

Climate crisis and ecological emergency

why they concern (neuro)scientists, and what we can do

Anne E. Urai
2 May 2022
Donner lab, UKE



**Universiteit
Leiden**
The Netherlands

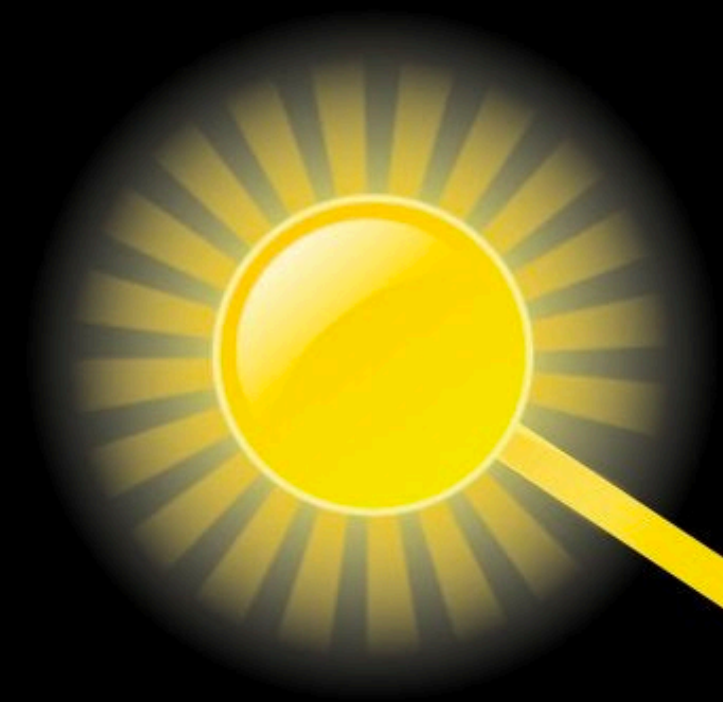
Today's talk

- The big picture: our predicament & what must be done
- Theory of social change
- Neuroscience & academia's role

The big picture

The big picture

The Greenhouse Effect

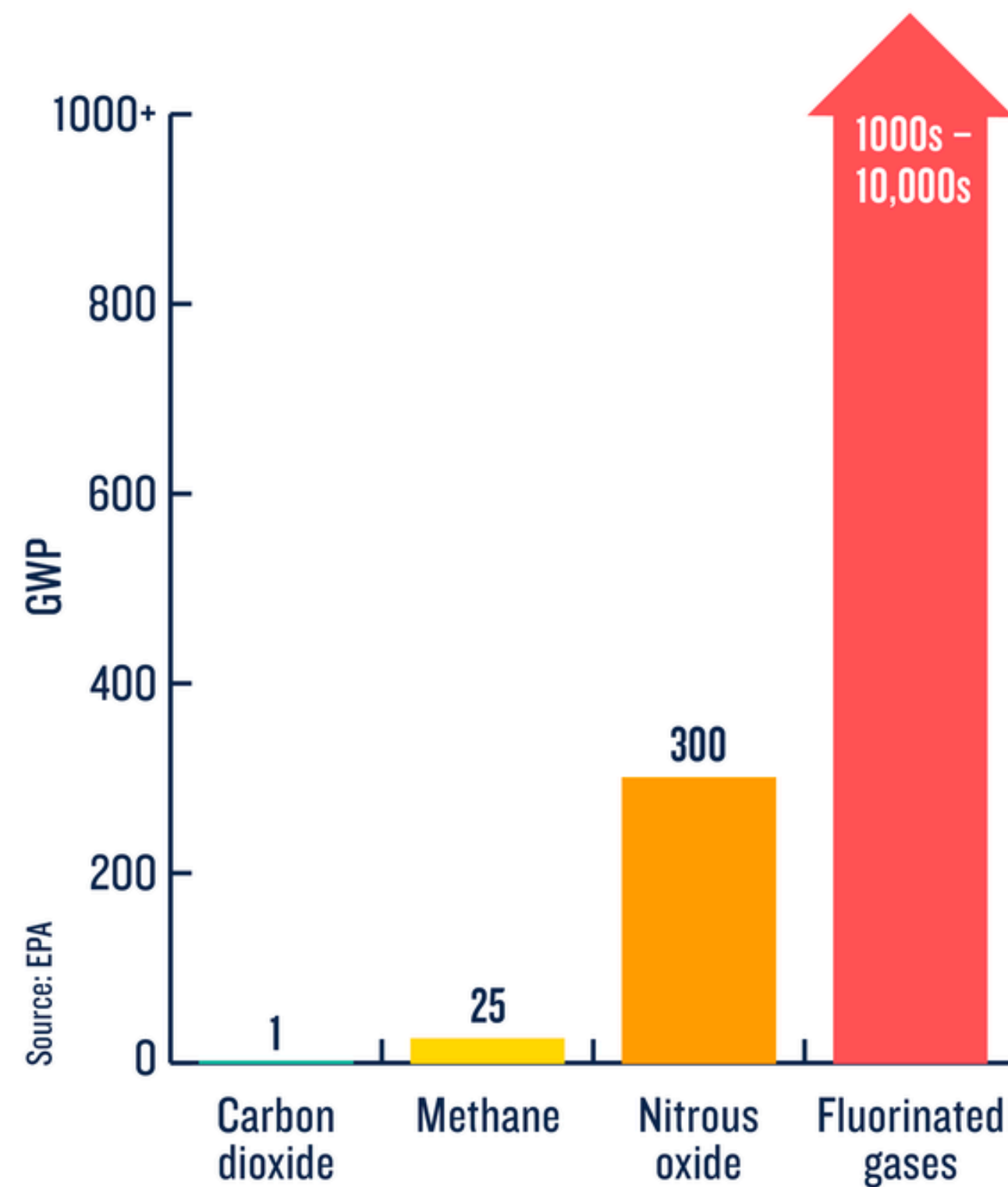


Some sunlight that hits Earth is reflected back into space, while the rest becomes heat

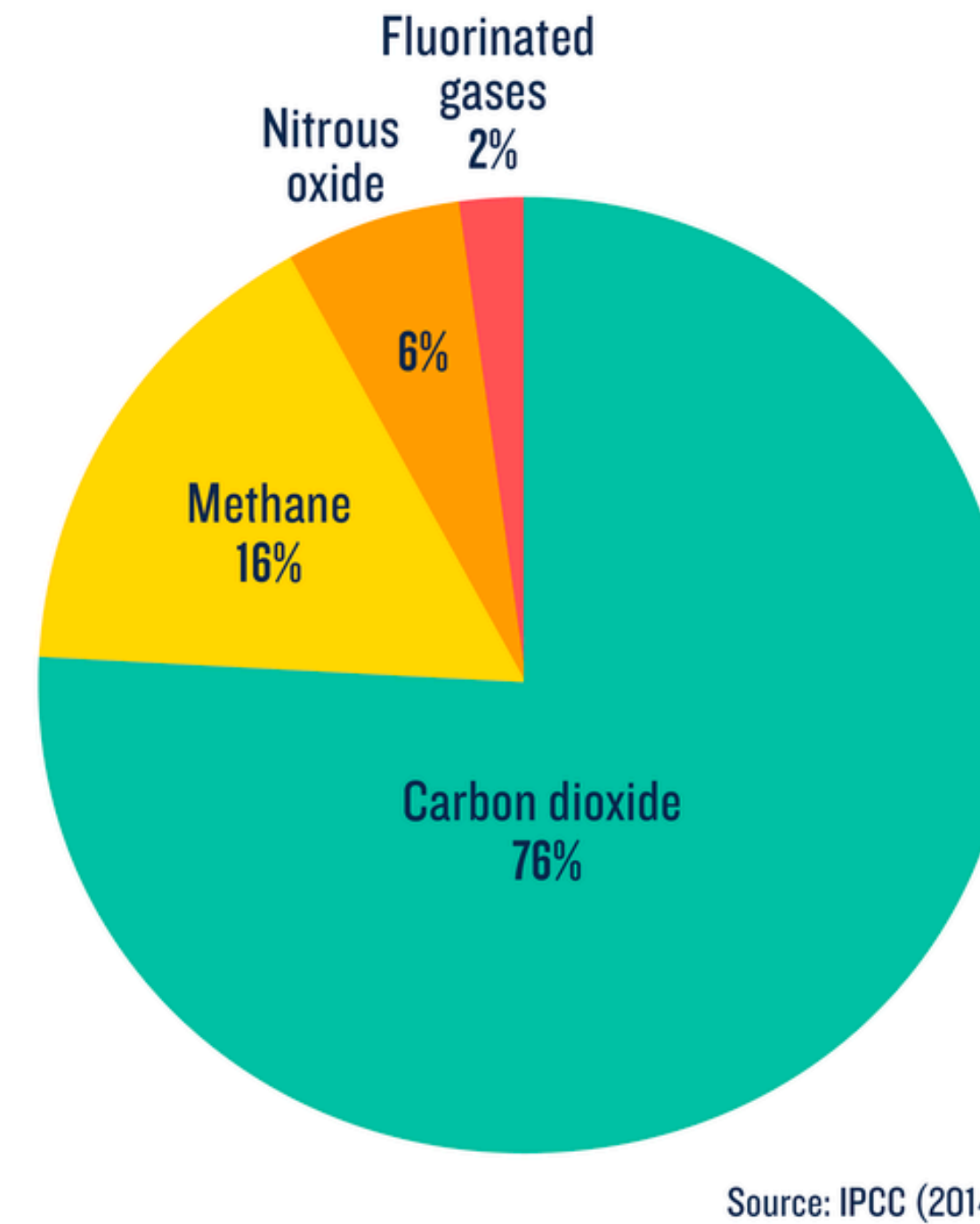
Greenhouse gases prevent heat from escaping into space, warming the planet



The big picture

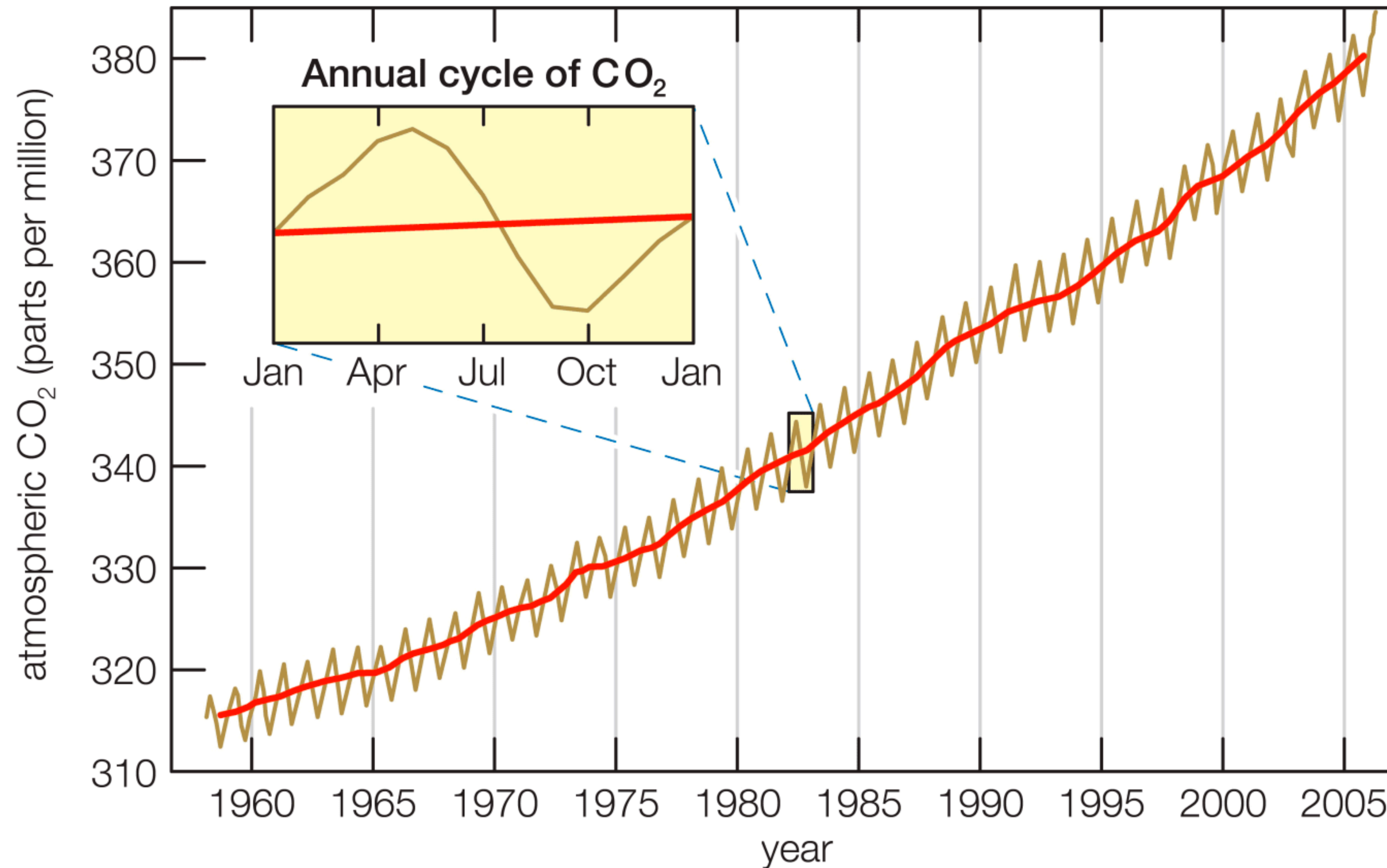


The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.

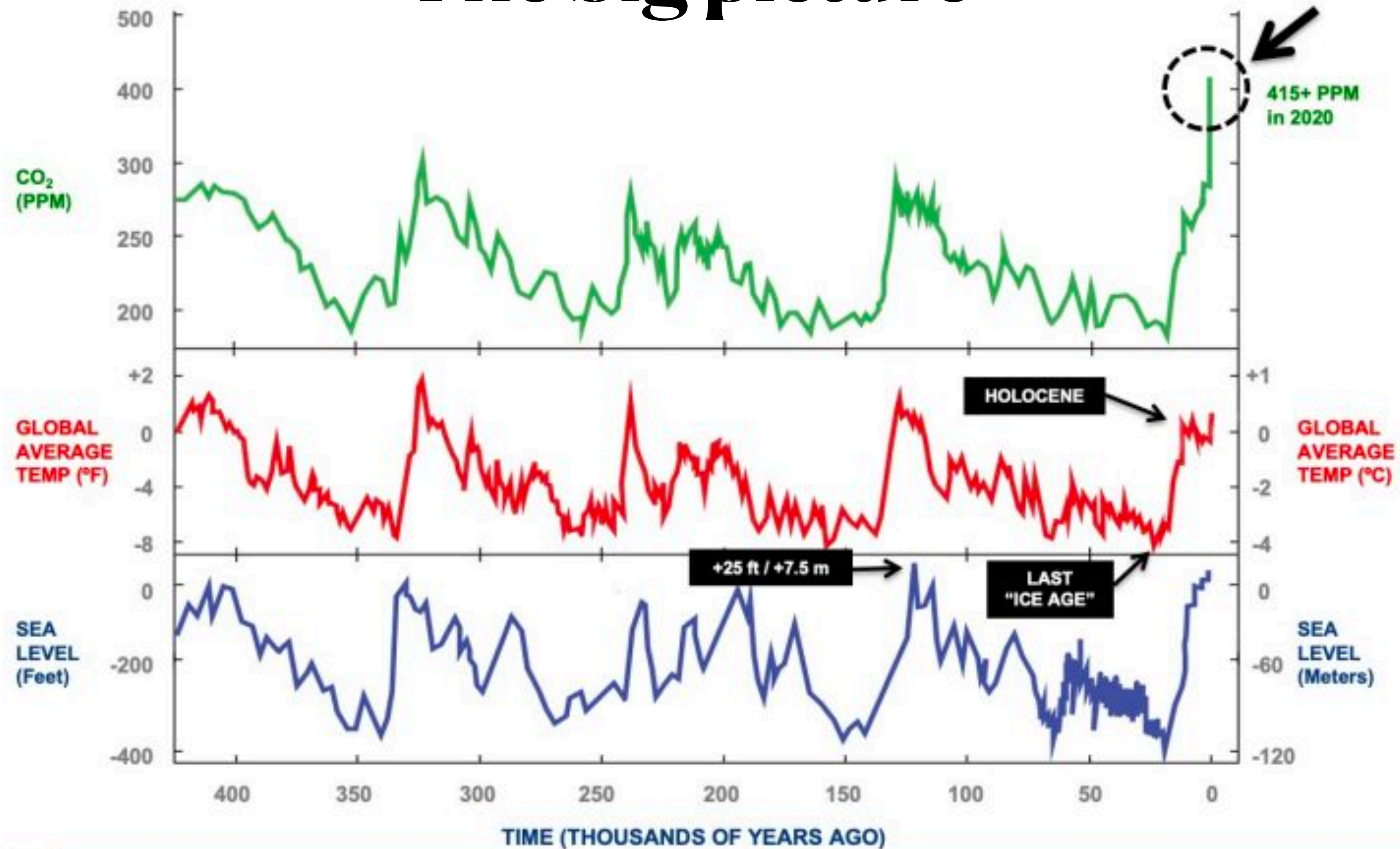


How much each human-caused greenhouse gas contributes to total emissions around the globe.

The big picture

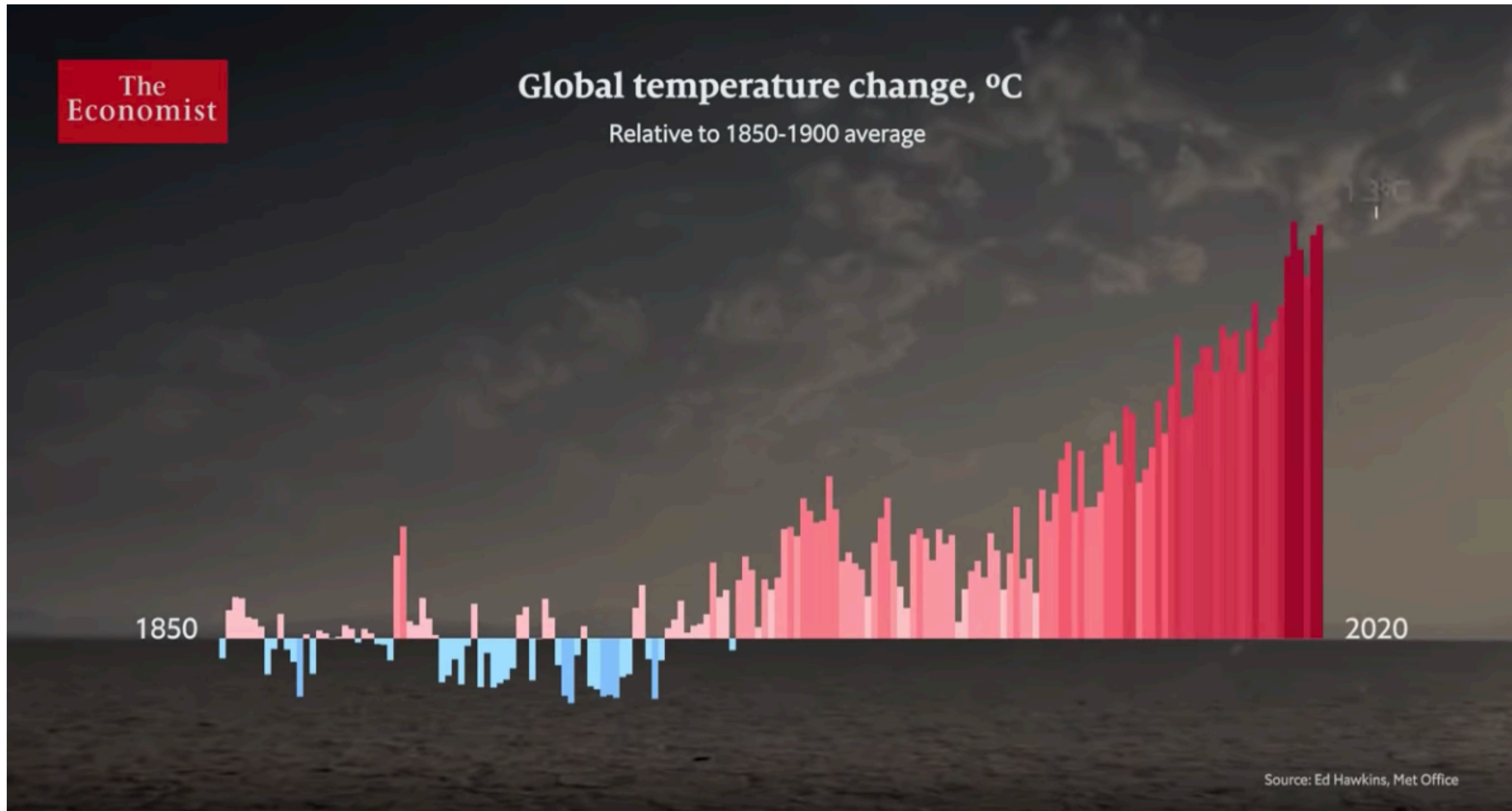


The big picture



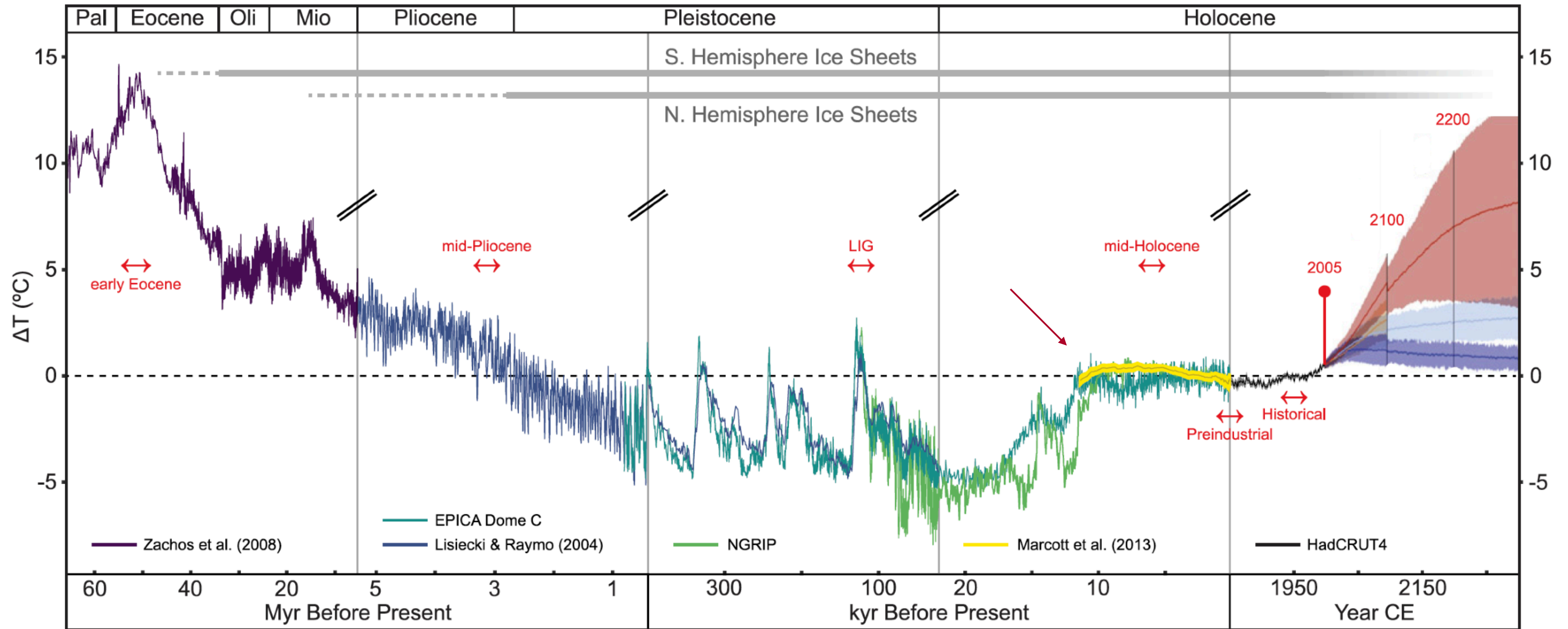
Englander, adapted from Hansen & Sato

The big picture

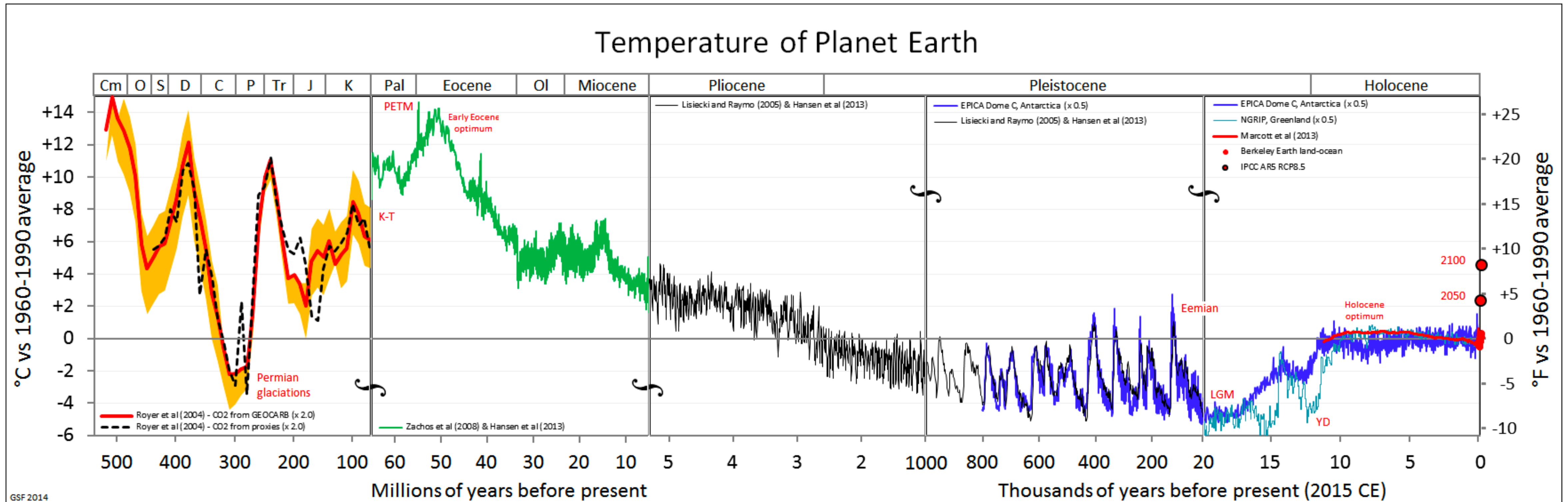


<https://www.economist.com/leaders/2021/07/24/a-3degc-world-has-no-safe-place>

The big picture



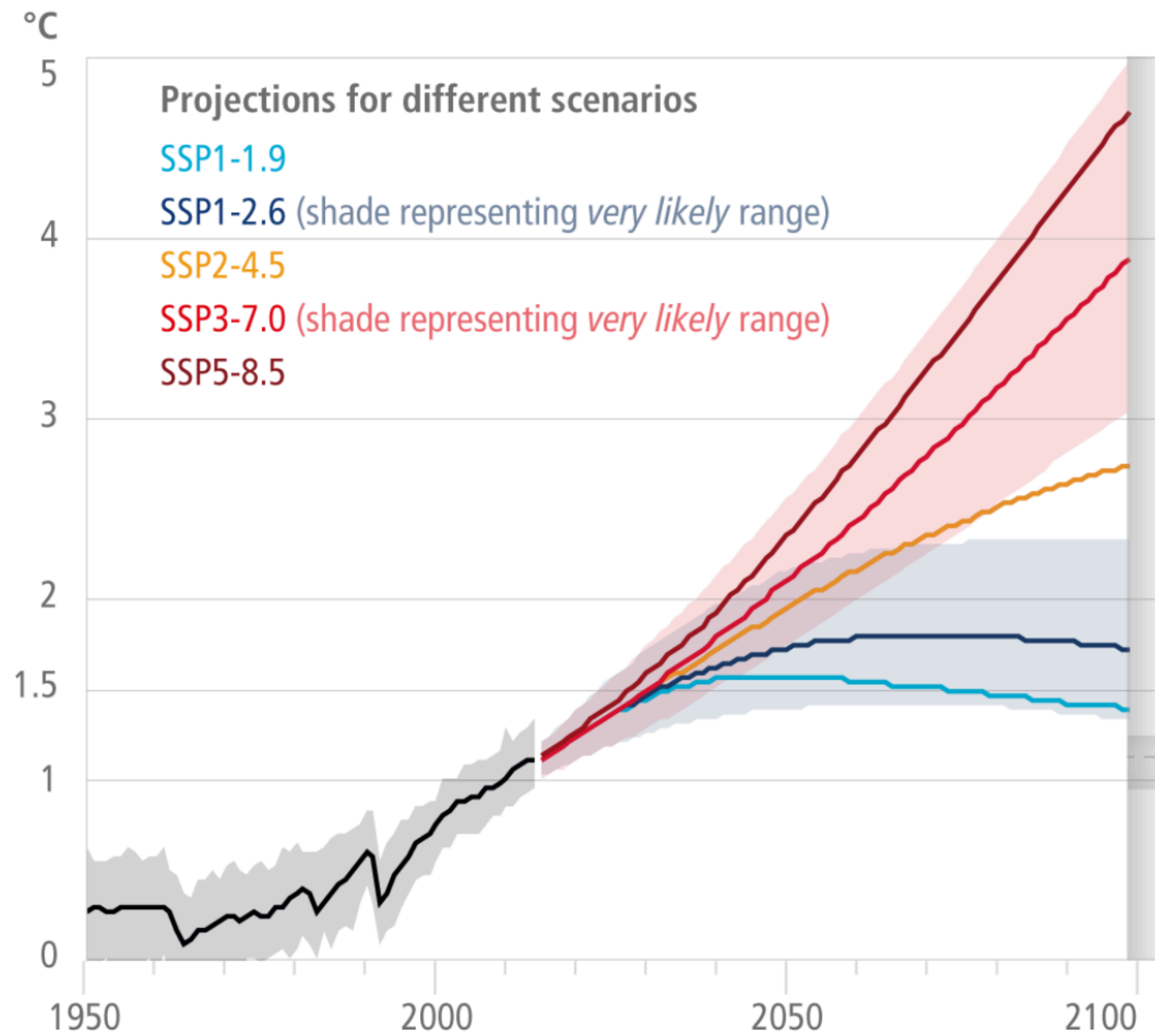
Why should we *worry*?



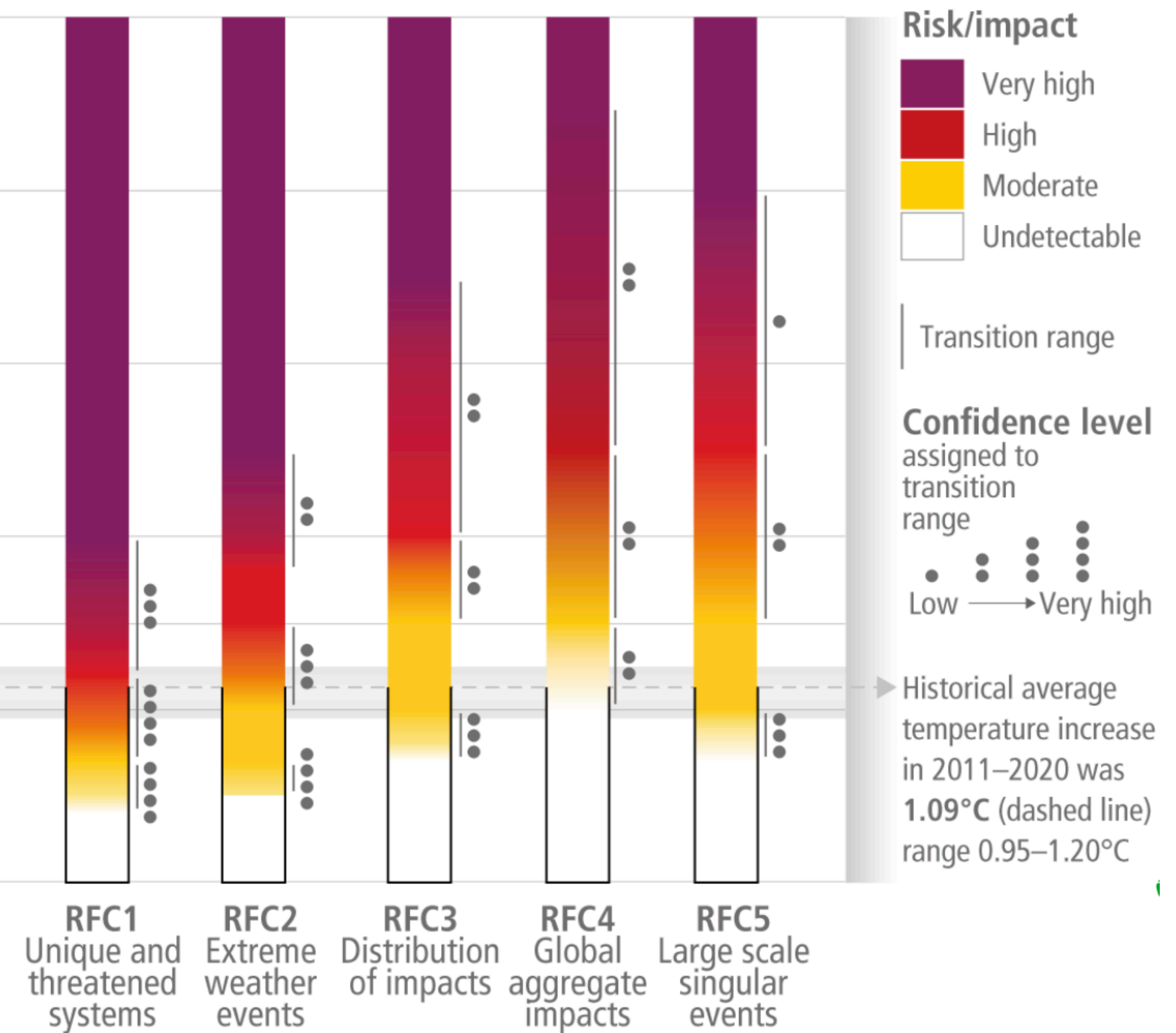
https://upload.wikimedia.org/wikipedia/commons/f/f5/All_palaeotemps.png

Why worry?

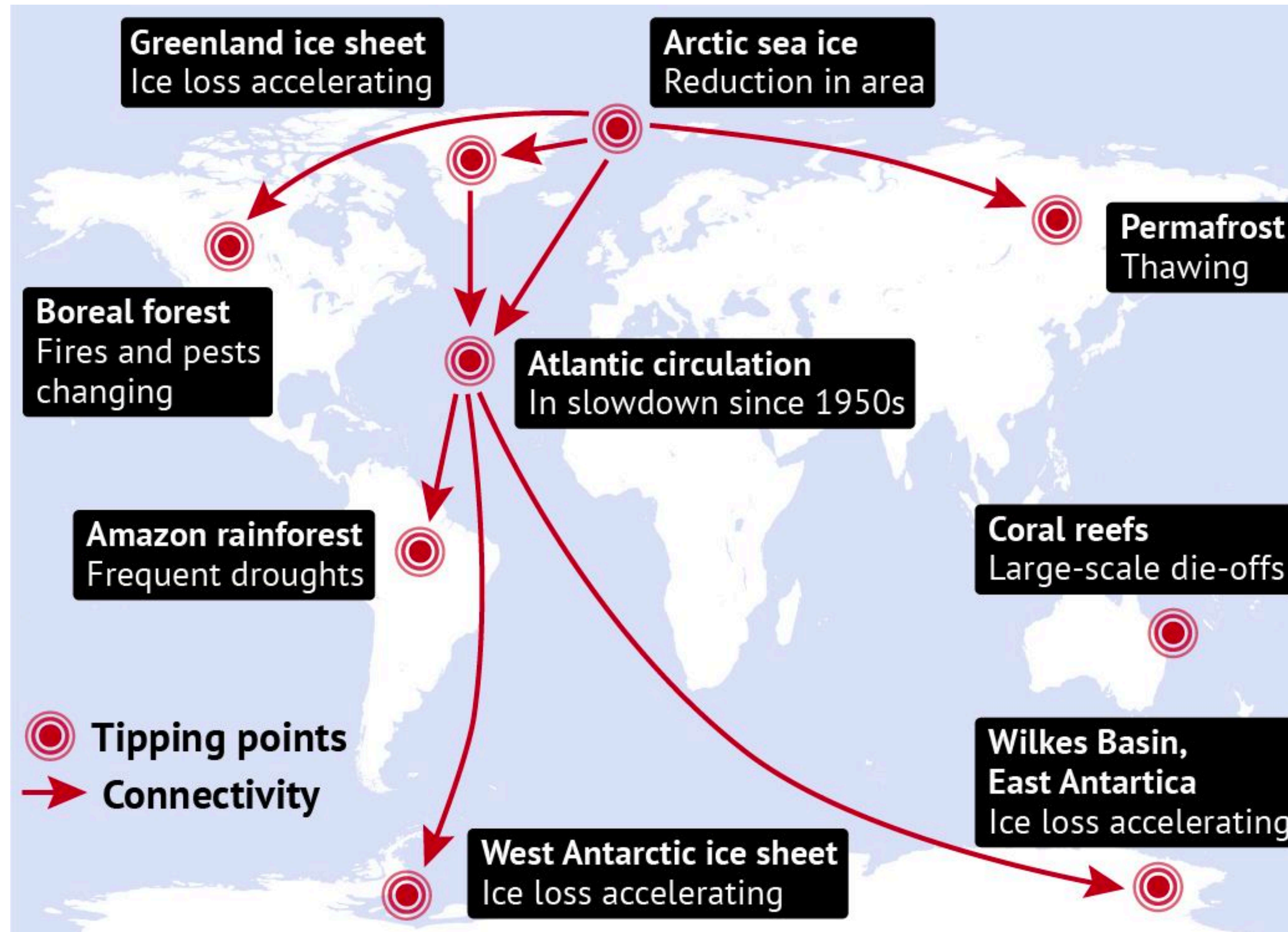
(a) Global surface temperature change
Increase relative to the period 1850–1900



(b) Reasons for Concern (RFC)
Impact and risk assessments assuming low to no adaptation



Why worry?





Why worry?

Climate crisis

- Extreme weather events: heatwaves, droughts, floods
- Sea level rise

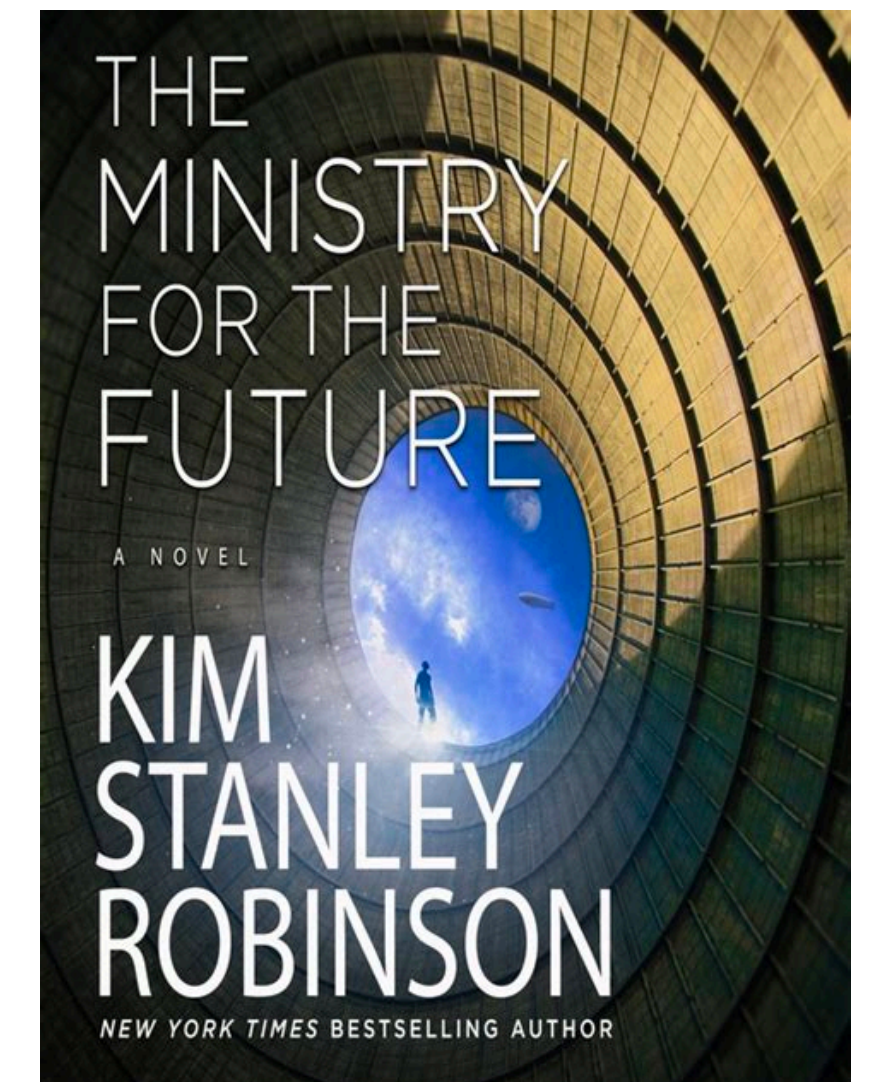
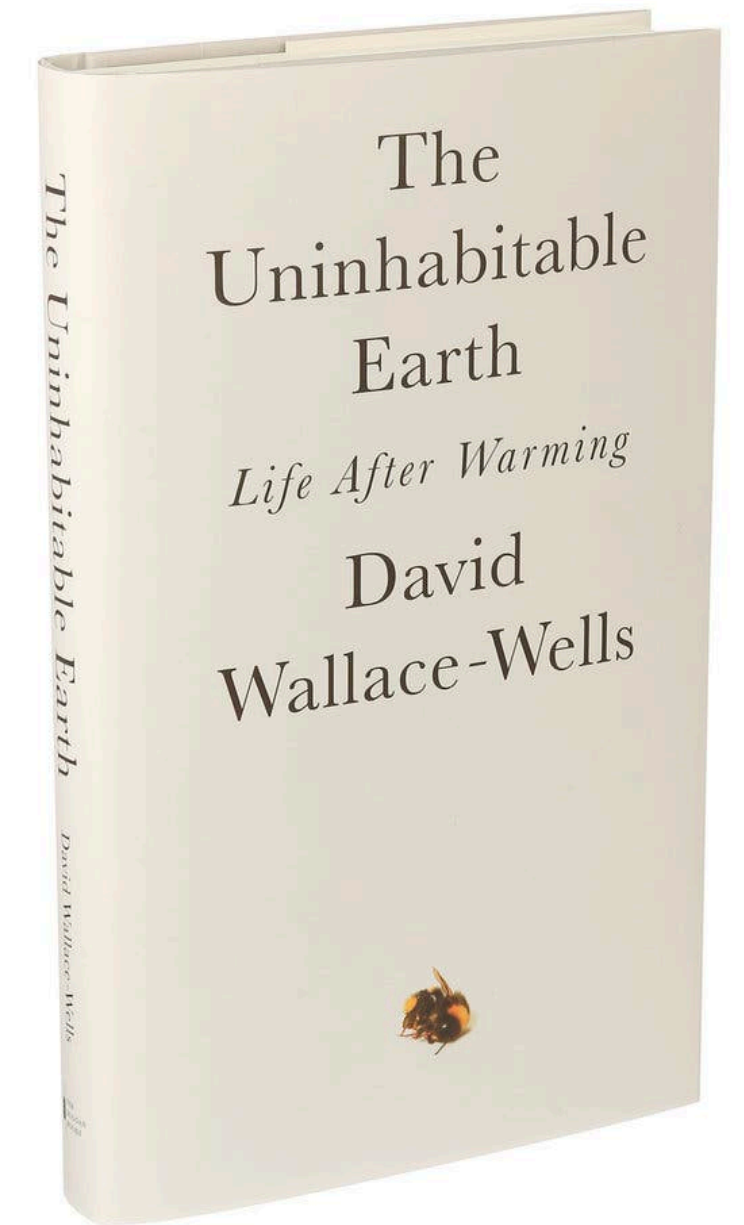
Ecological emergency

- Biodiversity loss
- Loss of agricultural lands, forests, fisheries

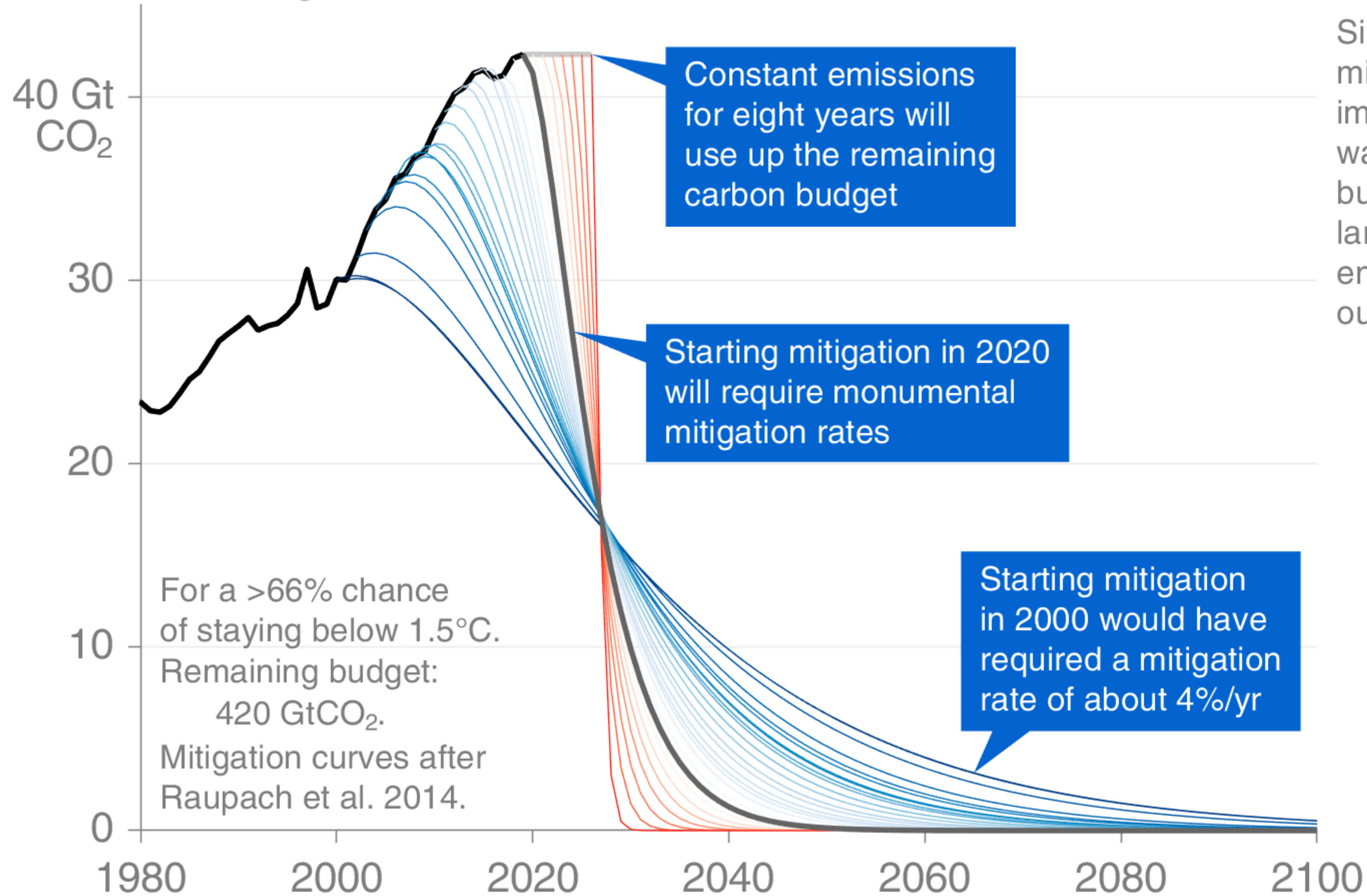
Society (& science!) is fragile

- Crop failures
- Water shortages
- Poverty and hunger
- Mass migration, conflict

[ipcc.ch](https://www.ipcc.ch)



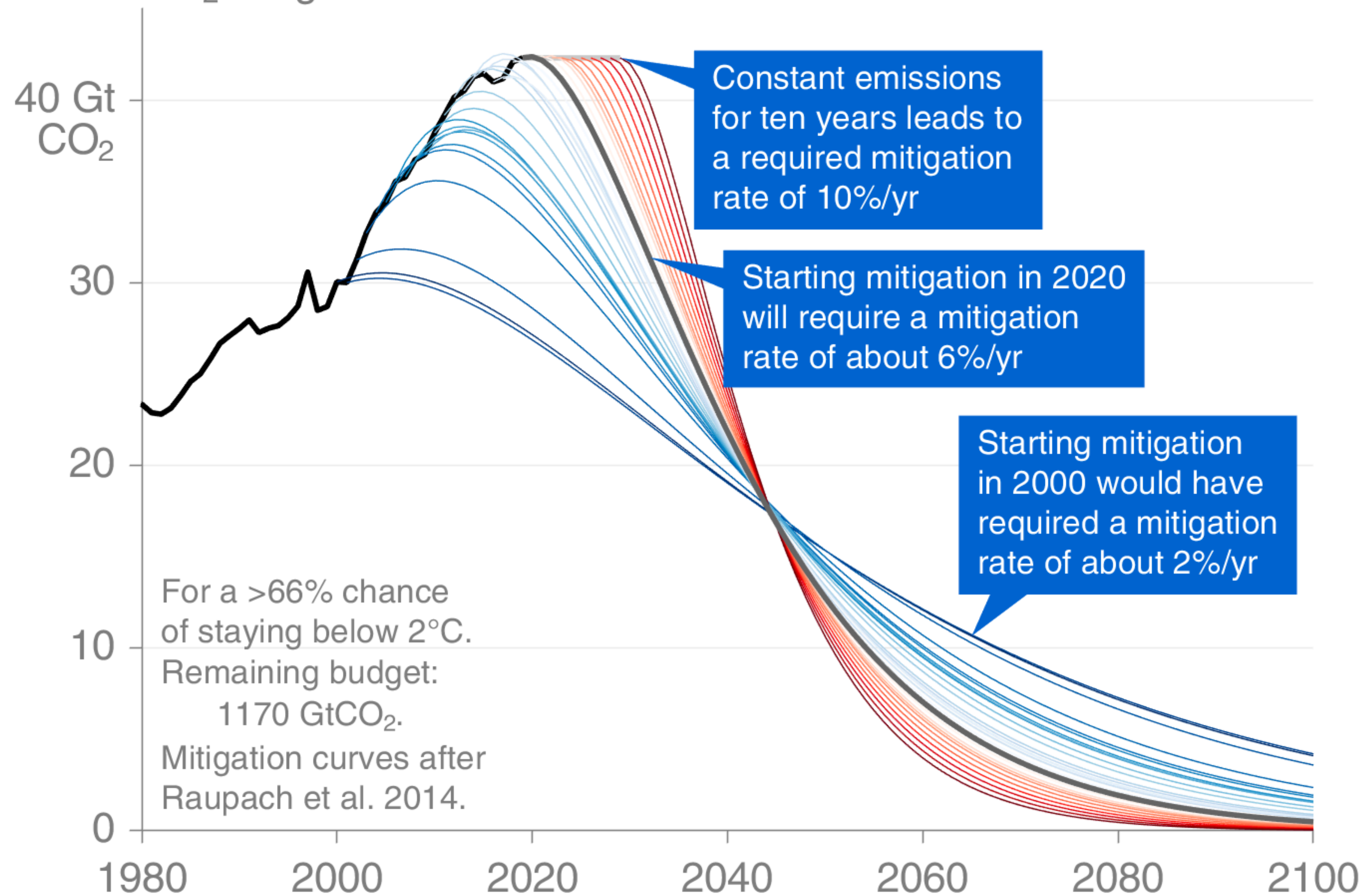
CO₂ mitigation curves: 1.5°C

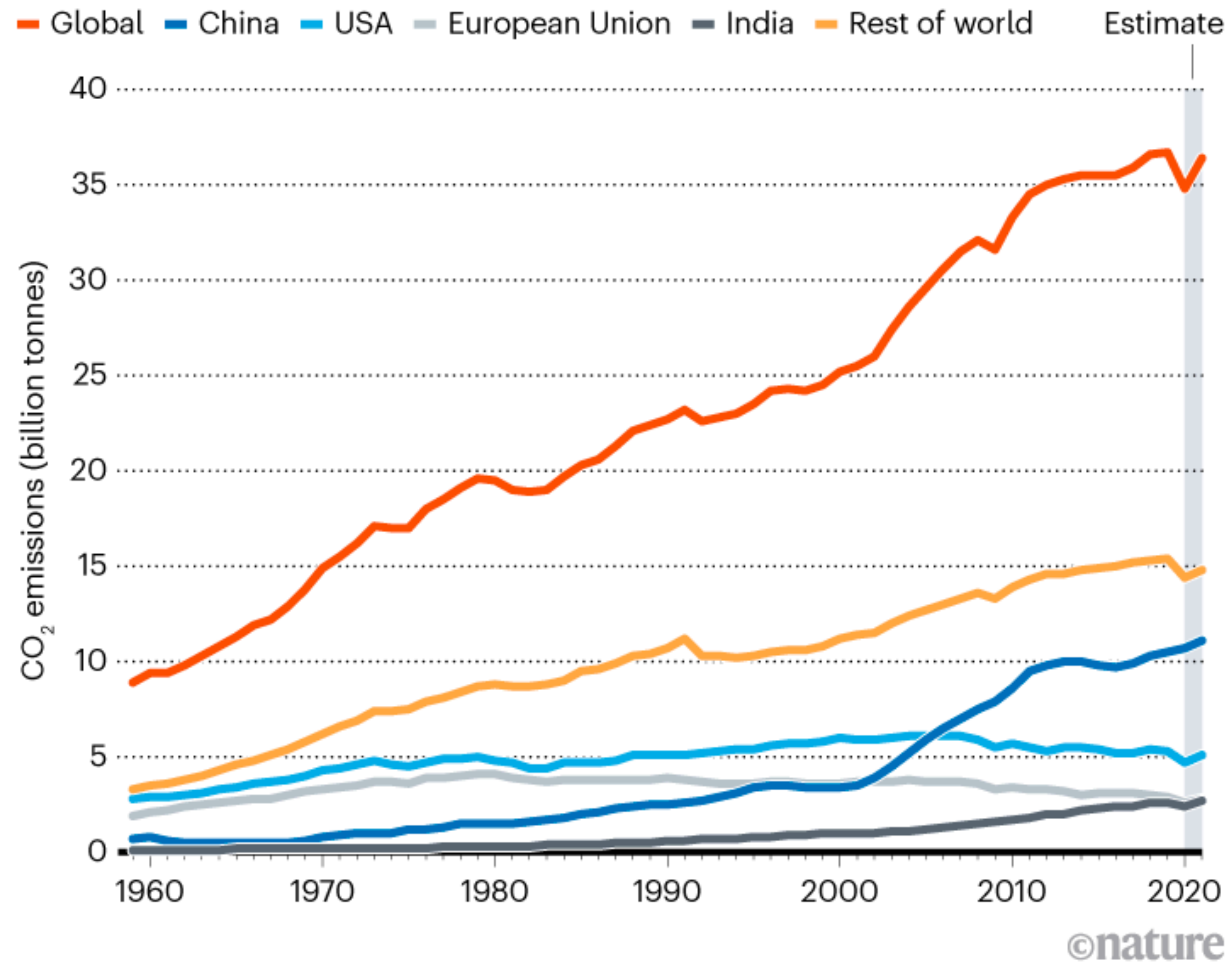


Since such steep mitigation is impossible, the only way to achieve this budget is with very large "negative" emissions: pulling CO₂ out of the atmosphere.

Real zero
vs.
Net zero

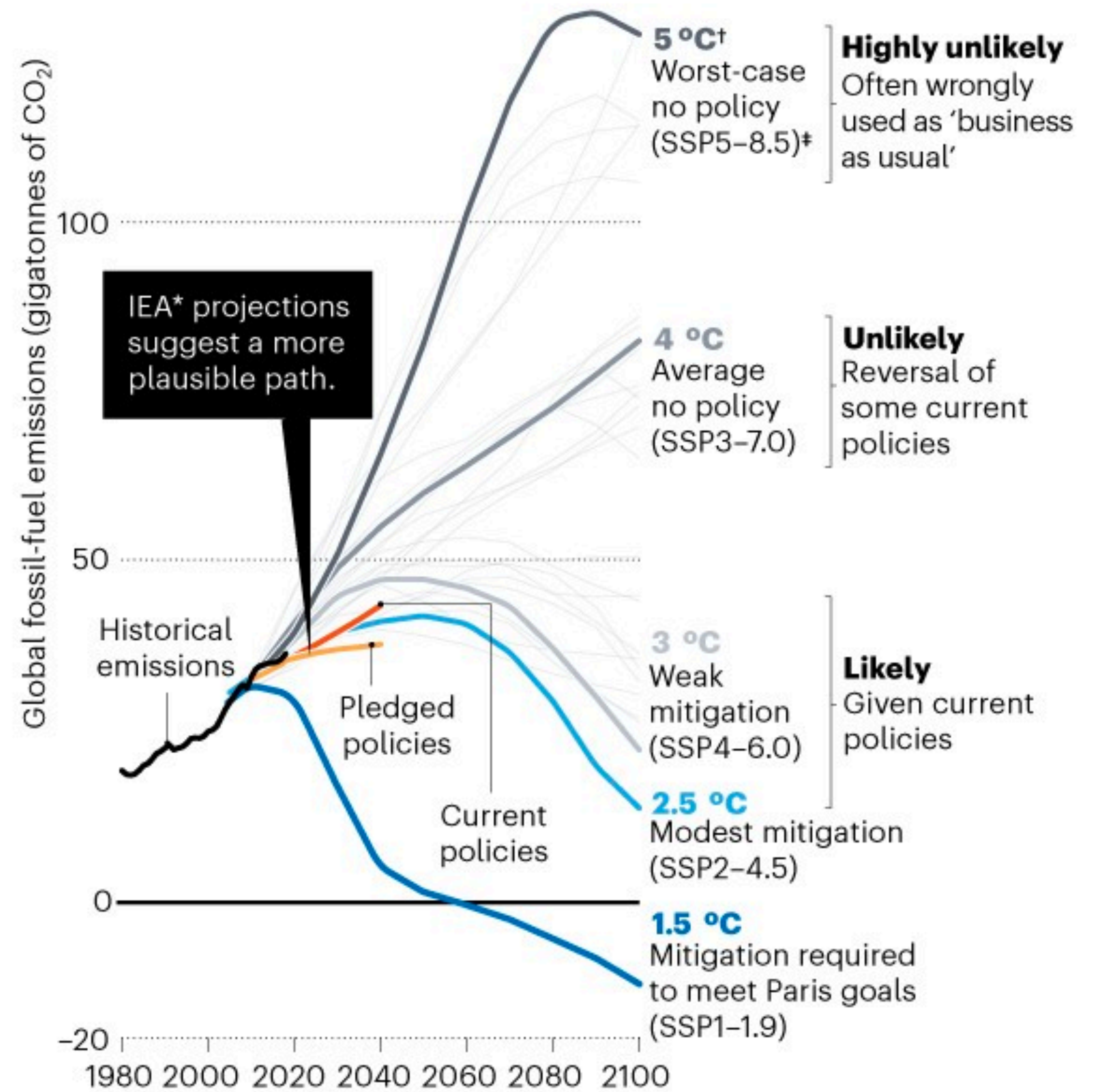
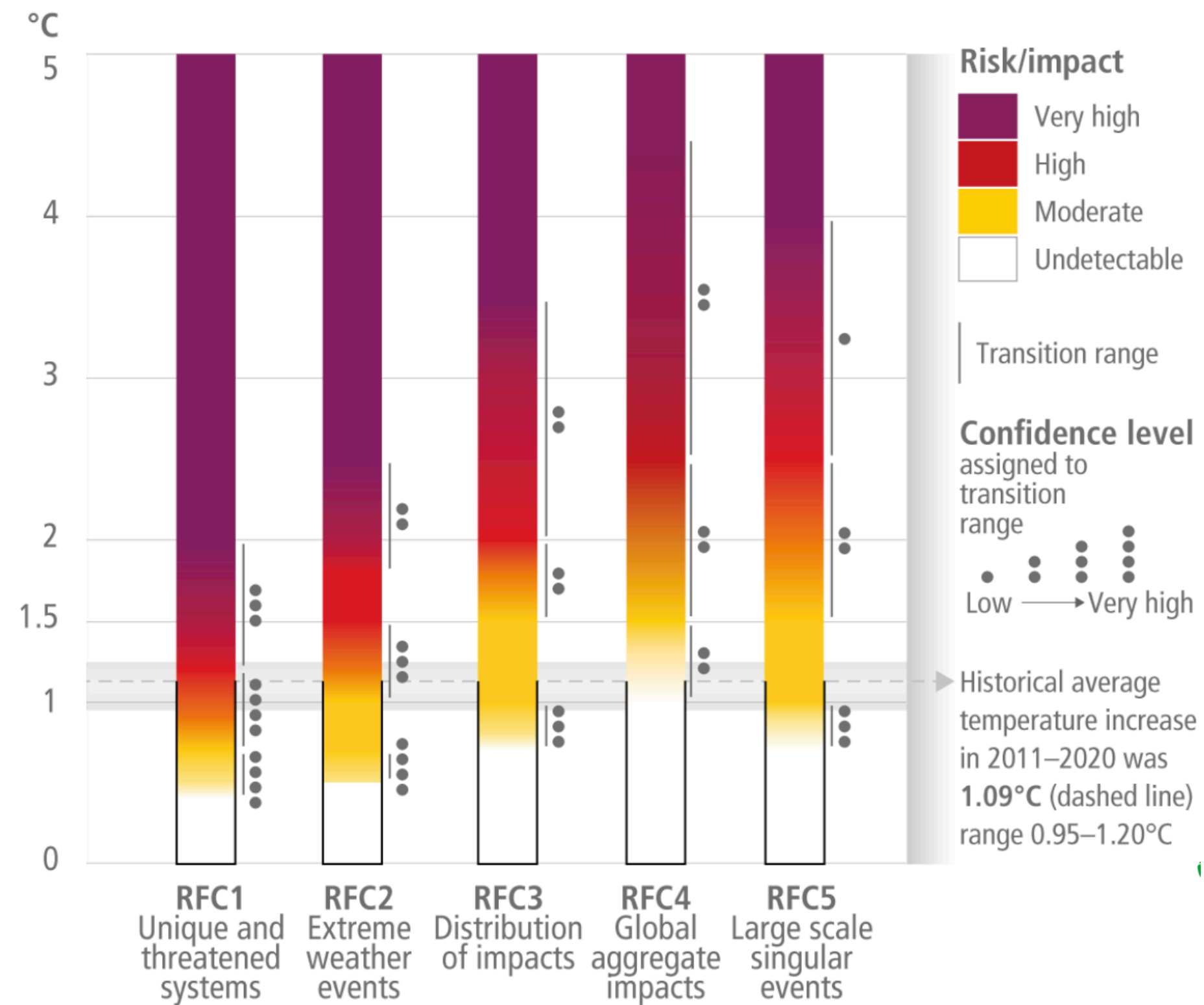
CO₂ mitigation curves: 2°C





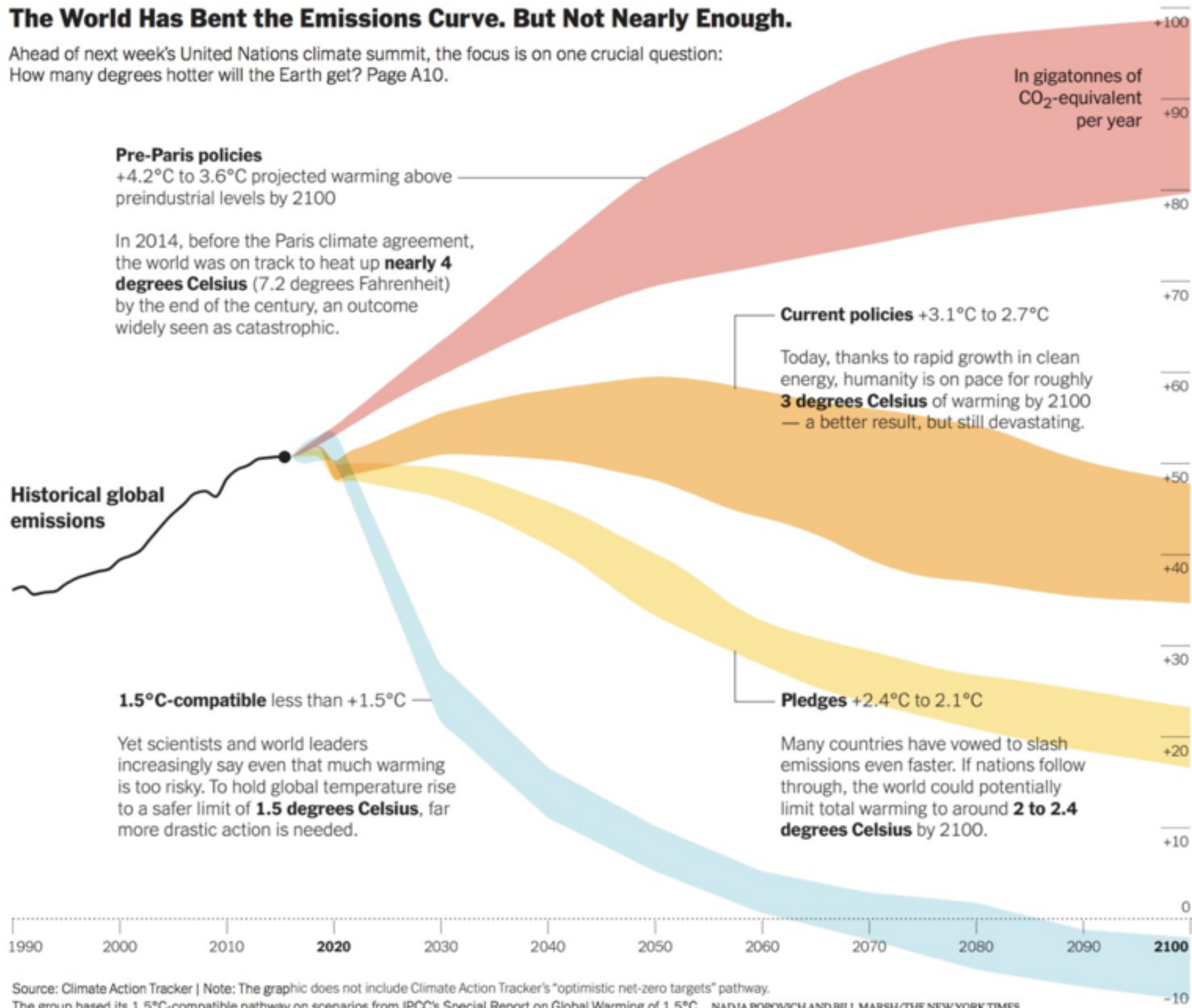
The big picture

(b) Reasons for Concern (RFC)
Impact and risk assessments assuming low to no adaptation



The World Has Bent the Emissions Curve. But Not Nearly Enough.

Ahead of next week's United Nations climate summit, the focus is on one crucial question: How many degrees hotter will the Earth get? Page A10.



Source: Climate Action Tracker | Note: The graphic does not include Climate Action Tracker's "optimistic net-zero targets" pathway.

The group based its 1.5°C-compatible pathway on scenarios from IPCC's Special Report on Global Warming of 1.5°C. NADJA POPOVICH AND BILL MARSH/THE NEW YORK TIMES



Tyler Comrie

<https://www.economist.com/leaders/2021/07/24/a-3degc-world-has-no-safe-place>

What can we do?

(as citizens,
individuals,
scientists)



Bill McKibben ✓

@billmckibben



Basic IPCC formula, in order

- 1) build massive amounts of (now cheap) sun and wind
- 2) Electrify everything to run on it
- 3) Conservation and efficiency
- 4) Research the hell out of the last hard stuff (planes, cement, etc)
- 5) Stop cutting down trees for cows (or anything else)



“I wish the Ring had never come to me. I wish none of this had happened”,

*“So do all who live to see such times, but that is not for them to decide.
All we have to decide is what to do with the time that is given to us.”*

History of systems change

technological - political - social

Easter morning 1900: 5th Ave, New York City. Spot the automobile.



Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.



Source: George Grantham Bain Collection.

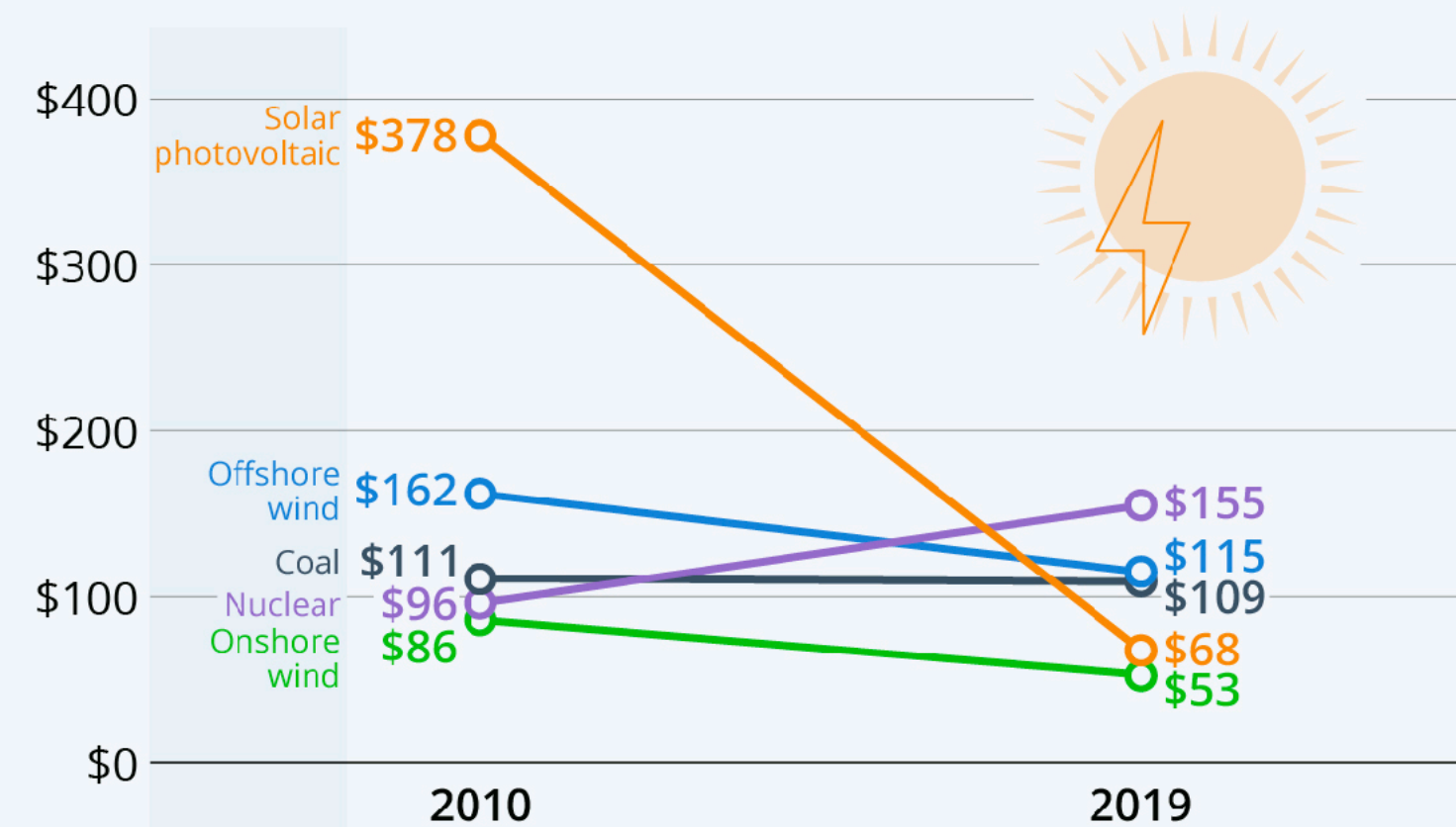


Future of systems change

technological - political - social

The Falling Cost of Renewable Energy

Price per megawatt hour of electricity, by source*



* Global weighted average of levelized costs of energy (LCOE), without subsidies.
Source: OurWorldinData.org



statista



The New York Times



[PLAY THE CROSSWORD](#)

[Daily Business Briefing >](#)

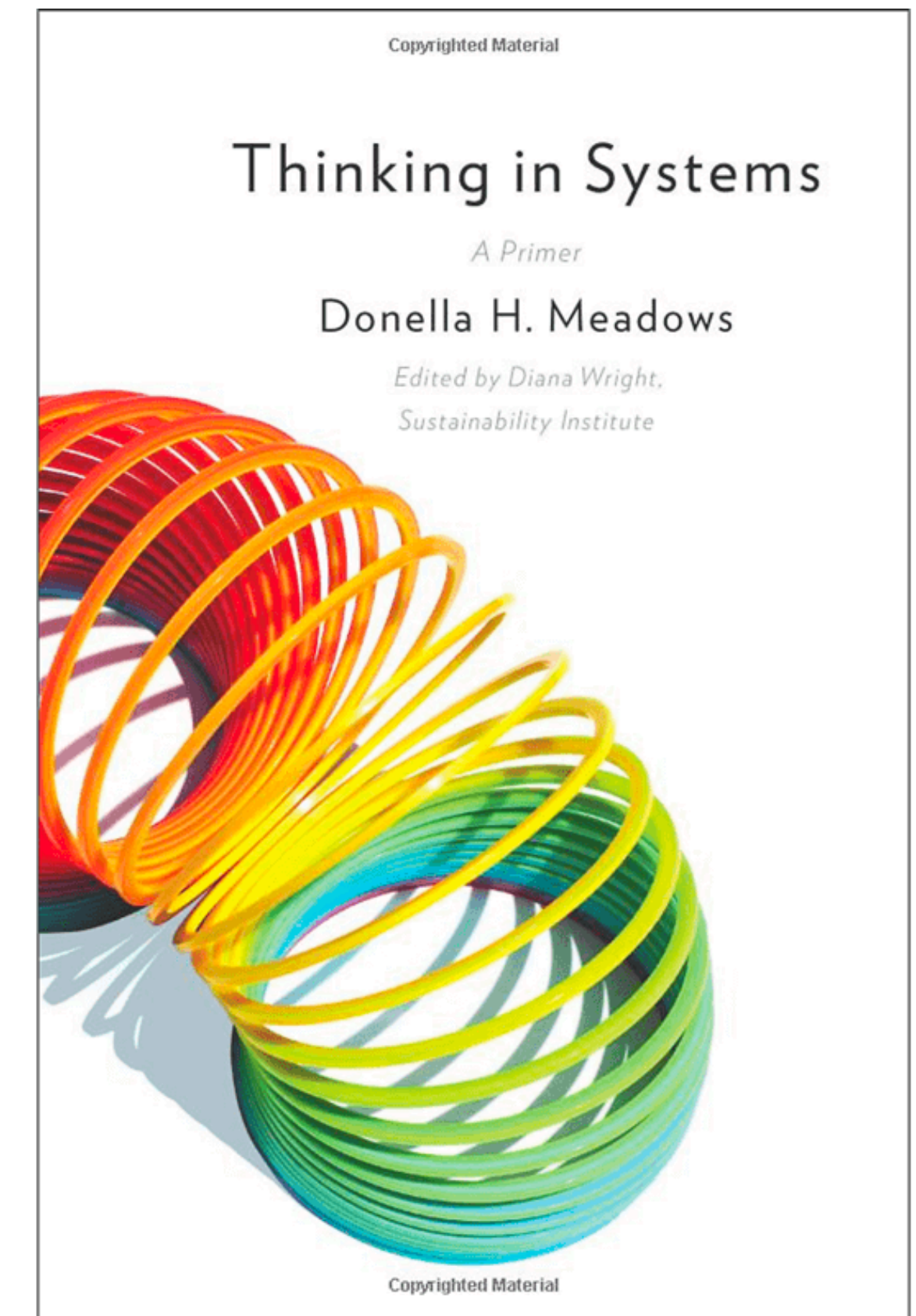
Germany puts a stop to Nord Stream 2, a key Russian natural gas pipeline.

Germany halted certification of the pipeline linking the country to Russia in response to the Kremlin's recognition of two separatist regions in Ukraine.



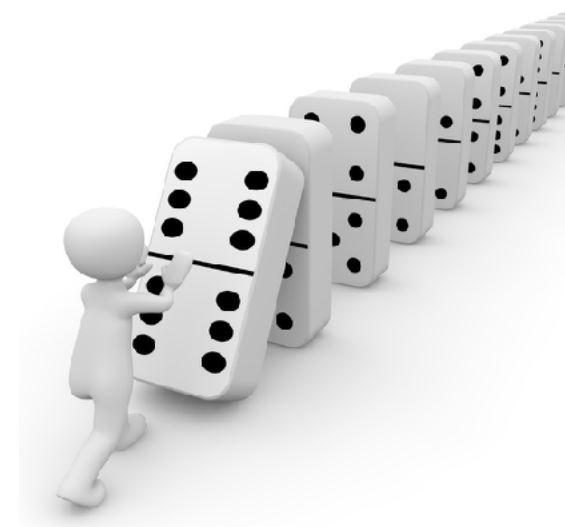
Systems change in academia

- *Why us scientists?*
 - We understand data (exponential growth, feedback loops, oscillatory dynamics)
 - We know something about human behavior
 - We are mostly respected
 - We are influential in some decision-making circles
- *Surely things won't really change?*
 - Open science: preprints, data sharing, replication studies
 - Diversity: MeToo, BLM



What can we do?

- Know the science
 - e.g. <https://fabindablander.com/menu/climate.html>
- Beware greenwashing
 - Leverage points vs. virtual signalling
 - Carbon footprint vs. climate shadow
- Use our data literacy, respect and influence
- Lead from the front & be the multiplier



Think global, act local

- It's where we are
- It's the politics we know
- It's what we can influence
- Our institutions can be big and influential
- When we change them it percolates
- Social change starts locally via *collective* action

Where to start?

Theory of social change

(all of us, as humans)




<https://www.mic.com/impact/forget-your-carbon-footprint-lets-talk-about-your-climate-shadow>

How Can Neuroscientists Respond to the Climate Emergency?

Adam R. Aron,^{1,*} Richard B. Ivry,² Kate J. Jeffery,³ Russell A. Poldrack,⁴ Robert Schmidt,⁵ Christopher Summerfield,^{6,*} and Anne E. Urai⁷

<https://doi.org/10.1016/j.neuron.2020.02.019>

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Charlotte L. Rae¹ , Martin Farley^{2,3}, Kate J. Jeffery⁴ 
and Anne E. Urai⁵ 

<https://doi.org/10.1177/23982128221075430>

All materials and more resources at
anneurai.net/green-neuroscience



These levels all influence each other



Our research impact



Our research footprint

- UCL: 48% of emissions from scientific facilities
 - Ventilation, refrigeration, equipment, plastics



Martin Farley @ BNA:
<https://youtu.be/cGgwXmMiGLU?t=1129>

Our research footprint

- Big, open data: more compute & storage
- Data centers: 2% of all CO₂ emissions
 - Efficient algorithms
 - When & where to compute?



Our research footprint



- Google: 100% renewable



- Amazon Web Services
 - currently 50% renewable



- non-renewable storage offset (highly problematic)



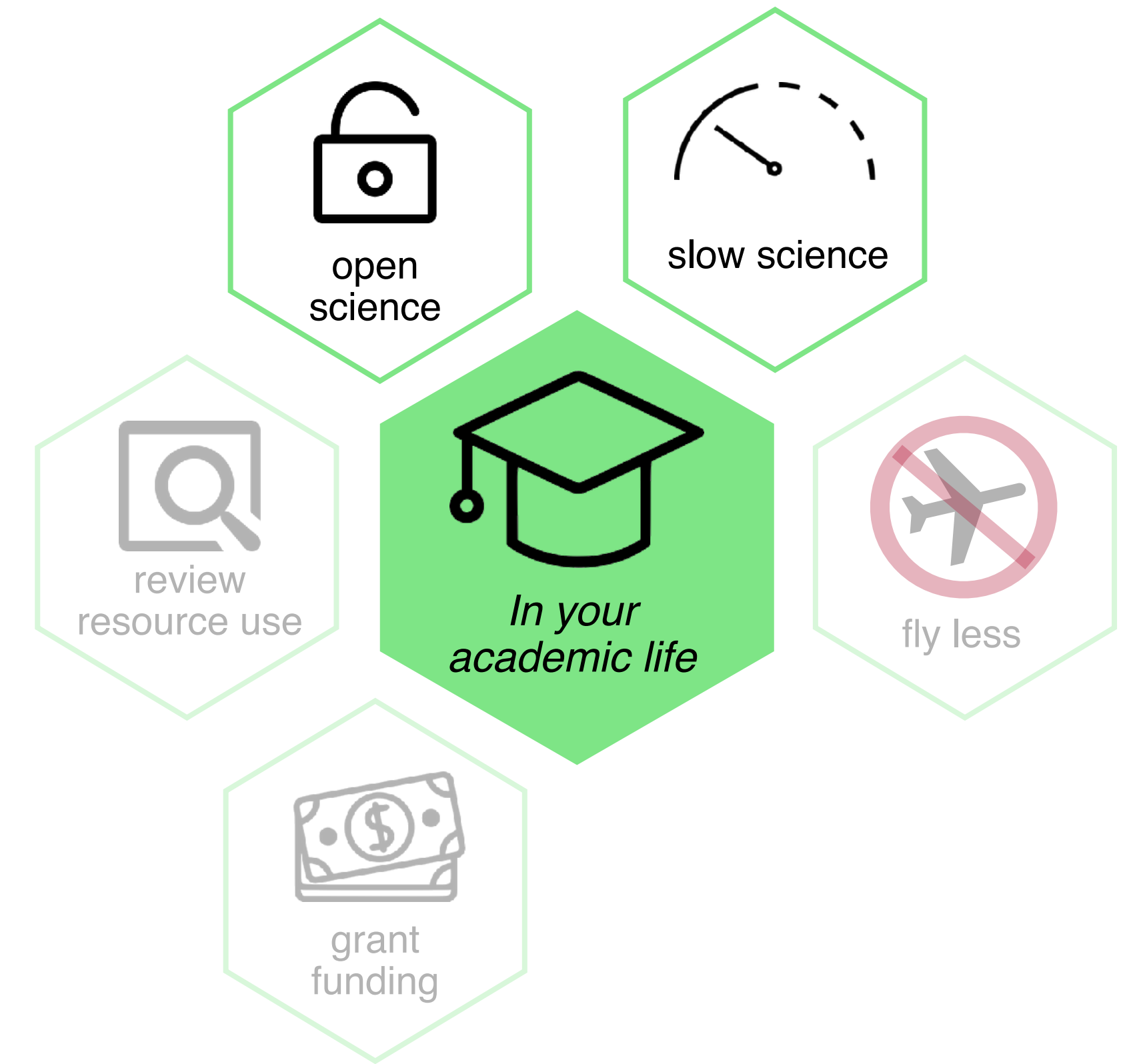
Our research footprint

- Liquid helium is *mined*:
byproduct of fossil fuel extraction
- Recycle helium boil-off
- Invest in non-helium options
 - e.g. OPM-MEG



Our academic practices

- **Open science**
 - Reuse & recycle
- **Slow science** (Frith, 2020)
 - Quality over quantity



Our academic practices

- Be resource conscious
 - *Resource use* reviews
(similar to ethical review boards)

Grant review

- e.g. UKRI: net-zero by 2040

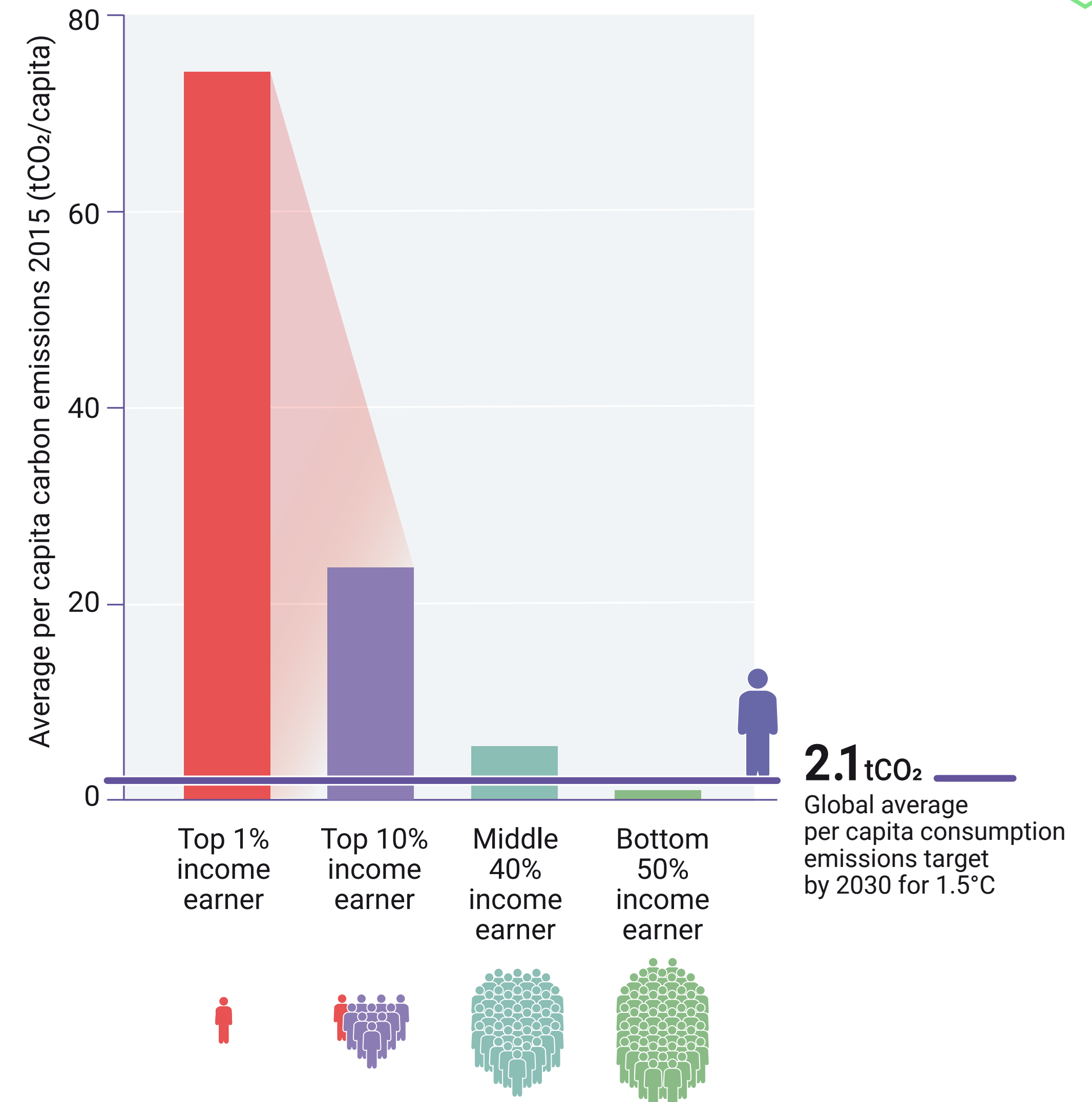


Flying less - the problem



<https://wedocs.unep.org/xmlui/handle/20.500.11822/34432>

- We fly *a lot*...
 - especially senior academics
 - mostly to conferences
 - 12-27% of university emissions (KNAW)
- Travel is ingrained in our professional norms
 - prestige, hiring, networking, opportunities

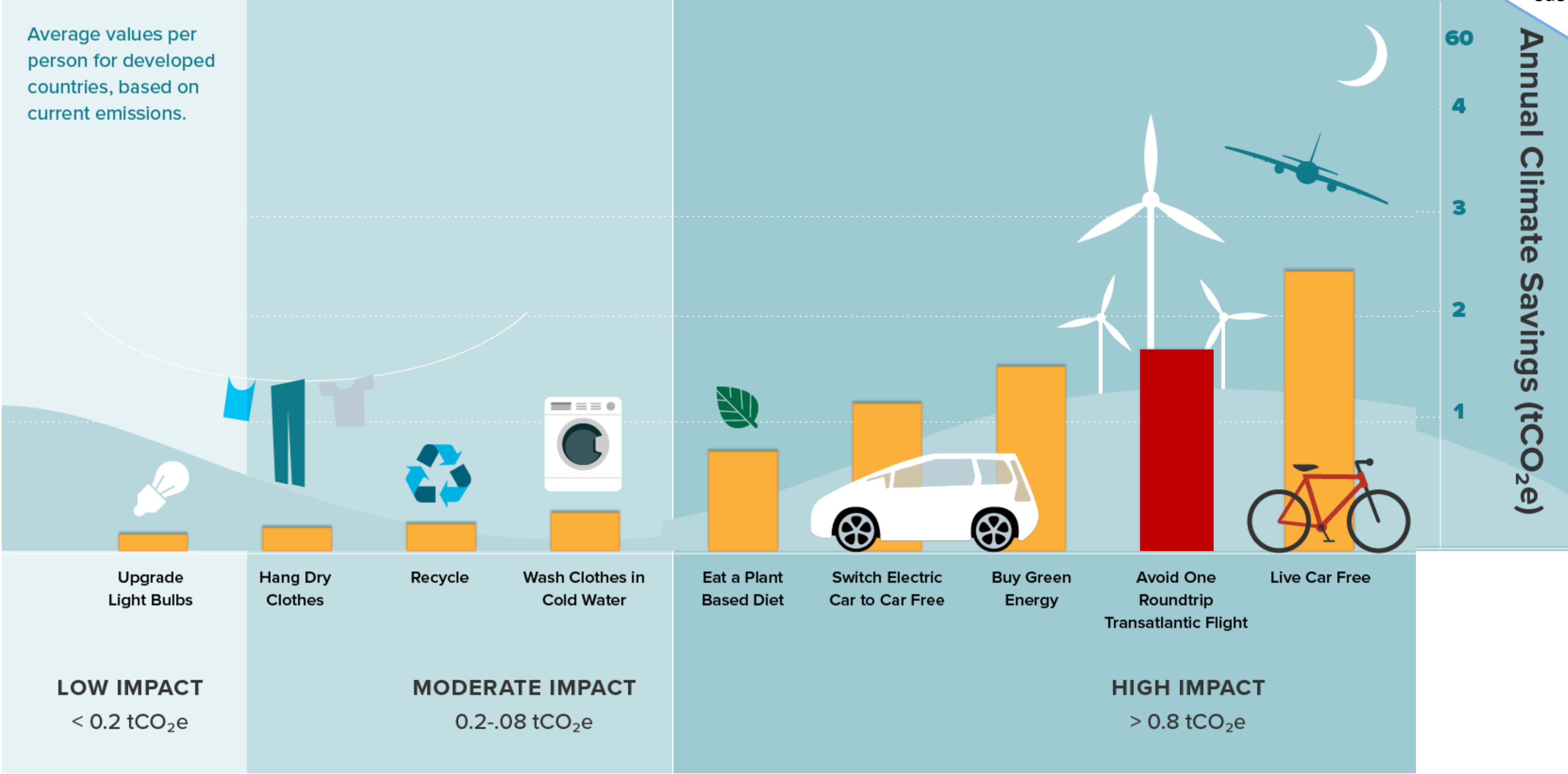


The problem with offsets



<https://features.propublica.org/brazil-carbon-offsets/inconvenient-truth-carbon-credits-dont-work-deforestation-redd-acre-cambodia/>

Individual behavior



Original Data from Wynes & Nicholas, 2017, Environmental Research Letters <https://doi.org/10.1088/1748-9326/aa7541>
Original Graphic from Catrin Jakobsson

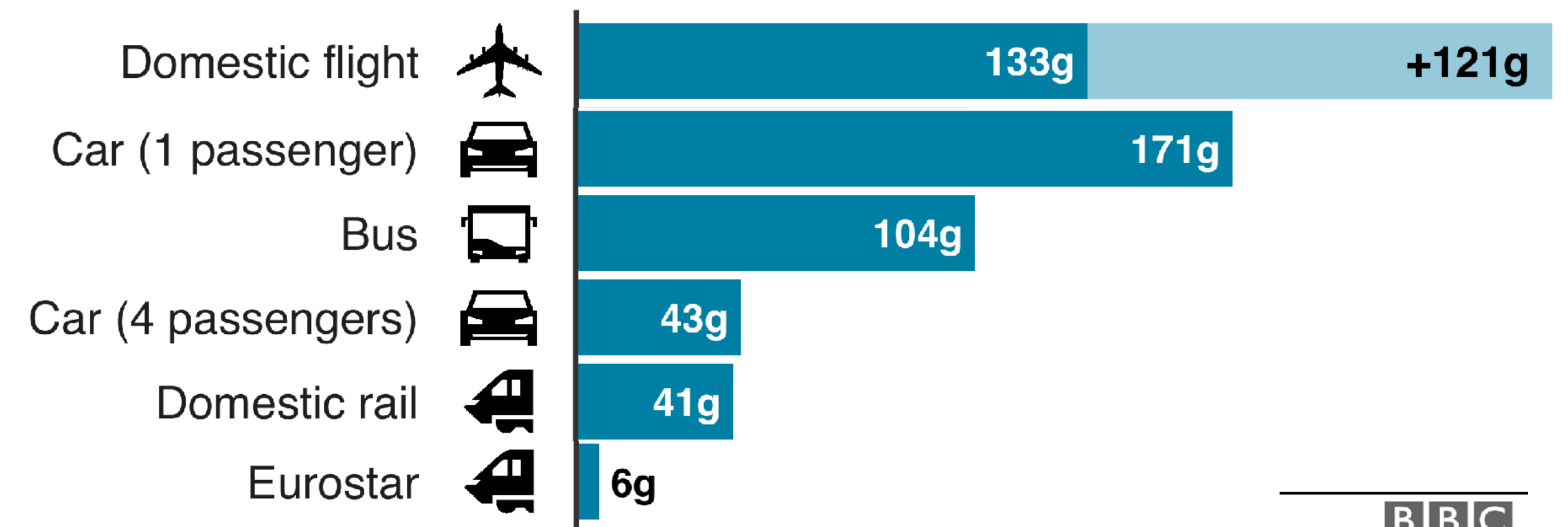
Individual behavior



- Travel overland: rail, car(share)
 - Enjoy and take time - slow travel
- Collaborate & conference locally
- When flying:
 - combine multiple trips into one
 - don't fly first class
- *Just don't fly so much*

Emissions per passenger per km travelled

■ CO2 emissions ■ Secondary effects from high altitude, non-CO2 emissions



BBC

<https://www.bbc.com/news/science-environment-49349566>



Leslie Vosshall PhD @leslievosshall · Sep 24, 2019

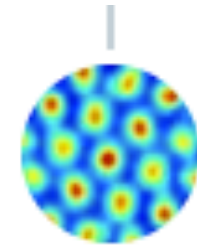
Drastically cutting back my science travel for the foreseeable future.

2015: 22 trips; 2016: 21 trips; 2017: 15 trips; 2018: 21 trips; 2019: 17 trips;
2020: 5 trips

Most of these were unnecessary and brought little benefit to my lab or my family or me

#ClimateCrisis

21 99



Kate Jeffery
@drkjjeffery

Replying to @Ruth_C_Dalton

Good for you! I've pledged no-fly for May 2020-May 2021 after current commitments have run through

3:23 PM · Jun 11, 2019 · Twitter for iPhone



HOME RESEARCH PEOPLE TEACHING PUBLICATIONS
CONTACT CLIMATE CRISIS

Climate Crisis

"Every decade is consequential in its own way, but the twenty-twenties will be consequential in a more or less permanent way. Global CO2 emissions are now so high – in 2019, they hit a new record of 43 billion metric tons – that ten more years of the same will be nothing short of cataclysmic. Unless emissions are reduced, and radically, a rise of two degrees C (3.6 F) will be pretty much unavoidable by 2030. This will make the demise of the world's coral reefs, the inundation of most low-lying island nations, incessant heat waves and fires and misery for millions – perhaps billions – of people unavoidable" – Elizabeth Kolbert, 2020.



INTRODUCTION METHODS RESULTS DISCUSSION

russpoldrack.org

Thursday, June 27, 2019

Why I will be flying less

Since reading David Wallace Wells' ["The Uninhabitable Earth: Life After Warming"](#) earlier this year, followed by some deep discussions on the issue of climate change with my friend and colleague [Adam Aron from UCSD](#), I no longer feel we can just sit back and hope someone else will fix the problem. And it's becoming increasingly clear that if we as individuals want to do something about climate change, changing our travel habits is probably the single most effective action we can take. Jack Miles made this case in his recent Washington Post article, ["For the love of Earth, stop traveling"](#):

Commit: <https://noflyclimatesci.org/>

Wednesday, Oct 23, 2019, 21:01



> To: Anne Urai

Cc:

Dear Anne,

Unfortunately, this conference does not accept any remote talk. All speakers should be at the place.

Monday, Mar 18, 2019, 11:01



> To: Anne Urai

Cc:

Dear Anne,

Thanks for letting us know in advance. We think it's better to have people in the flesh for the interactions, so we will ask if she's interested in taking your spot.
No doubt there will be more opportunities later on.

Monday, Mar 9, 2020, 11:31



To: Anne Urai

Cc:

Hi Anne,

We're going ahead with those who are able to attend the conference. It's a pity to be missing you, but I am sure we will have another opportunity in the future.

Flying less

 anneurai  13 April 2022  Research

I hereby commit to flying less. This means that if you invite me for a conference, talk or visit that requires flying, I will likely decline. I am happy to travel by train and to give virtual talks.

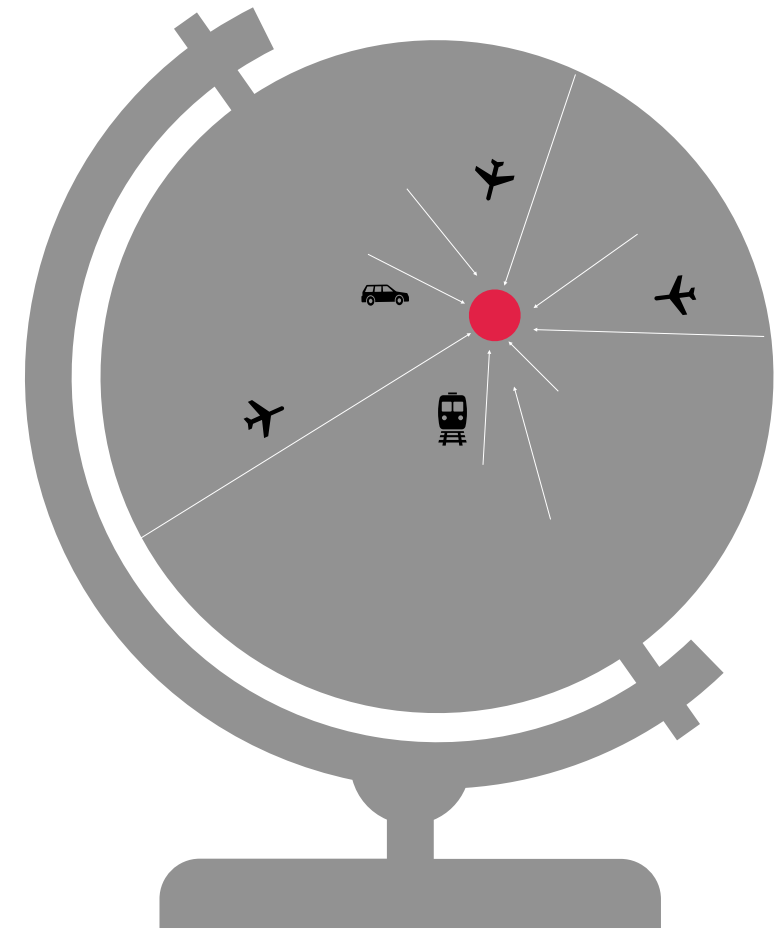
This not only reduces my carbon footprint, but also aims to question the social norm that scientists need to jetset around the world to be successful.

<https://anneurai.net/2022/04/13/flying-less/>

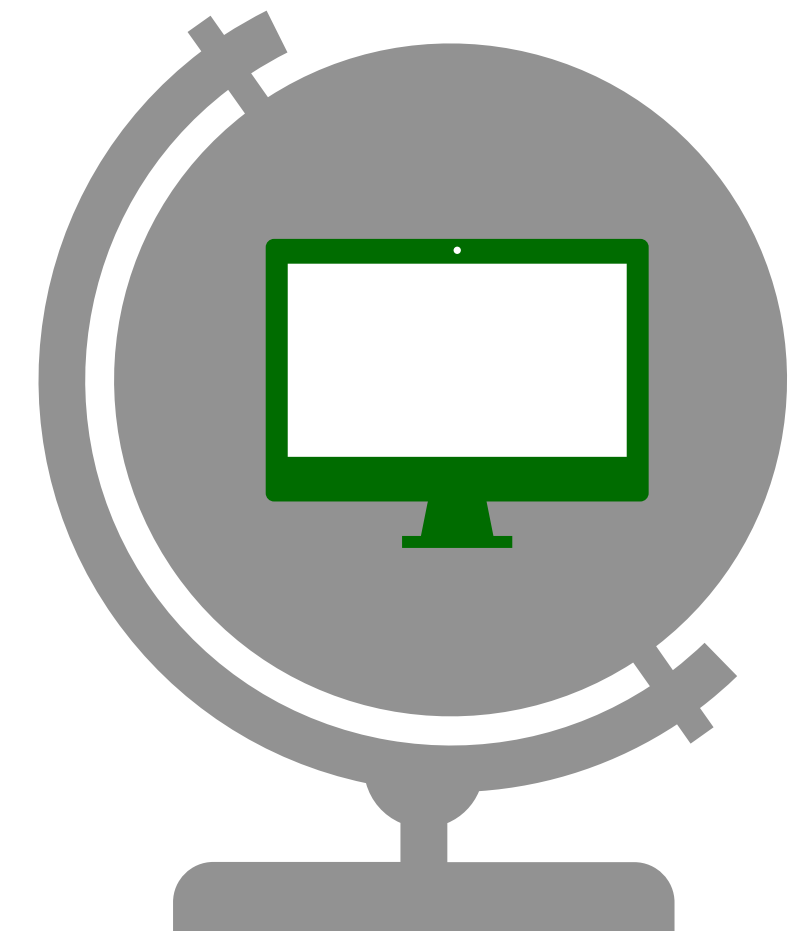
Community norms: conferences



Traditional 'legacy'
meeting



Virtual meeting

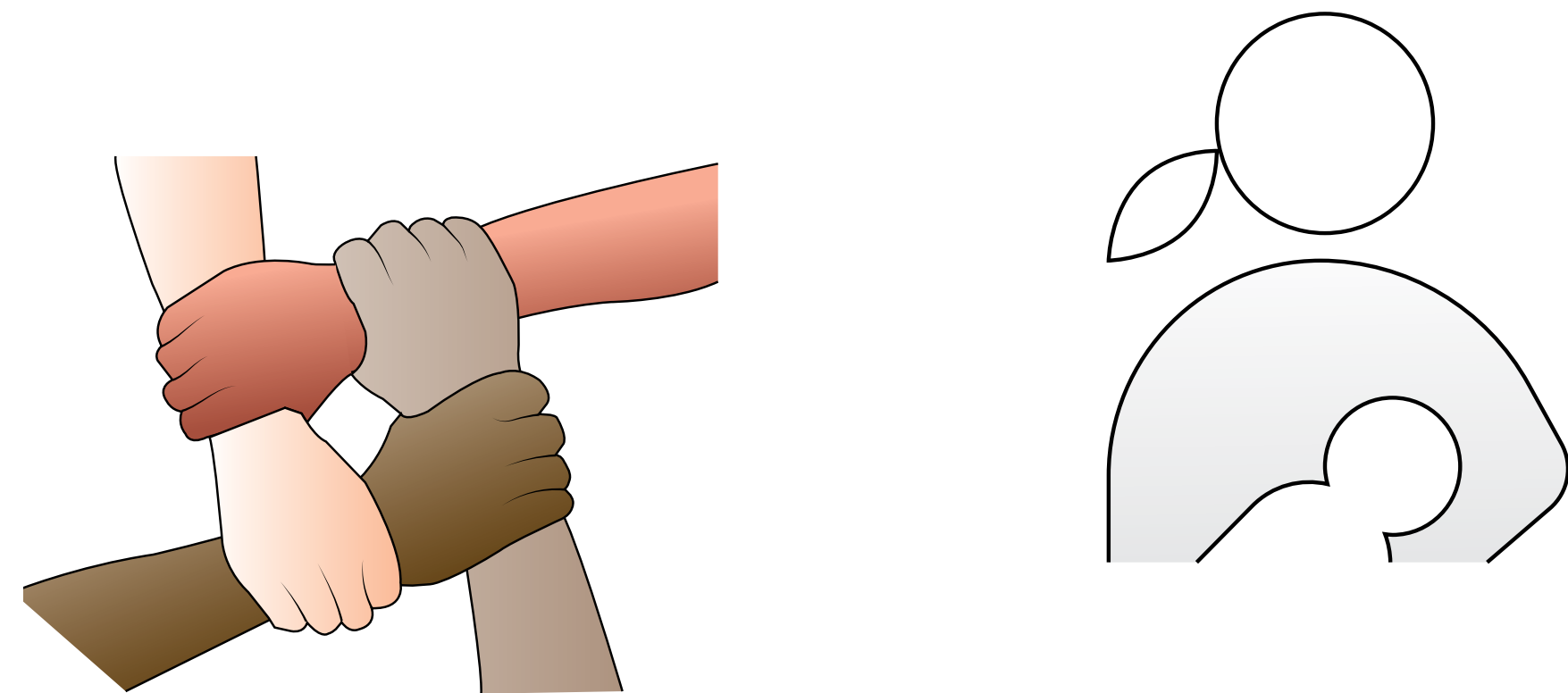


Community norms: conferences



Virtual conferences

- Low cost
- Accessibility
 - Visa restrictions
 - Family responsibilities
 - Travel difficulties
- *More diversity*



Sarabipour et al. (2021) Changing scientific meetings for the better. *Nature Human Behaviour* 5:296–300.

Community norms: conferences



Virtual conferences

- Less networking & community building
- Zoom fatigue, digital multitasking
- Less engagement: ongoing demands at home & work

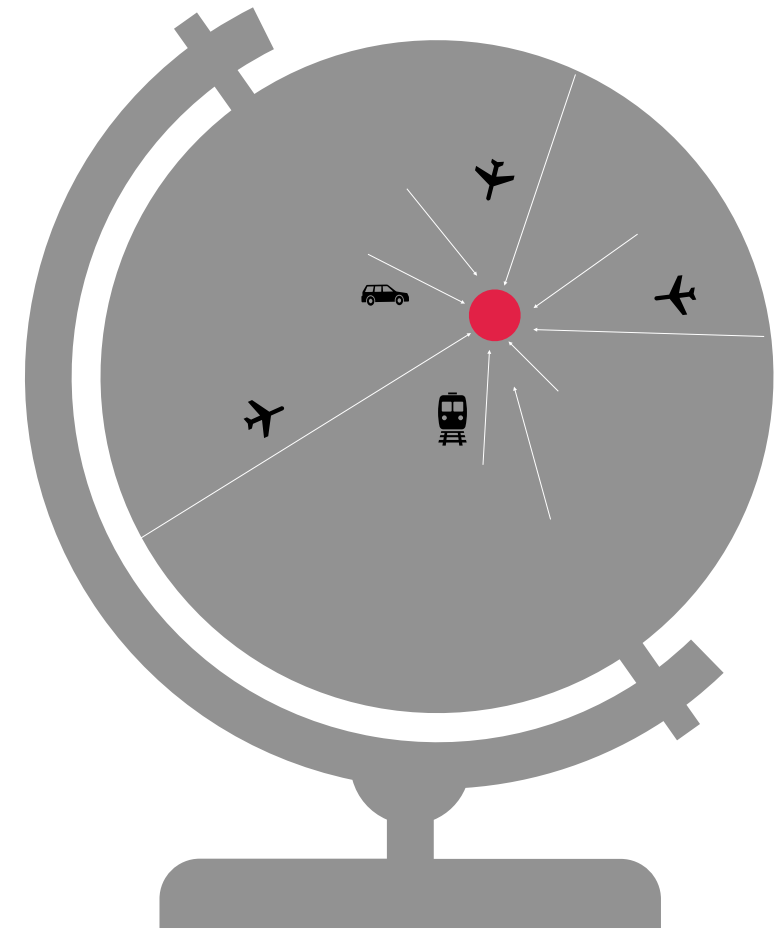


<https://twitter.com/GretchenTG/status/1305974239984484353>

Community norms: conferences



Traditional 'legacy'
meeting

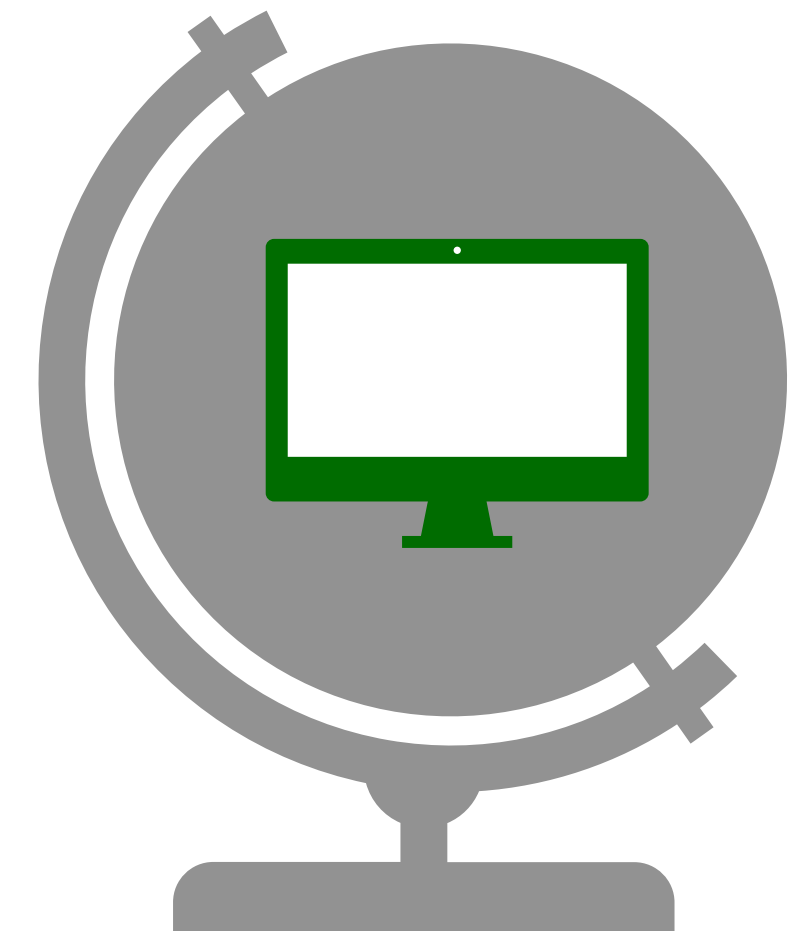


Travel sparsely

Virtual meetings as second tier

Best of both worlds

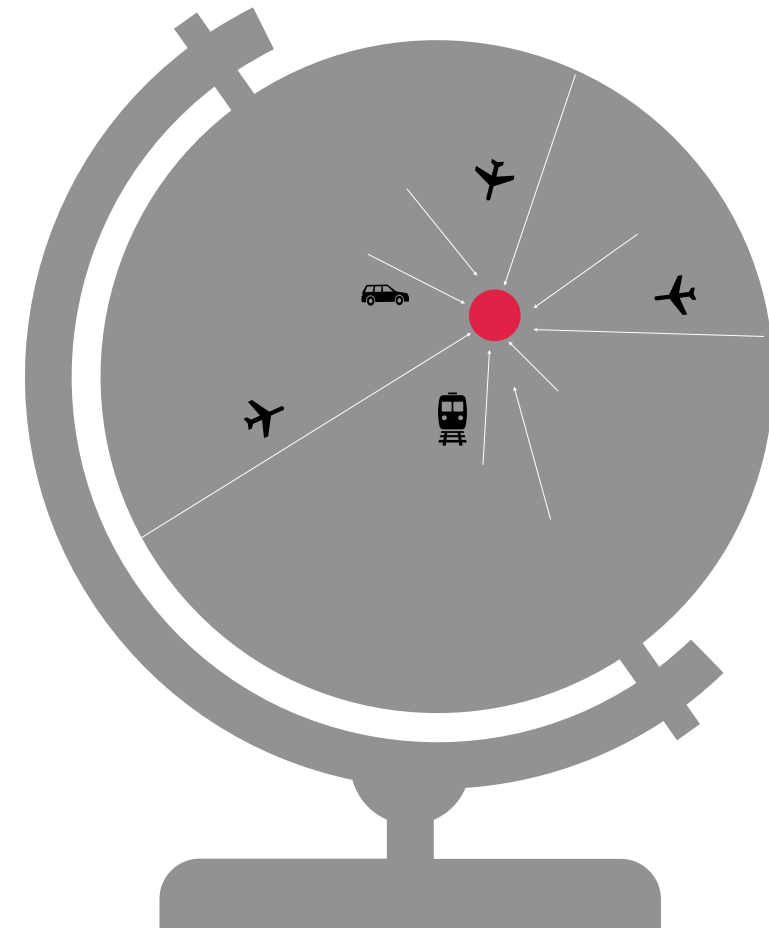
Virtual meeting



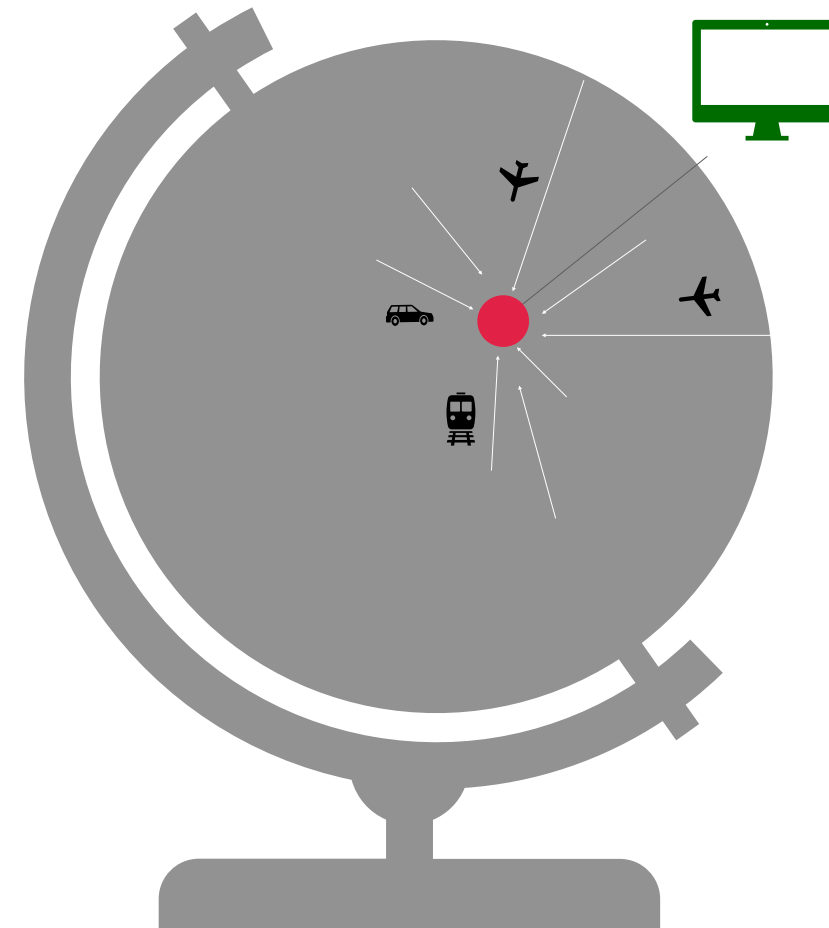
Community norms: conferences



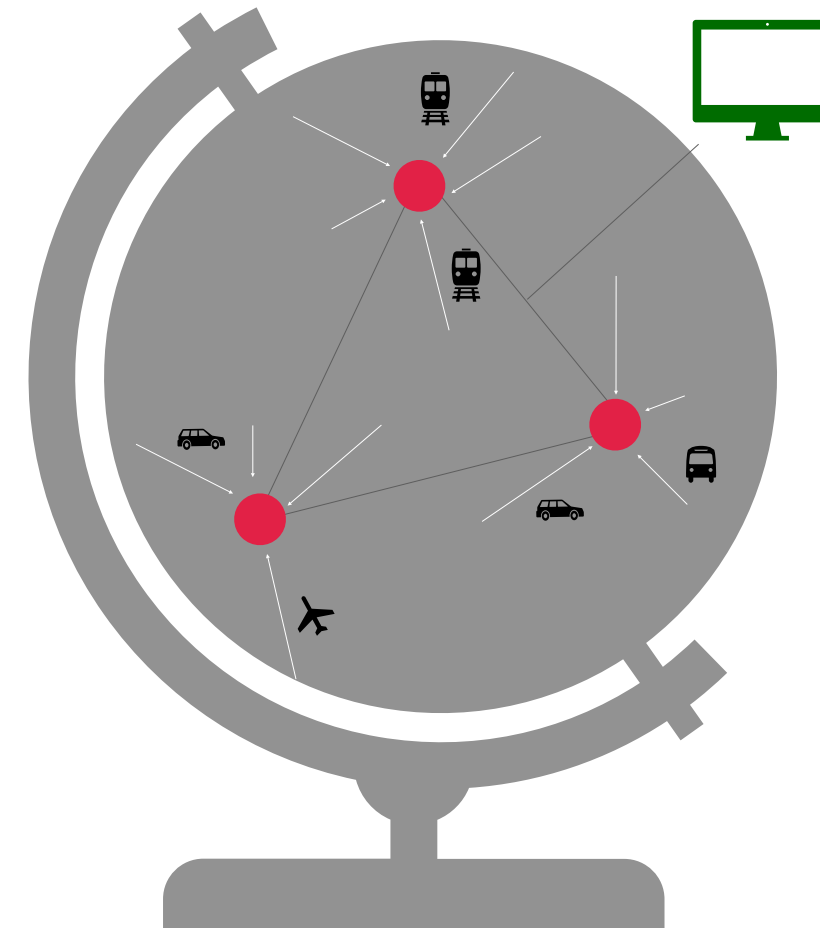
Traditional 'legacy'
meeting



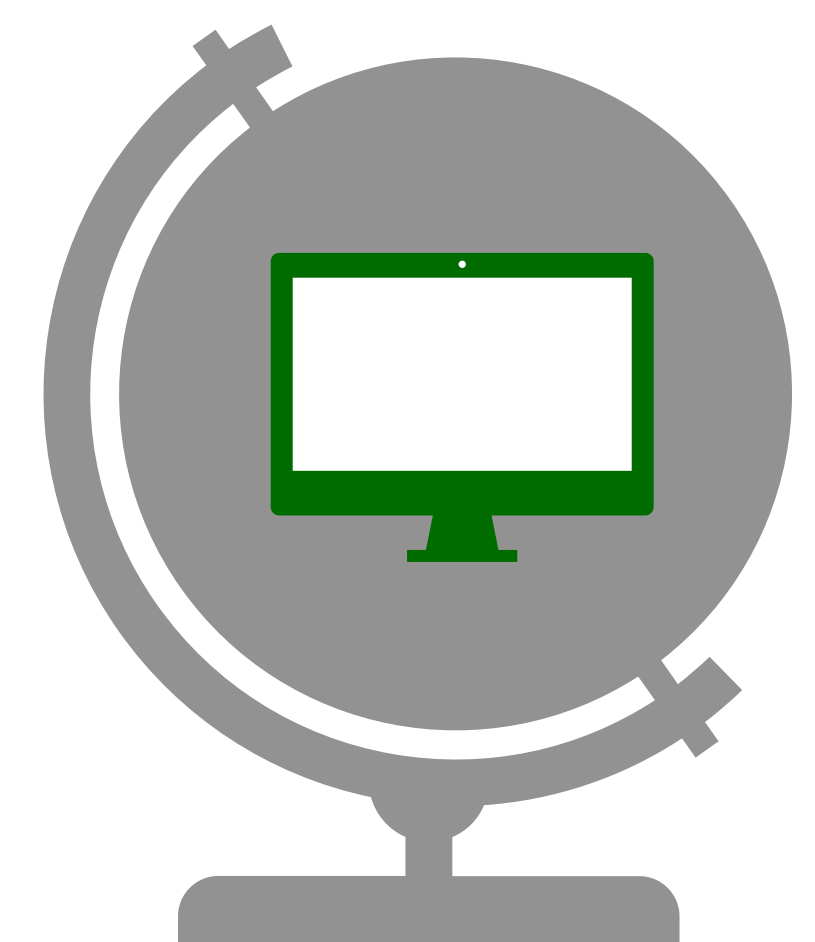
Traditional
+ virtual option



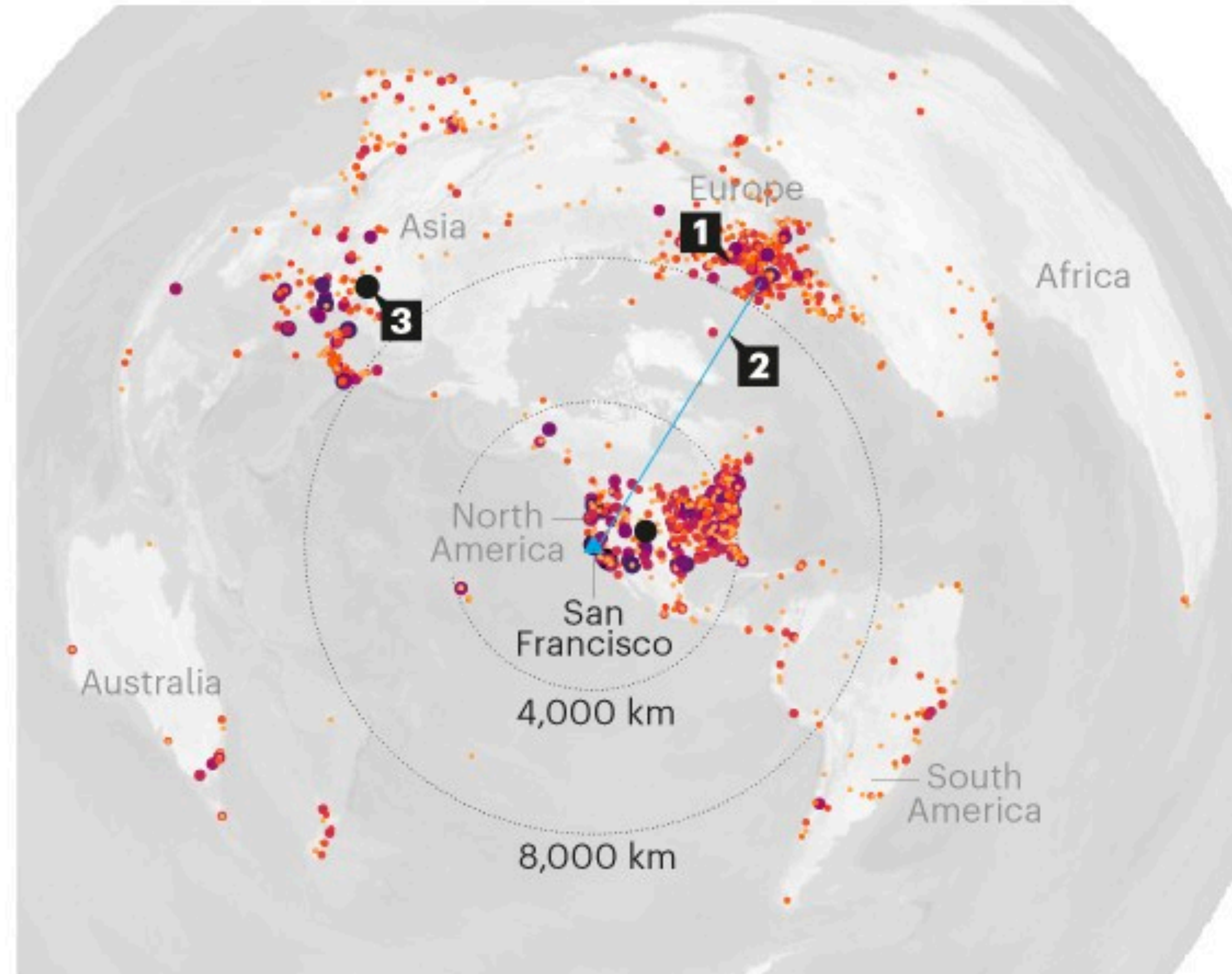
In-person
meeting 'hubs'



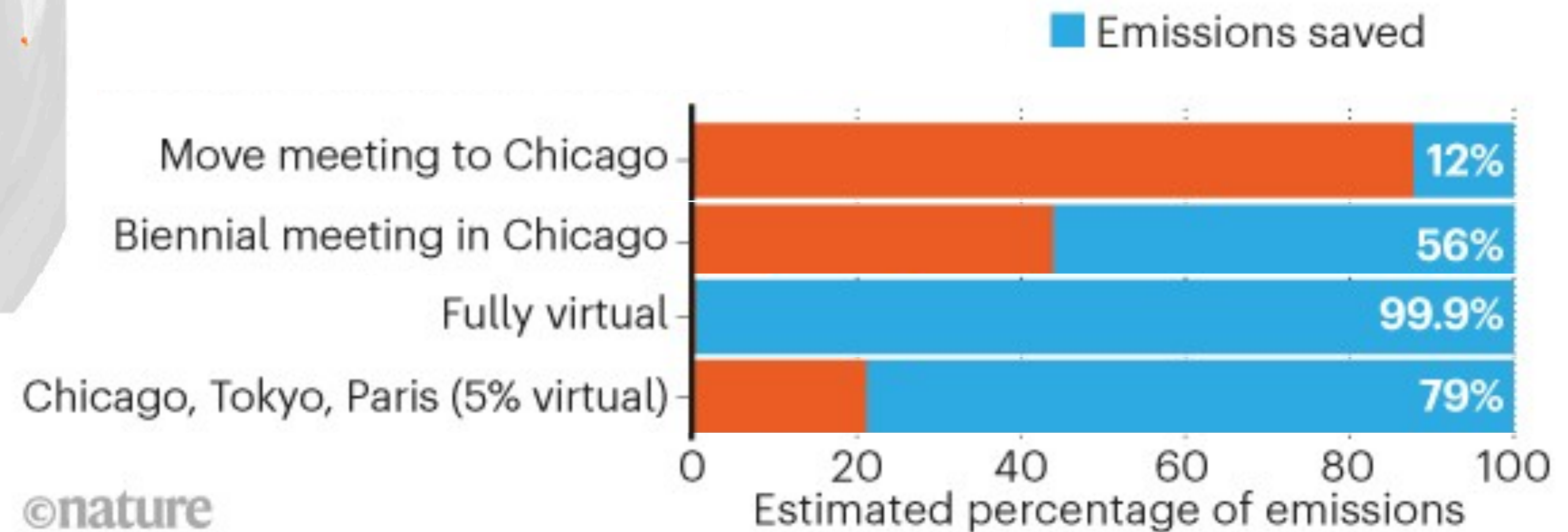
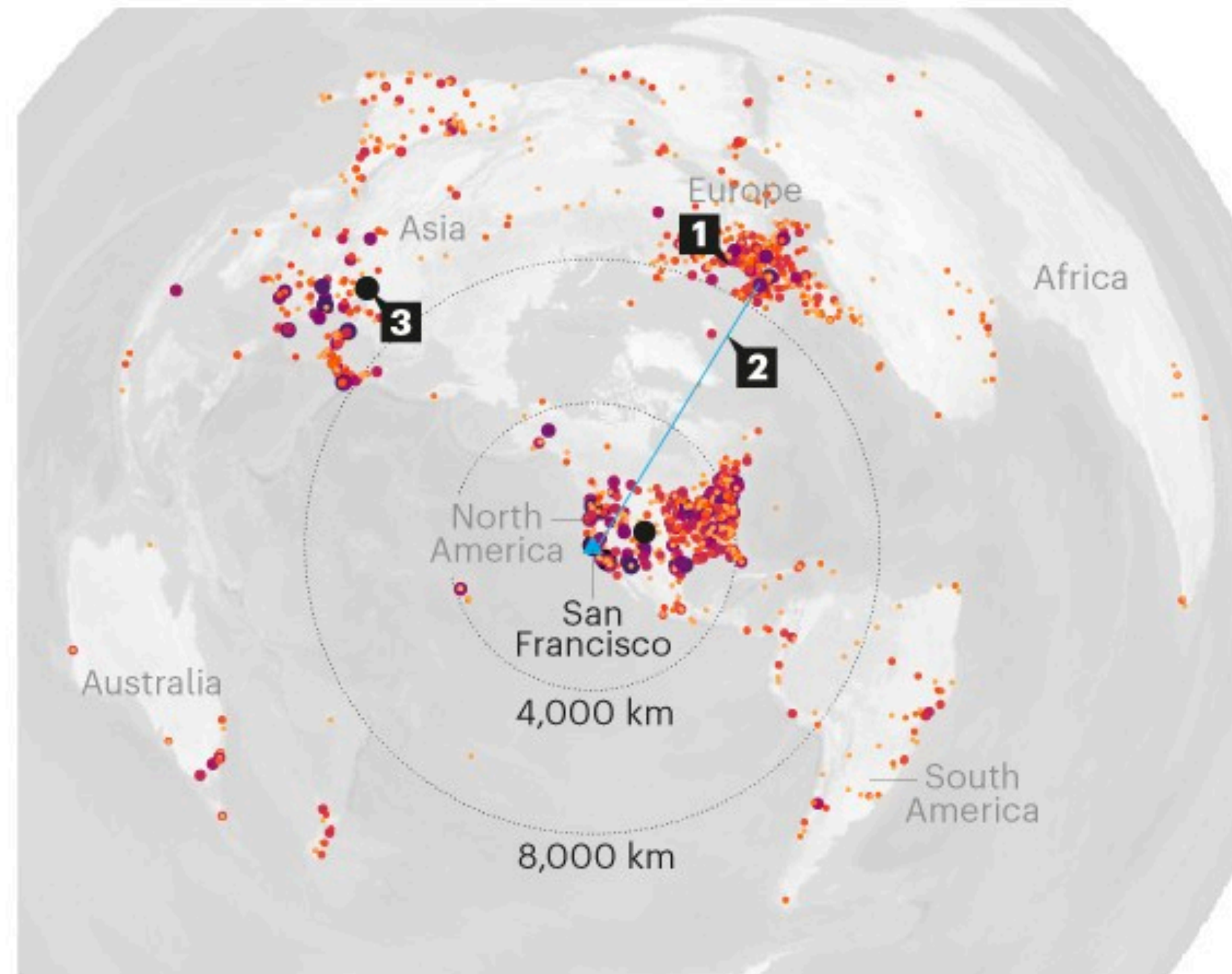
Virtual meeting



Community norms: conferences



Community norms: conferences



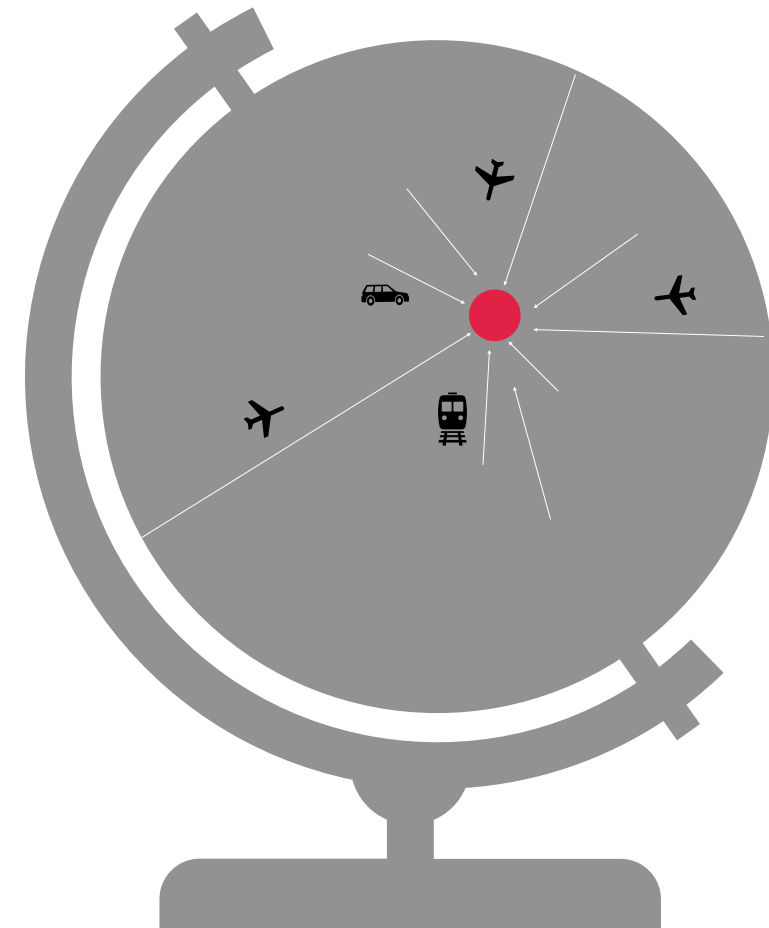
©nature

Source: M. Klöwer <https://doi.org/10.5281/zenodo.3553784> (2019)

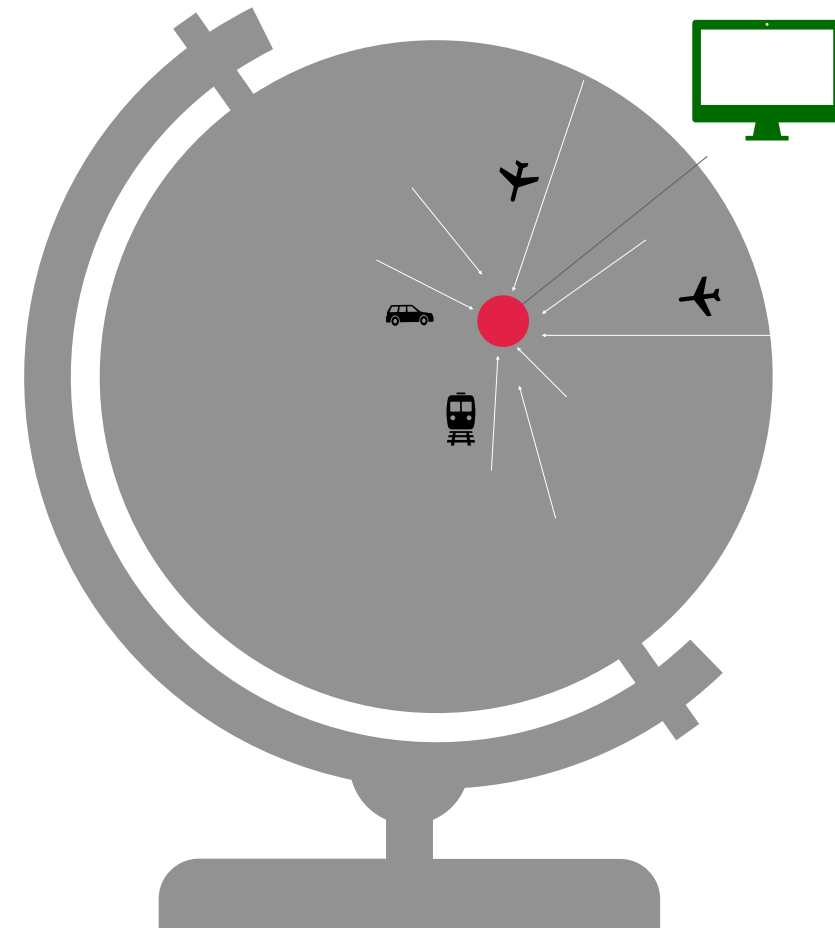
Community norms: conferences



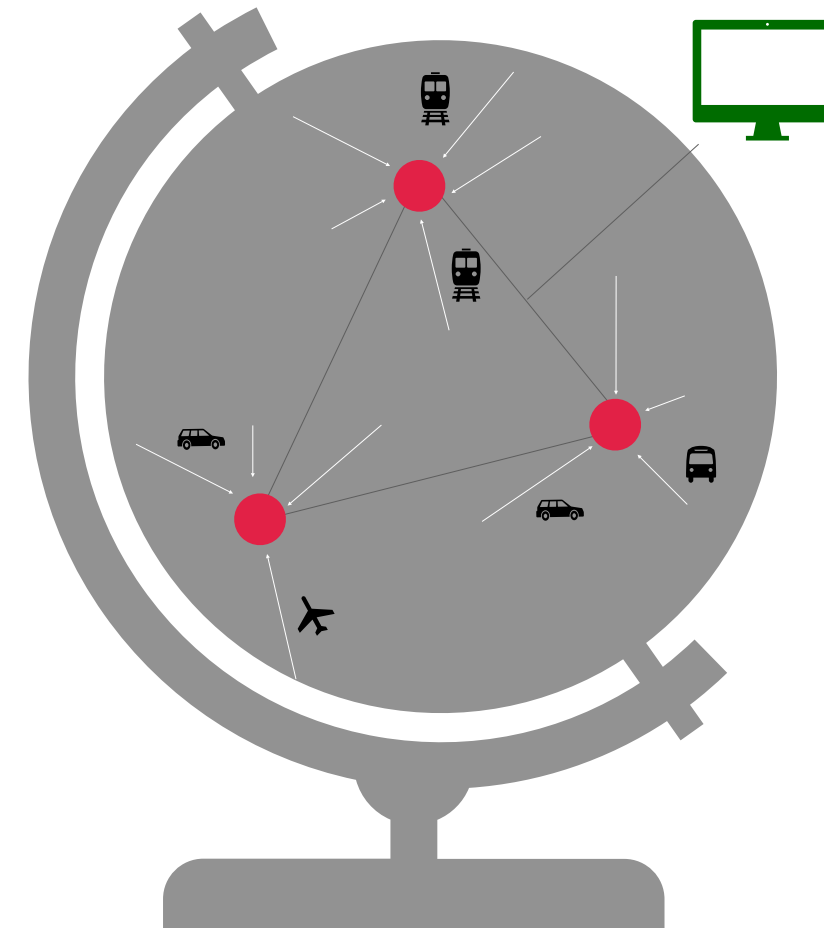
Traditional 'legacy'
meeting



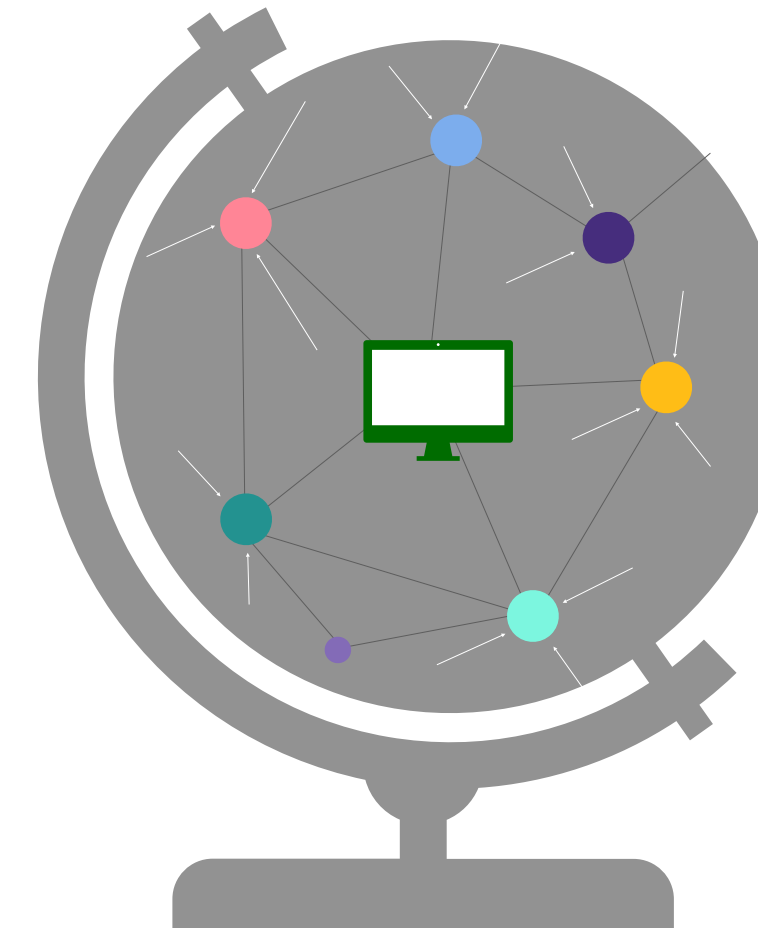
Traditional
+ virtual option



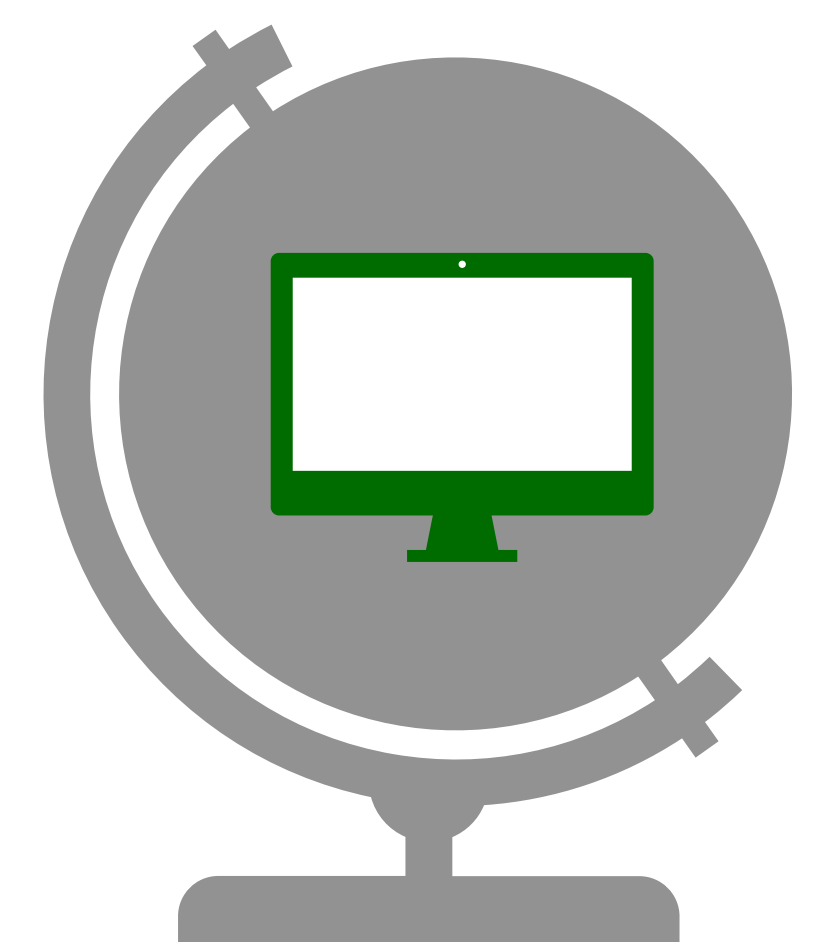
In-person
meeting 'hubs'



Network of
local meetups



Virtual meeting



neuromatch

Neuromatch is a 501c3 not-for-profit organization in the United States. We are an online community of computational neuroscientists whose mission is to foster inclusive global interactions for learning, mentorship, networking, and professional development.

We run 2 organizations within Neuromatch: Neuromatch Academy (academy.neuromatch.io) and Neuromatch Conference (conference.neuromatch.io)



Local meetups at NMC 4.0



Instructions ▾

Agenda ▾

About ▾

Hi Anne! ▾



Instructions ▾

Agenda ▾

About ▾

Hi Titipat! ▲

neuromatch 4.0

A conference for the computational neuroscience community

After three conferences in 2020, Neuromatch is pleased to be holding our fourth. Each of our conferences is providing new innovations to the virtual conference space, and with this one we are pleased to combine virtual and in-person experiences. Participants are encouraged to host or attend a local meetup, bringing people together to enjoy the

Host your local meetups

Join local meetups

Profile

Submission

Meetups (Host)

Meetups (Attendee)

Payment

Logout

Register to be a local host

Hosting institution or location

Select a location by querying in the search box on the top-right corner of the map. We recommend a safe, accessible, public space suitable for academic mingling, preferably a room or space in your university/institute. We do not encourage hosting at your home or another private space. This information will be visible to all NMC attendees, so keep it general. Don't worry if the pinned location is not exact, you can provide more information in detailed location which will be available for accepted attendees below (e.g. building name, exact address, ...).

Search your hosting location



<https://conference.neuromatch.io/instructions/how-to-meetups>

Local meetups at NMC 4.0



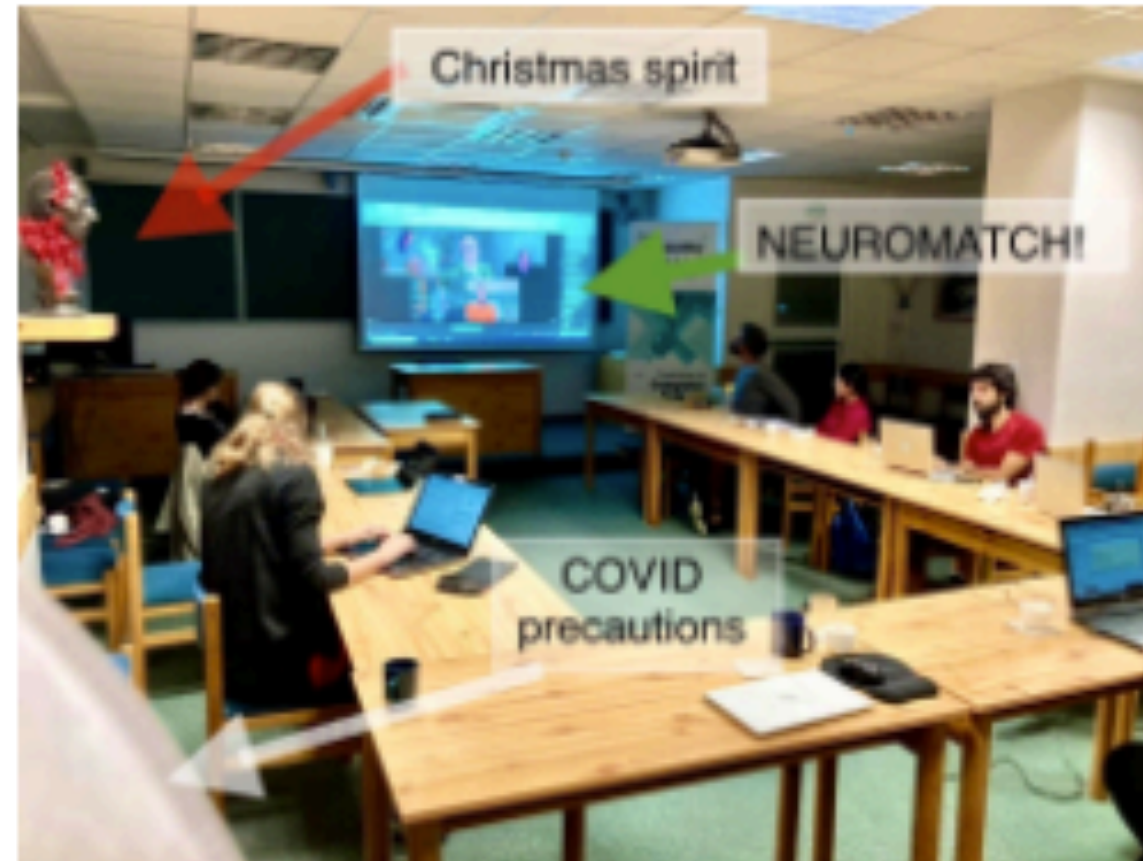
- Demand driven, bottom-up and distributed
 - Resilient to local Covid disruptions
- Accessibility
 - Low carbon impact, low cost (short travel distances)
 - Inclusive (go home at night), great for students
 - Flexibility with time-zones (no jetlag)
- Local networking & physical event with socials

Local meetups at NMC4



<https://conference.neuromatch.io/instructions/how-to-meetups>

Local meetups at NMC4



Our experience

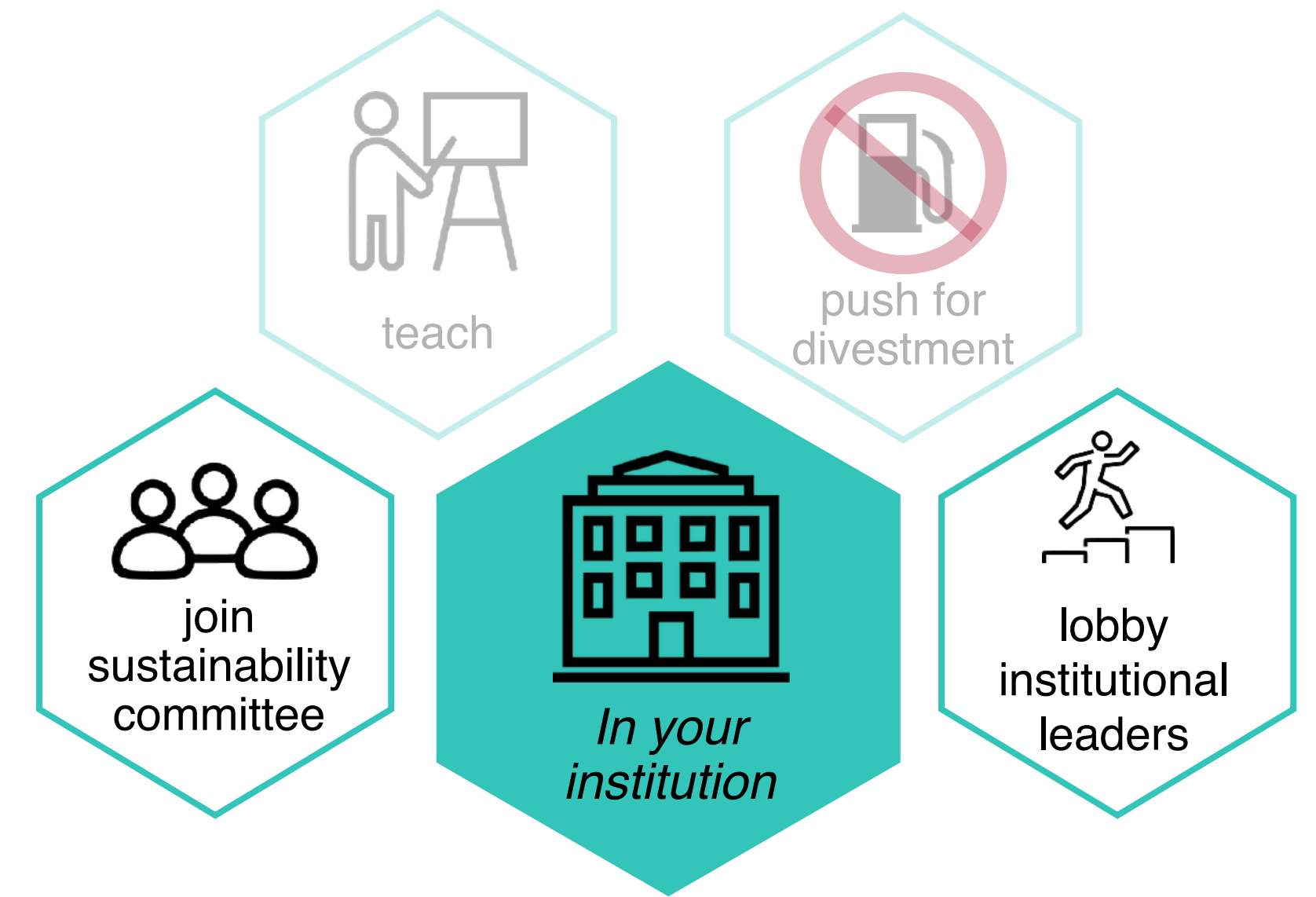


- Participants liked the meetups
- But: less enthusiasm than expected
 - Organising is time-consuming and difficult
- Vision for the future
 - Network of venues (Lorentz center?) with great setups
 - Tech stack ('NMC in a box')
 - Local meetups as 'watch parties' during smaller in-person meetings
- No silver bullet
- More thoughts on the meetup experiment: <https://anneur.ai.net/2022/01/20/2046/>

Our universities

Flying less

- Aviation at Dutch Universities: 12-27% of total emissions ([KNAW](#))
- Advocate for *institutional travel policies*
 - [Ghent Uni](#), Belgium: train to cities if < 6 hours
 - [#unter1000](#) in Germany: take the train for trips < 1000 km
- Investment in video conferencing facilities and equipment
 - Examples: [Green seminars, Geneva Uni](#)



Our universities

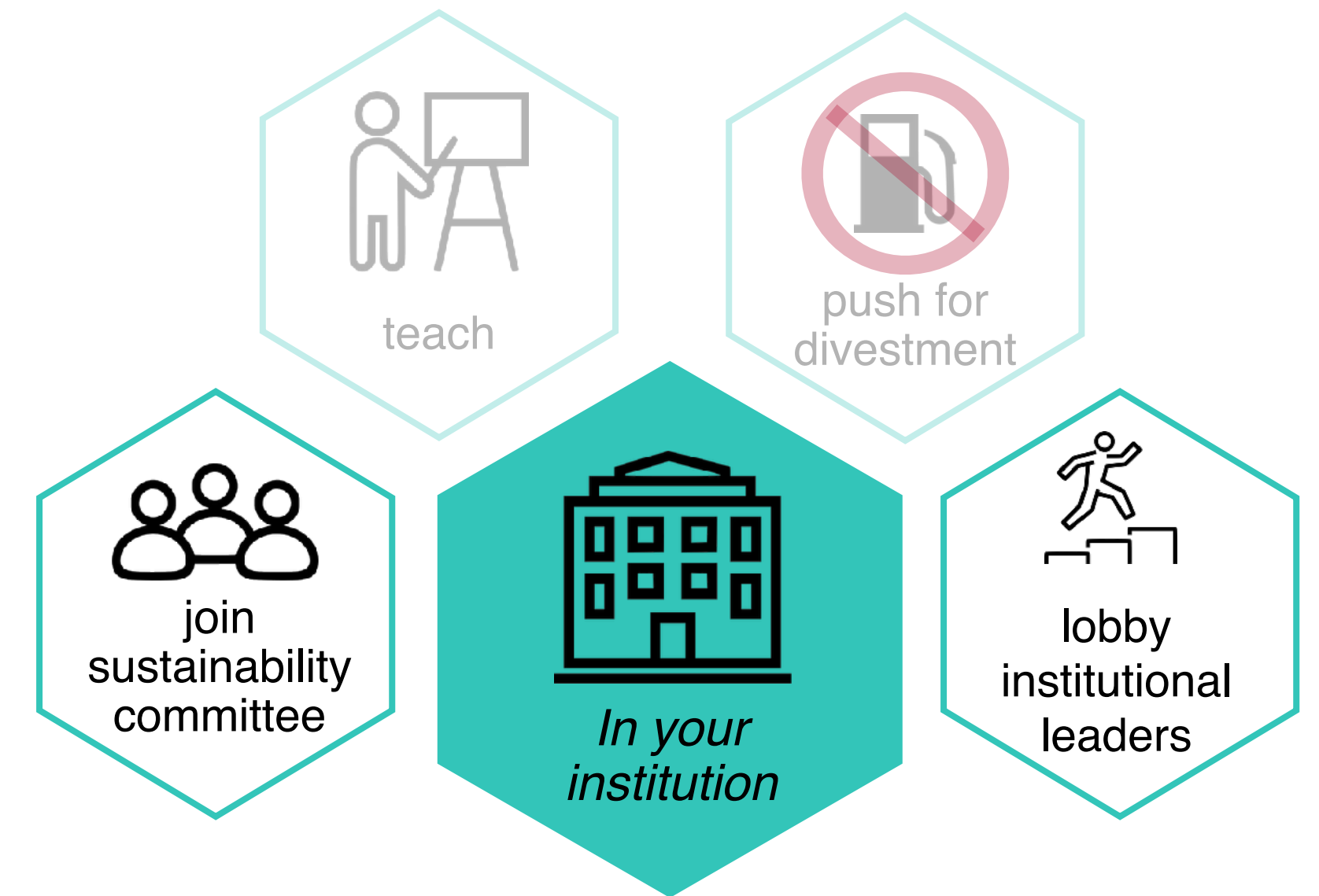
Campus energy needs

- buildings, transport, food

Finance and banking

- normalize action on environmental issues

Joint action: **top-down** (senior academics) & **bottom-up** (students)



Our universities

Endowments

- Wellcome Trust: £29 billion endowment to net-zero by 2050
- e.g. Harvard, Princeton

Pension funds

- e.g. Dutch ABP

Banking and finance

- e.g. UCSD



Our universities



Universität Hamburg

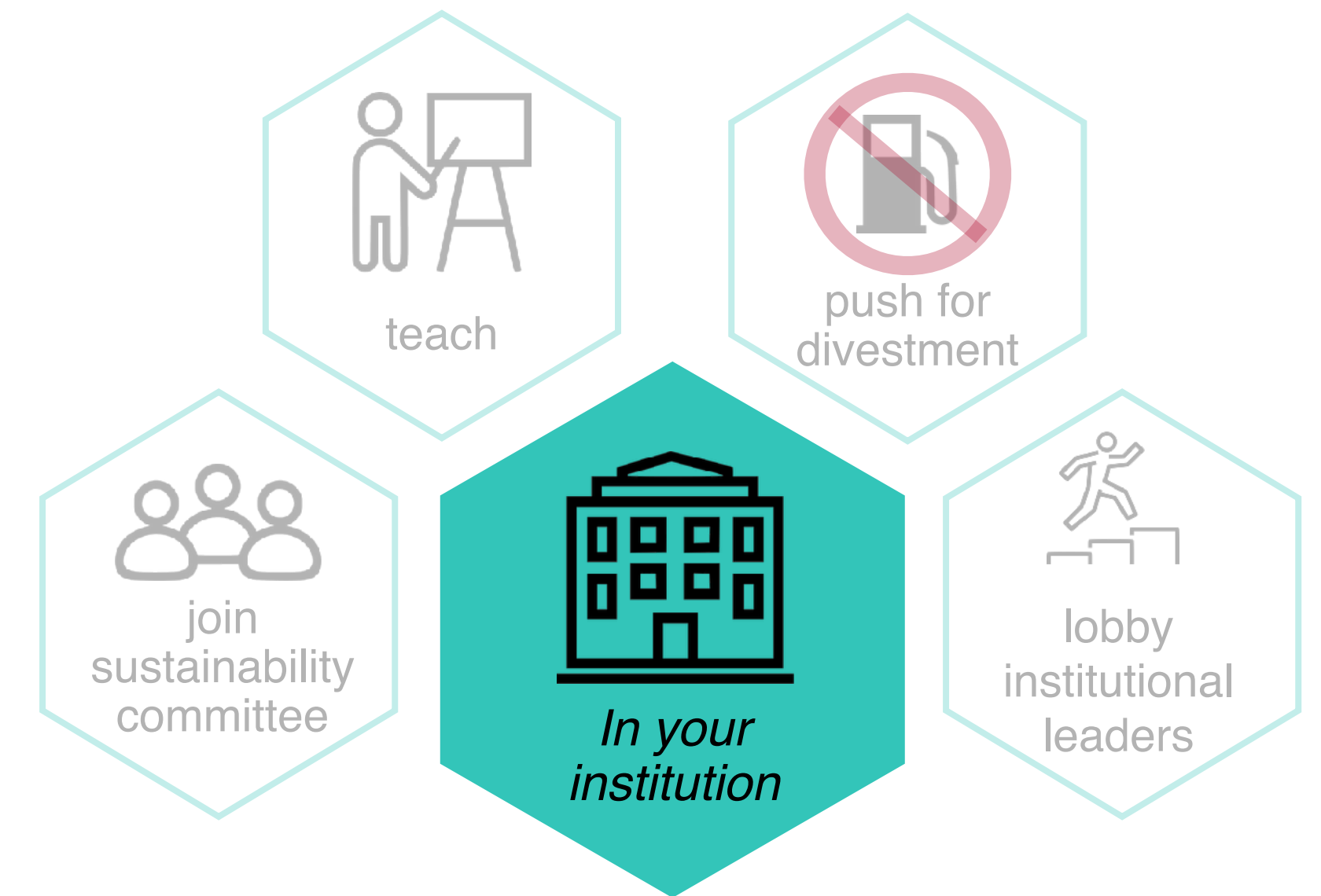
DER FORSCHUNG | DER LEHRE | DER BILDUNG

STUDIES

RESEARCH

INTERNATIONAL

K



🏠 UHH → About the University → Information for the media → Guidelines → **Sustain**

SUSTAINABILITY

Sustainable University

Universität Hamburg is devoted to sustainable science and scholarship and its faculties have made great strides towards sustainability in research and teaching.

The interdisciplinary [Center for a Sustainable University \(KNU\)](#) is a platform for the development and review of new academic procedures and methods on questions of sustainability.

Our universities

- Teach: psychology of the climate crisis
 - Use climate data/examples
 - teachgreenpsych.com



Overview of the TeachGreenPsych Site

PSYCHOLOGY SUBDISCIPLINES:

[Conservation Psychology](#)

[History of Psychology](#)

[Research Methods](#)

[Biopsychology](#)

[Health](#)

[Development](#)

[Learning](#)

[Cognition](#)

[Motivation and Emotion](#)

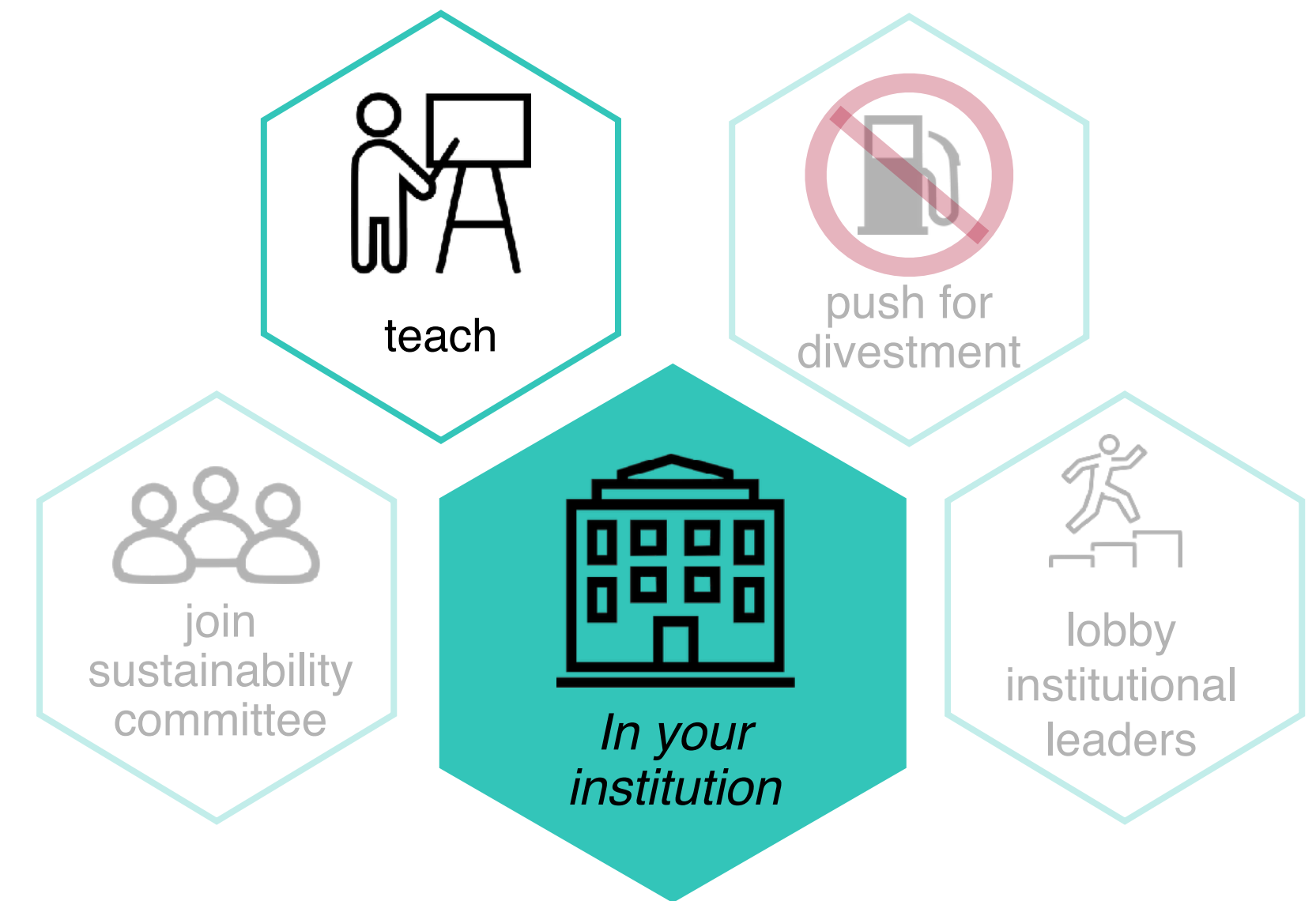
[Individual Differences](#)

[Social Psychology](#)

[Environmental Psychology](#)

[Ecopsychology](#)

[Mental Health](#)



Science & Society

The Climate Crisis
Needs Attention from
Cognitive Scientists

Adam R. Aron^{1,*}

<https://doi.org/10.1016/j.tics.2019.08.001>

Lifestyle changes



live
sustainably

Average values per
person for developed
countries, based on
current emissions.

Annual Climate Savings (tCO₂e)

60

4

3

2

1



Upgrade
Light Bulbs

LOW IMPACT
< 0.2 tCO₂e



Hang Dry
Clothes



Recycle



Wash Clothes in
Cold Water

MODERATE IMPACT
0.2-.08 tCO₂e



Eat a Plant
Based Diet



Switch Electric
Car to Car Free



Buy Green
Energy



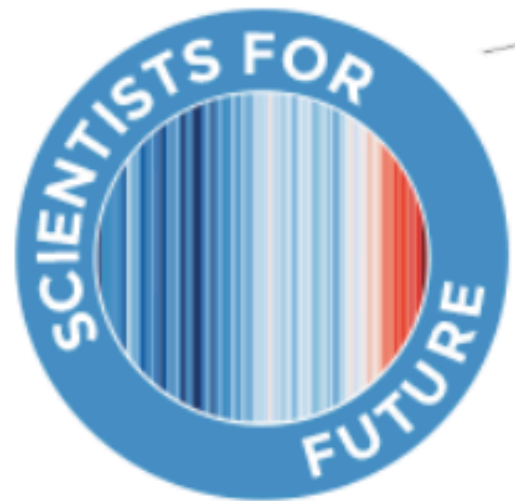
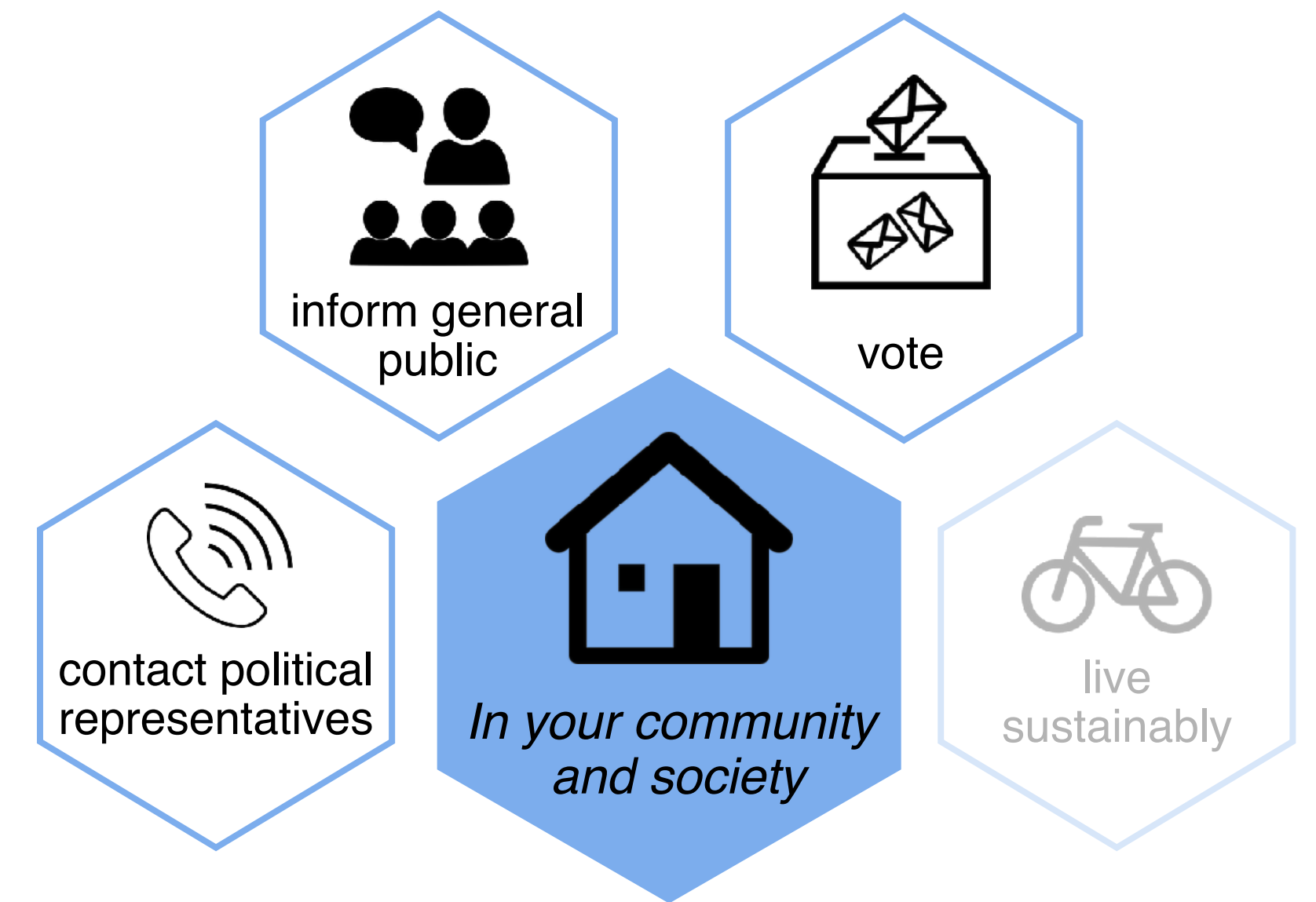
Avoid One
Roundtrip
Transatlantic Flight



Live Car Free

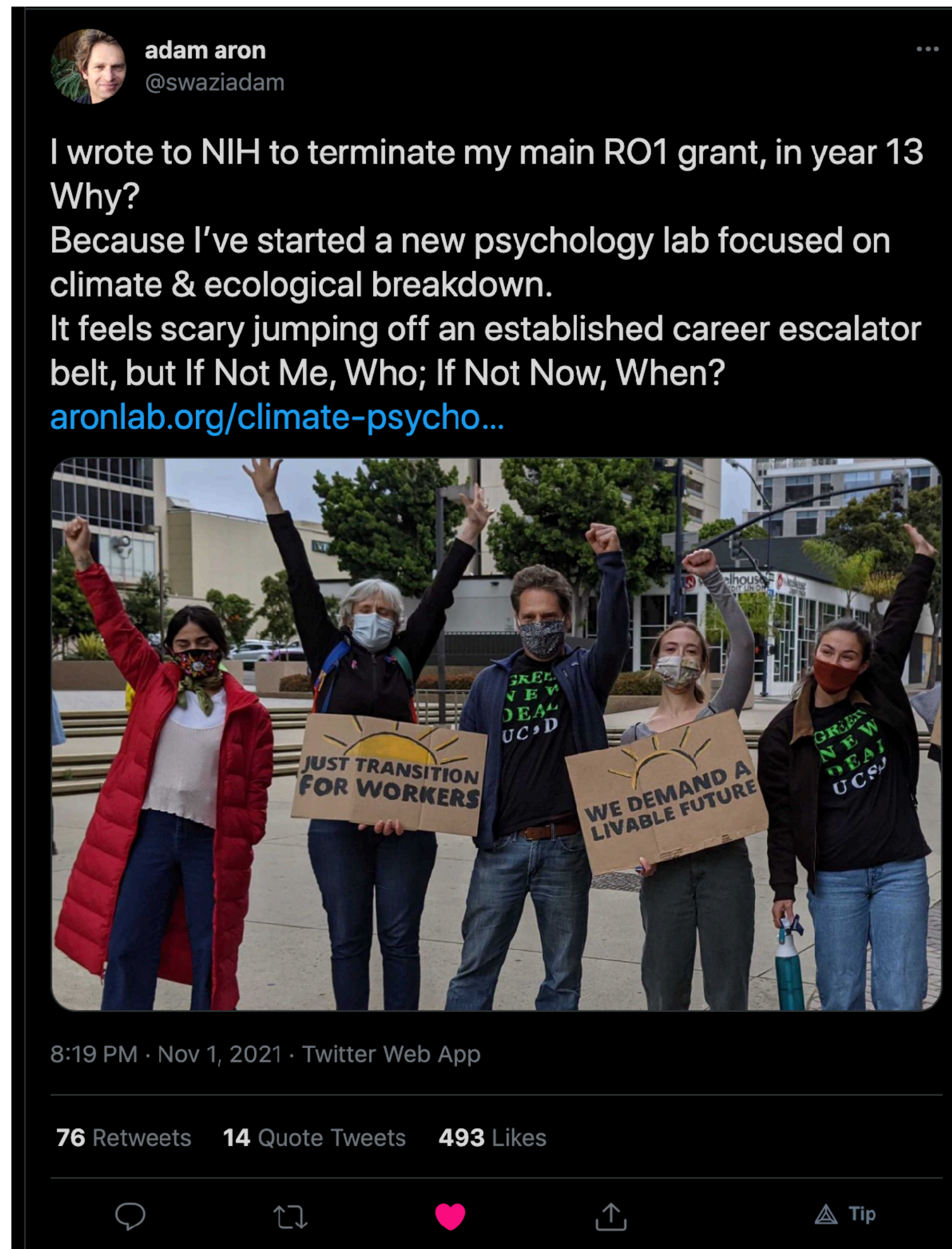
HIGH IMPACT
> 0.8 tCO₂e

Beyond the university



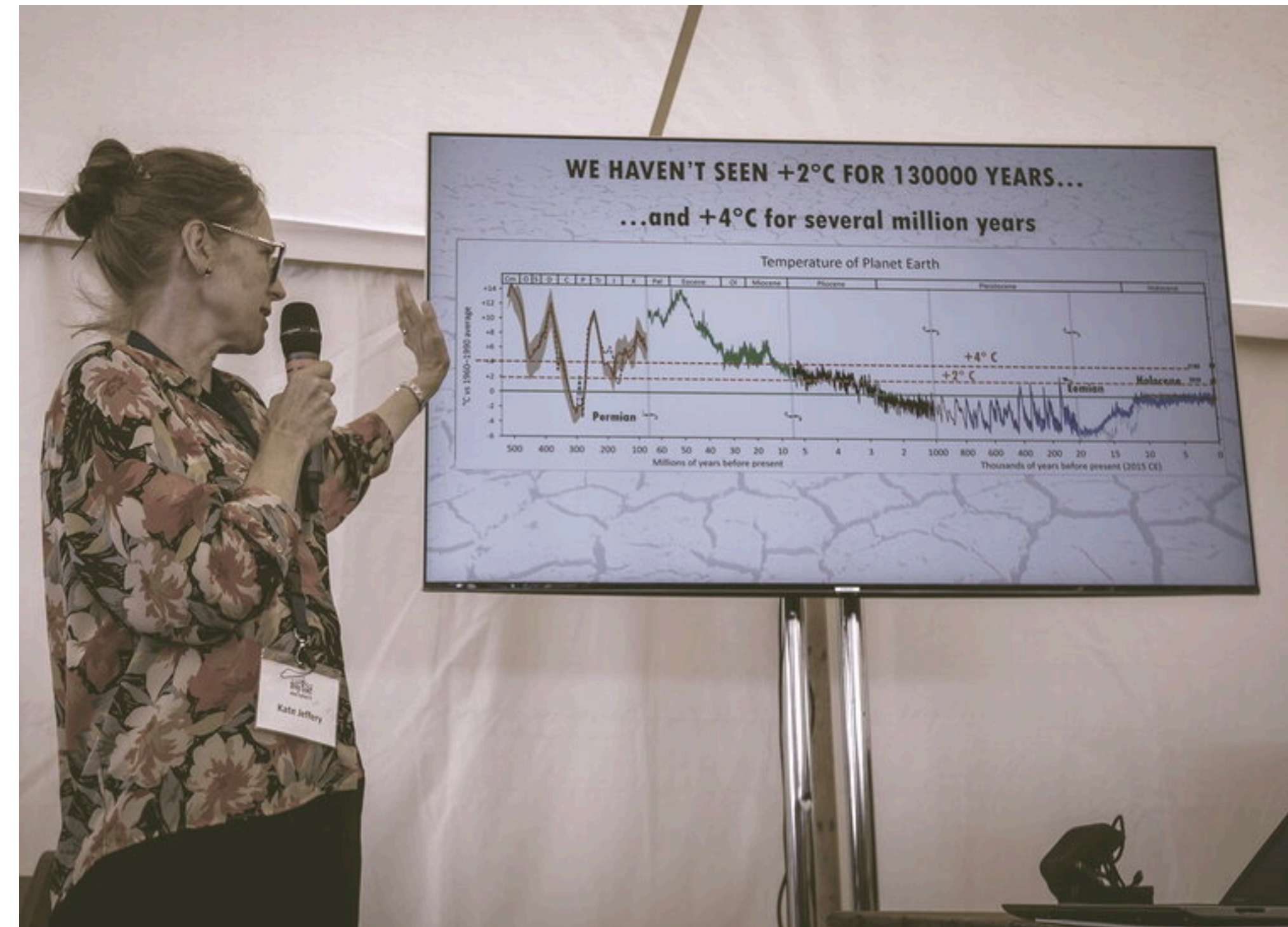
**Scientists for Future
Deutschland**

Adam Aron, UCSD



www.timeshighereducation.com/blog/how-i-quit-neuroscience-focus-preventing-climate-breakdown

Kate Jeffery, UCL

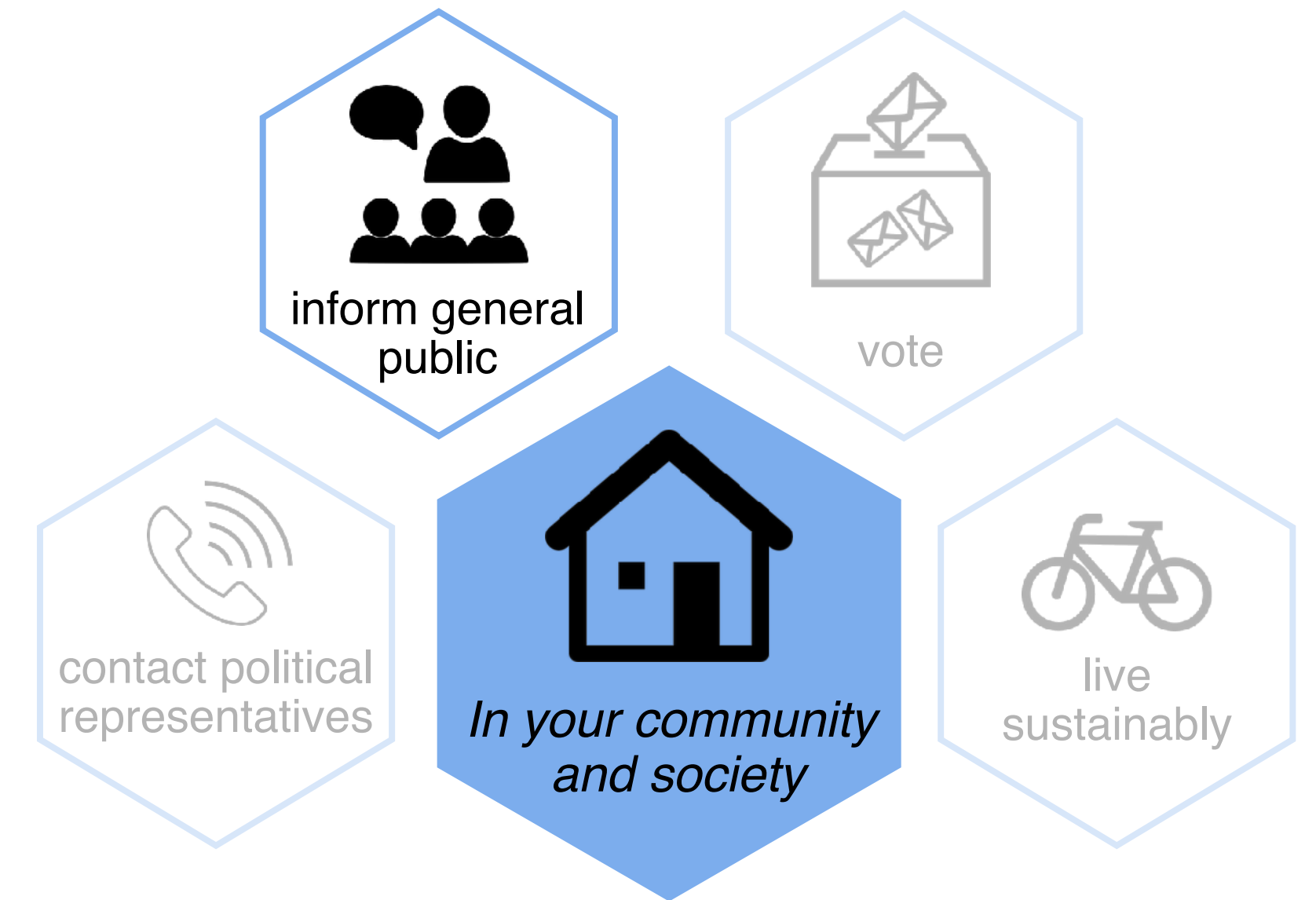
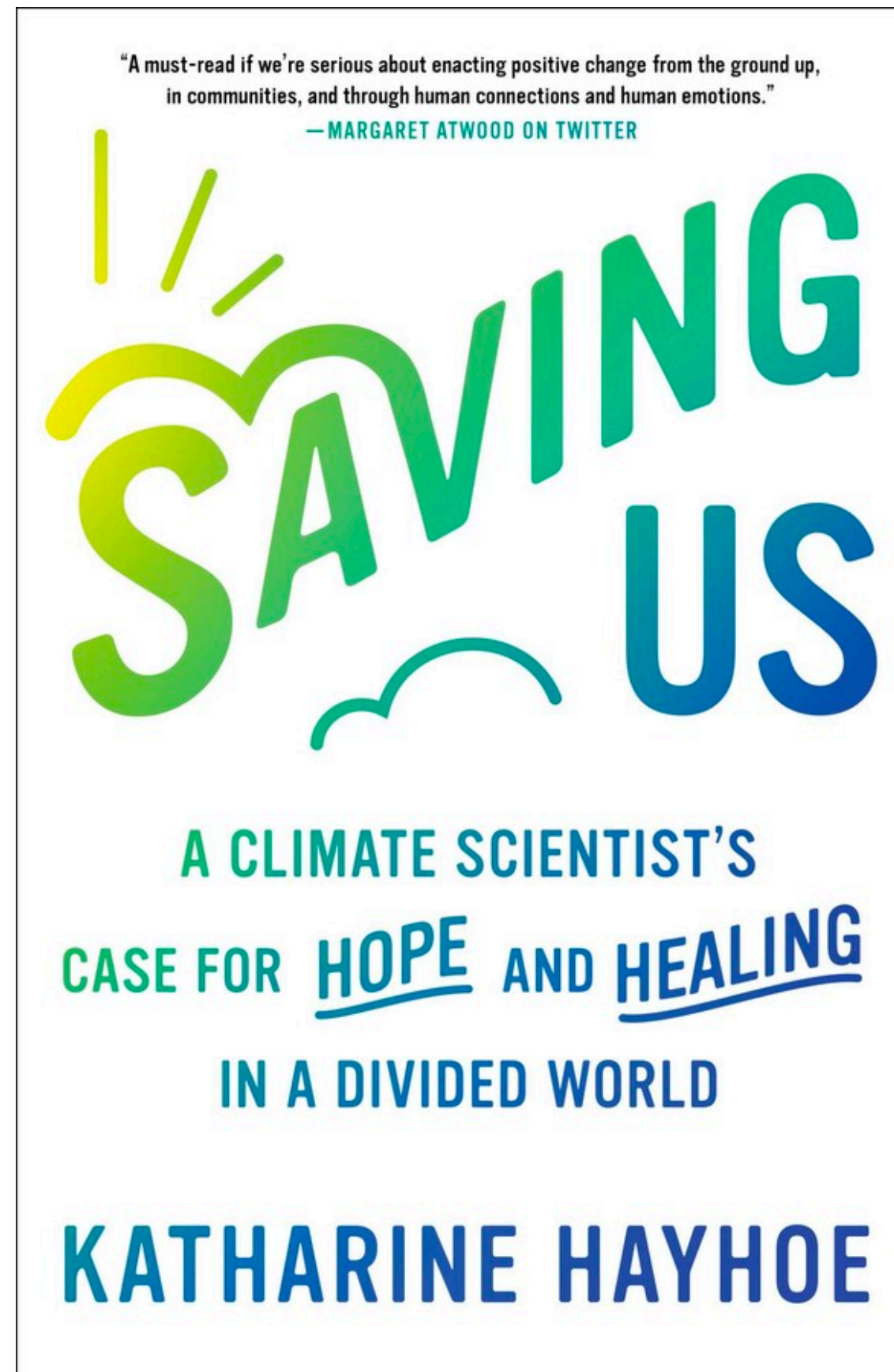


<https://jefferylab.com/climate-change>

Beyond the university

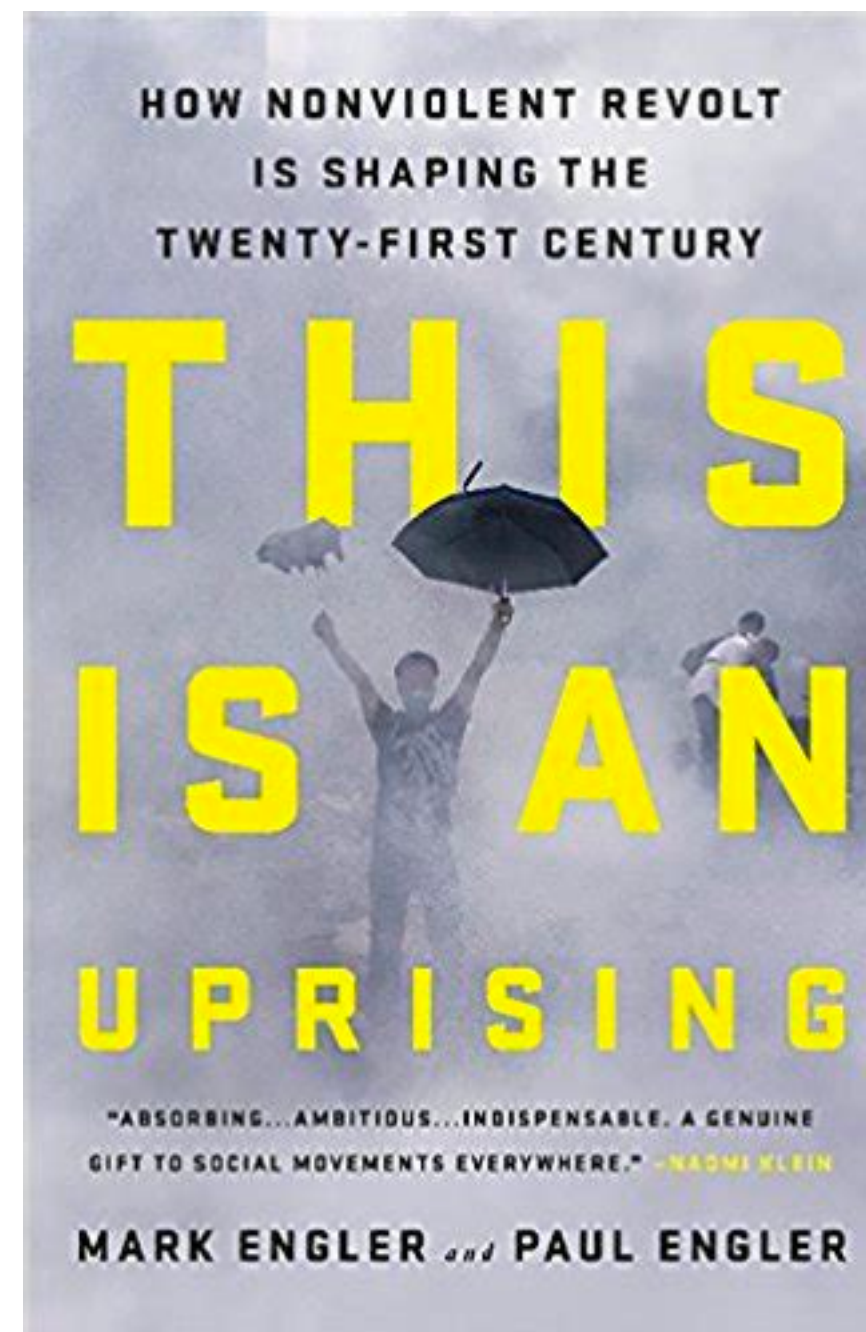
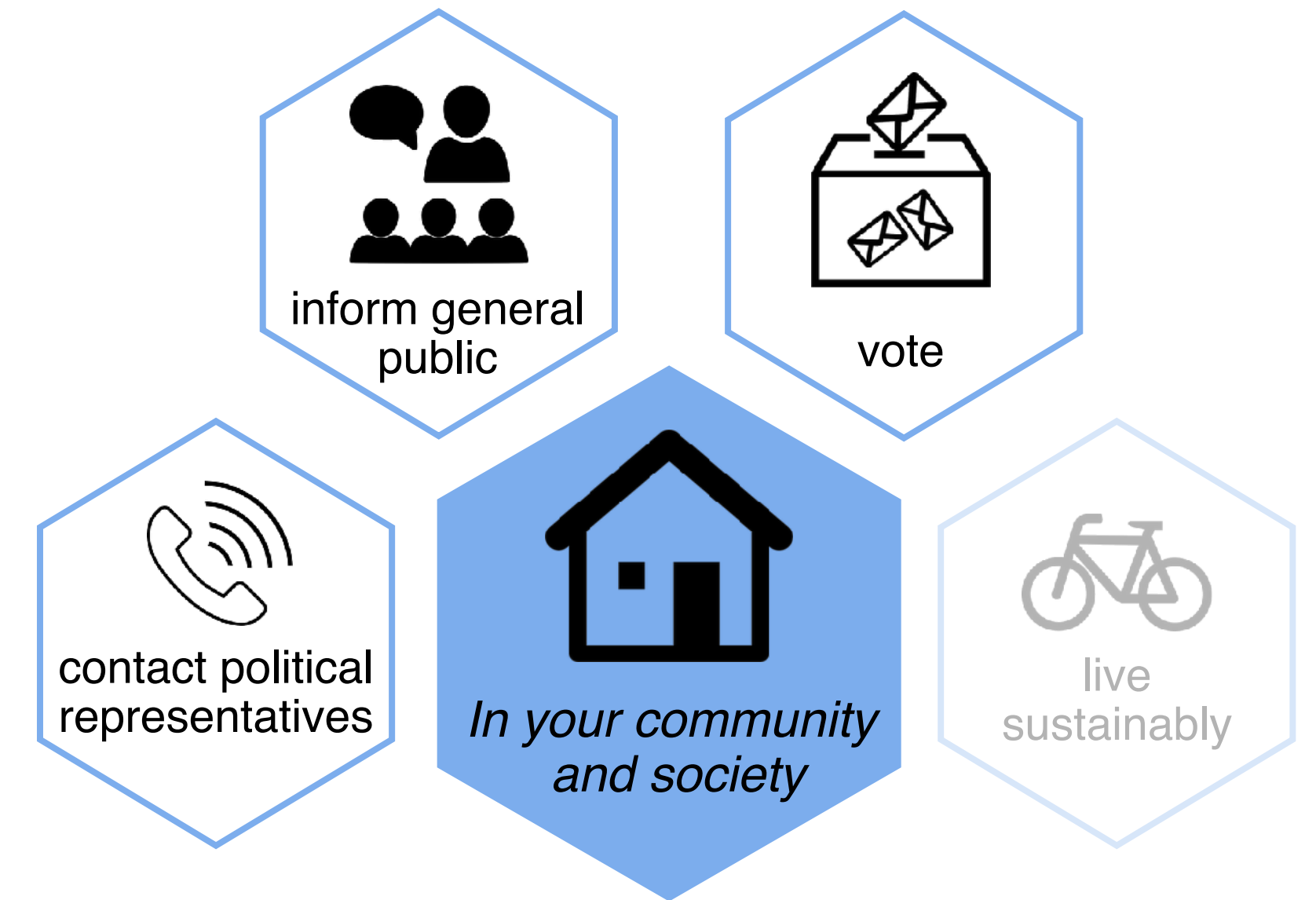
Talk about it

- Emotions, not facts
 - Haranguing doesn't change minds
 - Emphasize shared values
- *Normalize* discussion, worry & personal action
- Family, friends, neighbors, colleagues...



Beyond the university

- Write to your representatives
- Lobby parliament
- Talk to friends and colleagues
- Talk to the public and schools
- Help change academia's ways
- If you have to - protest!



Wrapping up



Thanks & further resources

- Adam Aron, Kate Jeffery, Charlotte Rae, Fabian Dablander and many others

- <https://anneur.ai.net/green-neuroscience/>

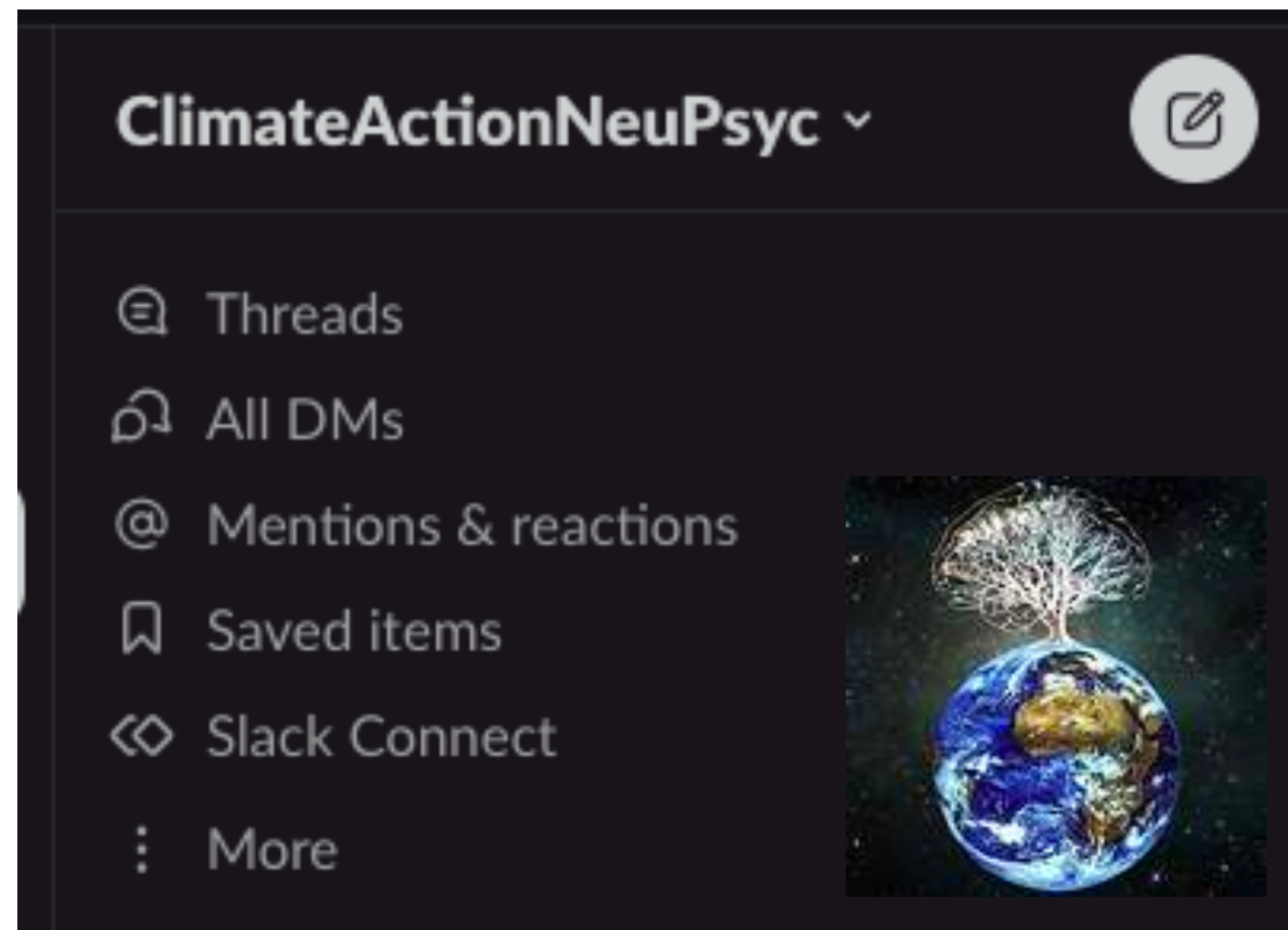
- <https://aronlab.org/climate-crisis/>

- <https://jefferylab.com/climate-change>

<https://fabiandablander.com/menu/climate.html>

Team up & join the community

<https://t.co/mb5g64XH0P?amp=1>



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