRODUCTION OF NOVEL ENTITIES
STRATOSPHERIC OZONE DEPLETION
INCREASE IN ATMOSPHERIC AEROSOL LOADING
OCEAN ACIDIFICATION
MODIFICATION OF BIOGEOCHEMICAL FLOWS
Phosphorus Cycle
Nitrogen Cycle
FRESHWATER CHANGE
Green Water
Blue Water
LAND SYSTEM CHANGE
CHANGE IN BIOSPHERE INTEGRITY
Genetic Diversity
Functional Integrity
SAFE OPERATING SPACE
Boundary Transgression
Safe Operating Space
Increasing Risk Zone
High Risk Zone



Inequality | Poverty | Gender Empowerment | Food and land systems | Energy

The majority of people surveyed in the G20 understand the urgency of major action to protect nature and the environment.

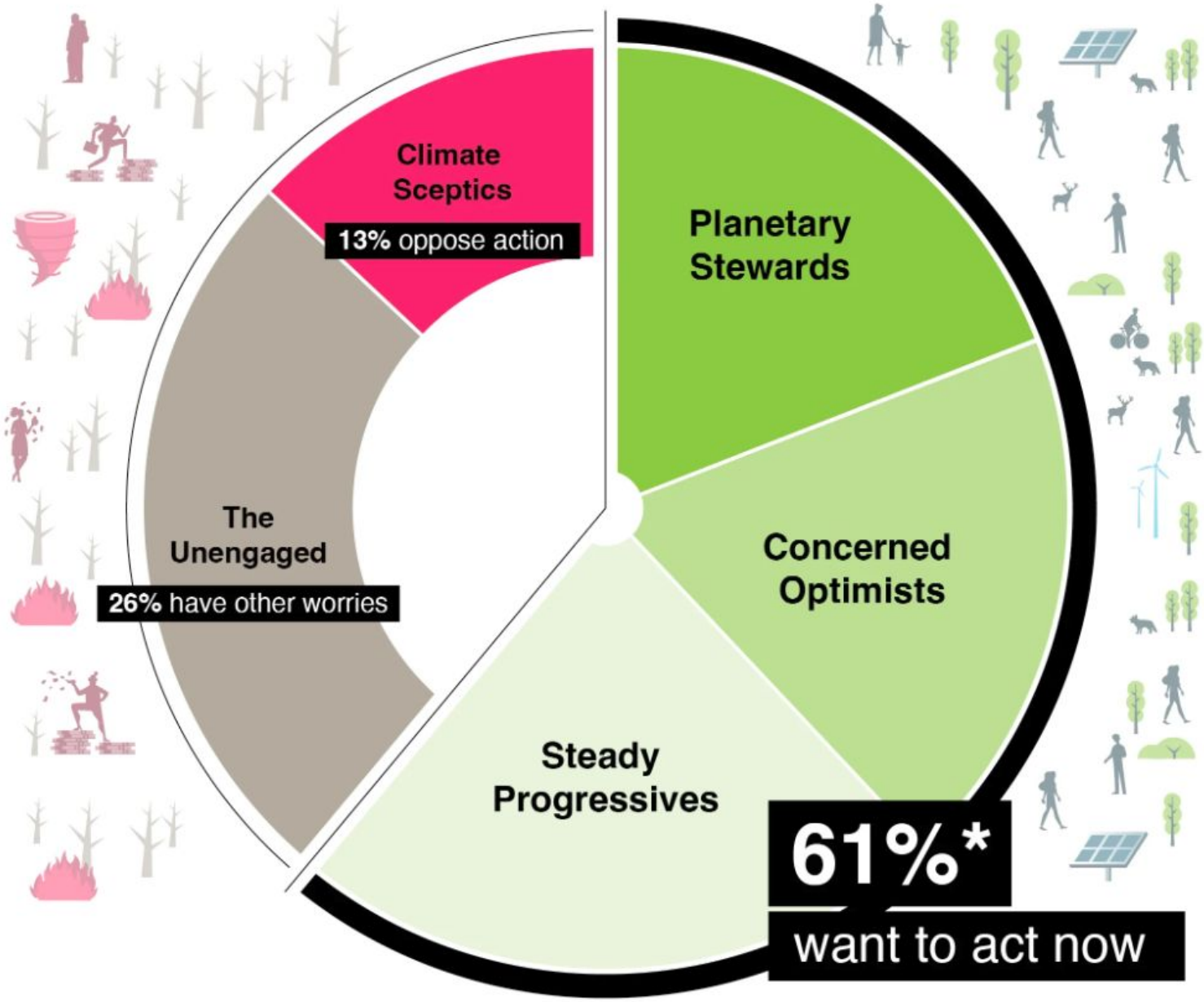


Top 2 box
69%
n/a

Q5. To what extent, if at all, do you agree or disagree with the following statements? And Q6. Thinking about climate change and protecting nature, how quickly do you think the world needs to take major action to reduce carbon emissions from electricity, transport, food, industry, and buildings? Base: 18,000 across 18 G20 countries, 18 - 55-75, online interviews, 5th March – 8th April 2024. Argentina (1,000), Australia (1,000), Brazil (1,000), Canada (1,000), China (1,000), France (1,000), Germany (1,000), India (1,000), Indonesia (1,000), Italy (1,000), Japan (1,000), Mexico (1,000), Saudi Arabia (1,000), South Africa (1,000), South Korea (1,000), Turkey (1,000), United Kingdom (1,000), United States (1,000). Percentages results are an arithmetic average of national results across the 18 G20 countries surveyed.

Who wants action to protect the planet?

Earth 4All



*of G20 countries, excluding Russia. Source: *Global Commons Survey 2021*, Ipsos

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United Nations, Geneva, 2 April 2025

Owen Gaffney

Earth4All, Nobel Prize Outreach