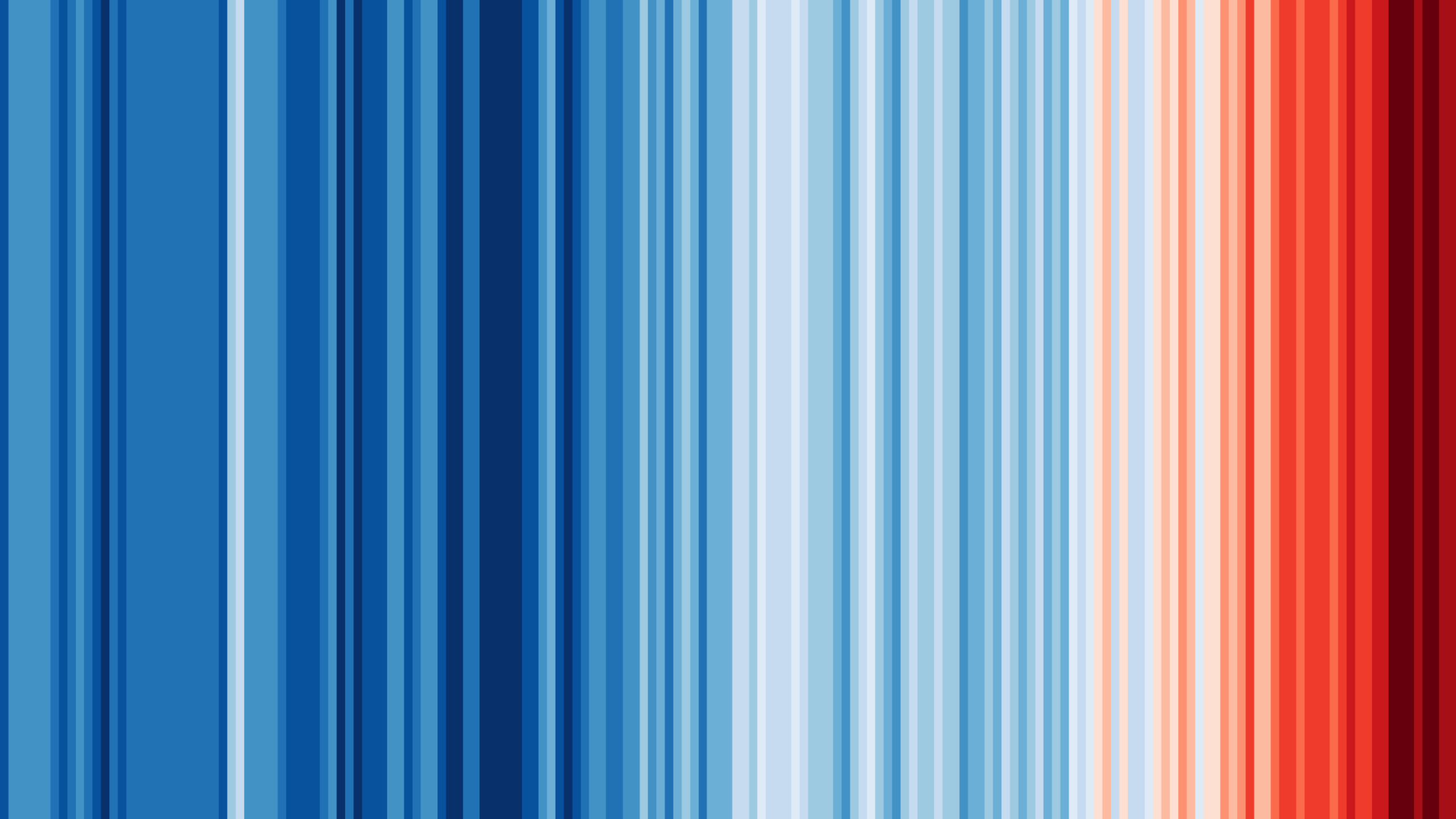

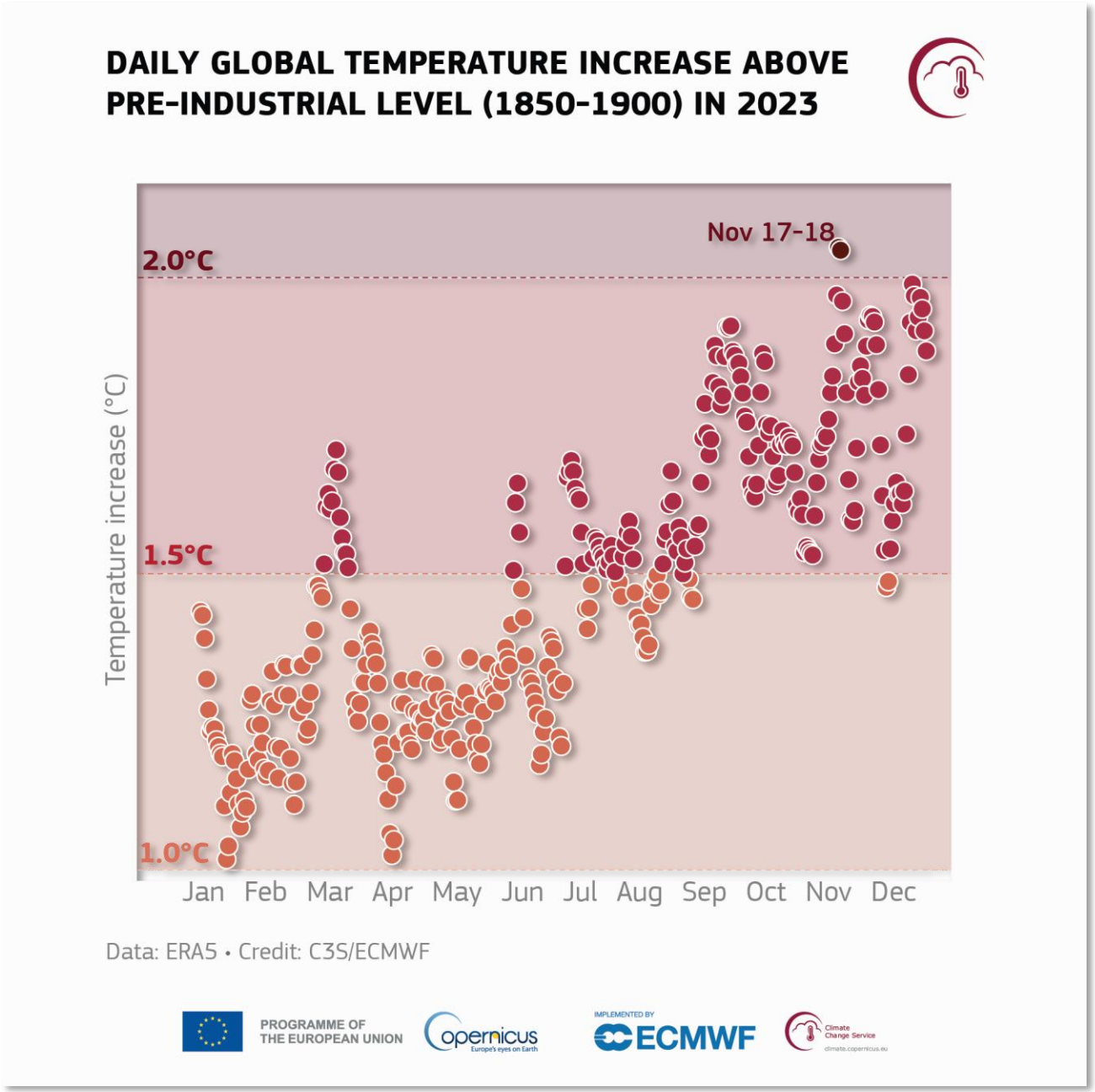

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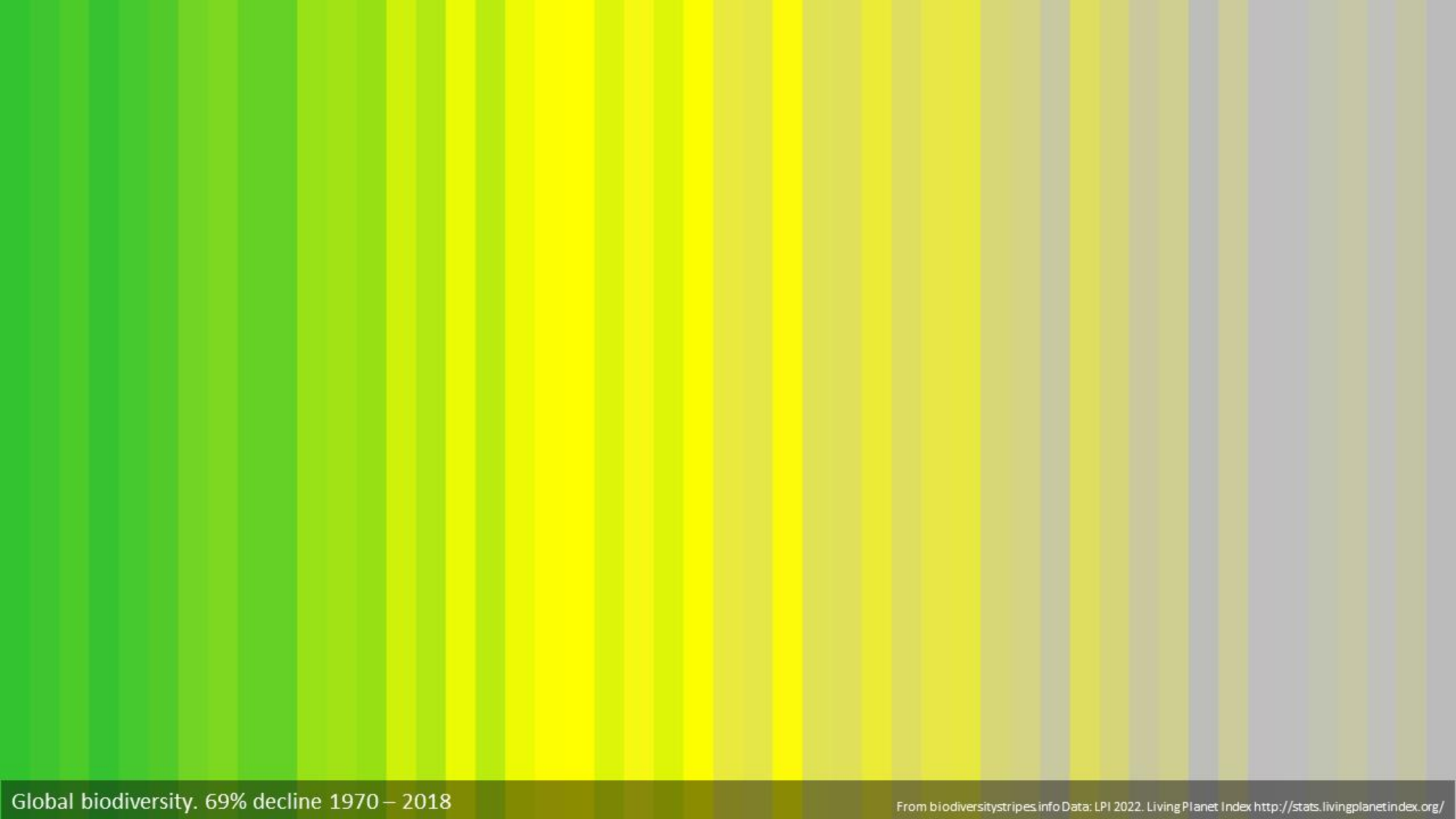
https://climate.copernicus.eu/global-climate-highlights-2023

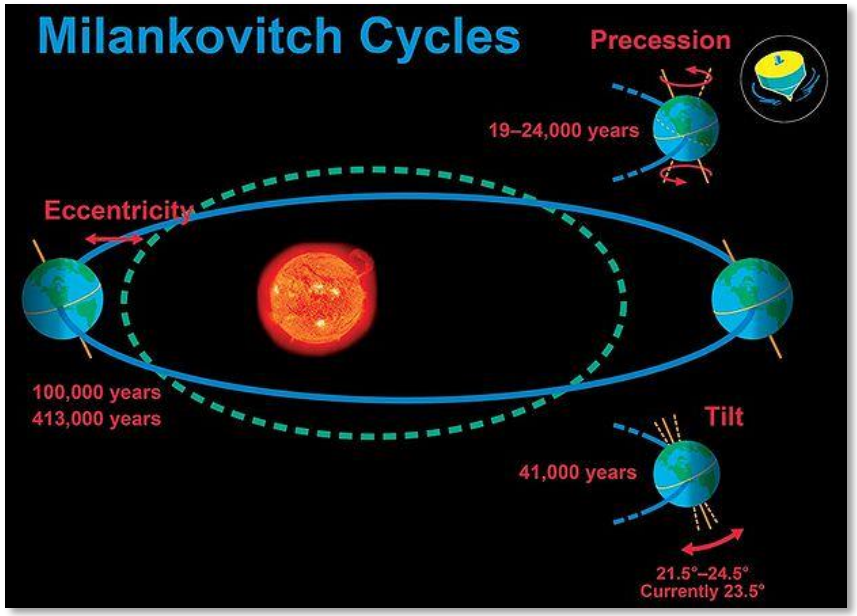

Global biodiversity. 69% decline 1970 – 2018
From biodiversitystripes.info Data: LPI 2022. Living Planet Index http://stats.livingplanetindex.org/

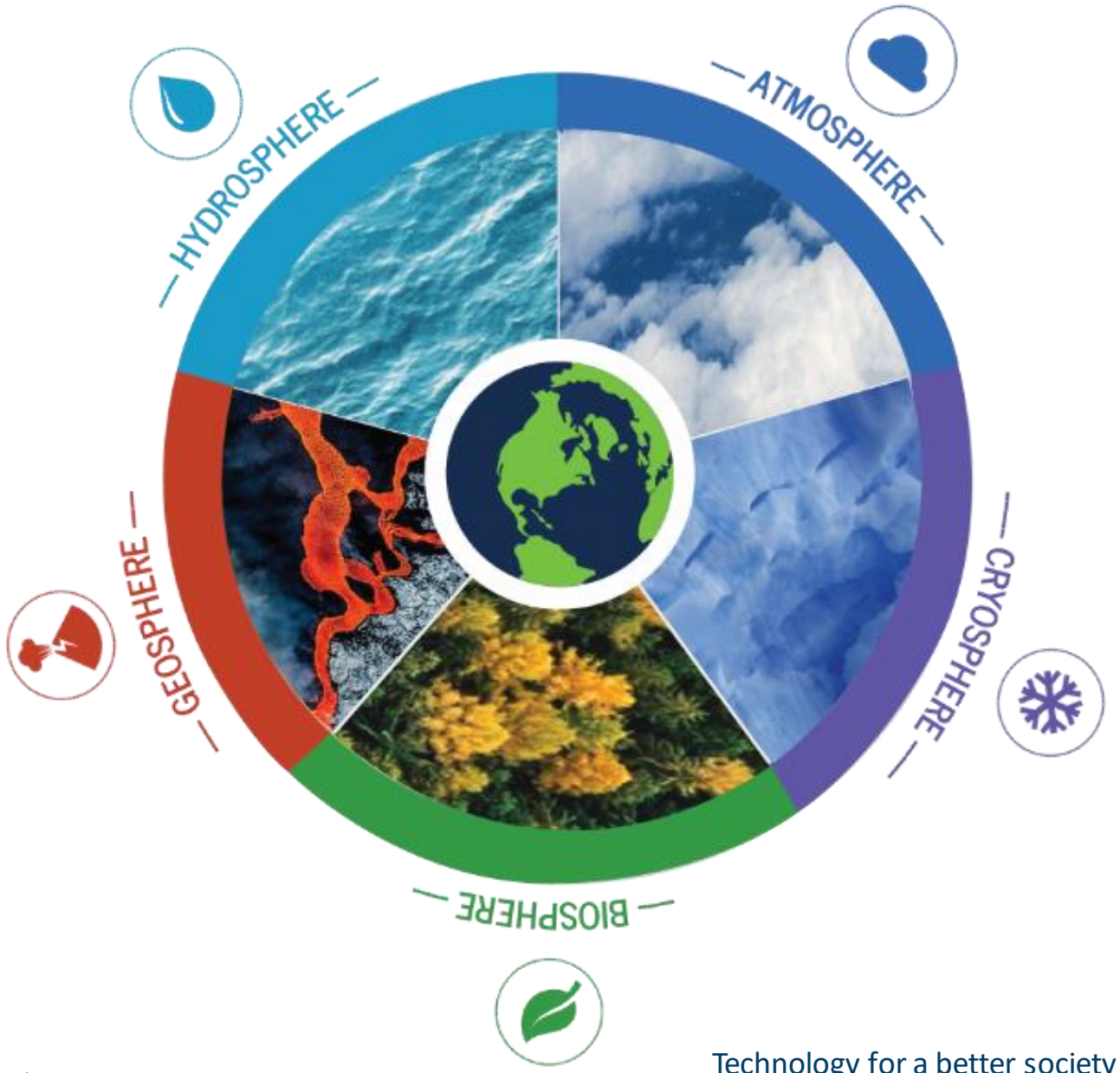
Past, Present, Future

Planetary Boundaries, Sustainable Development, and Post-Growth

Contents

The Earth System

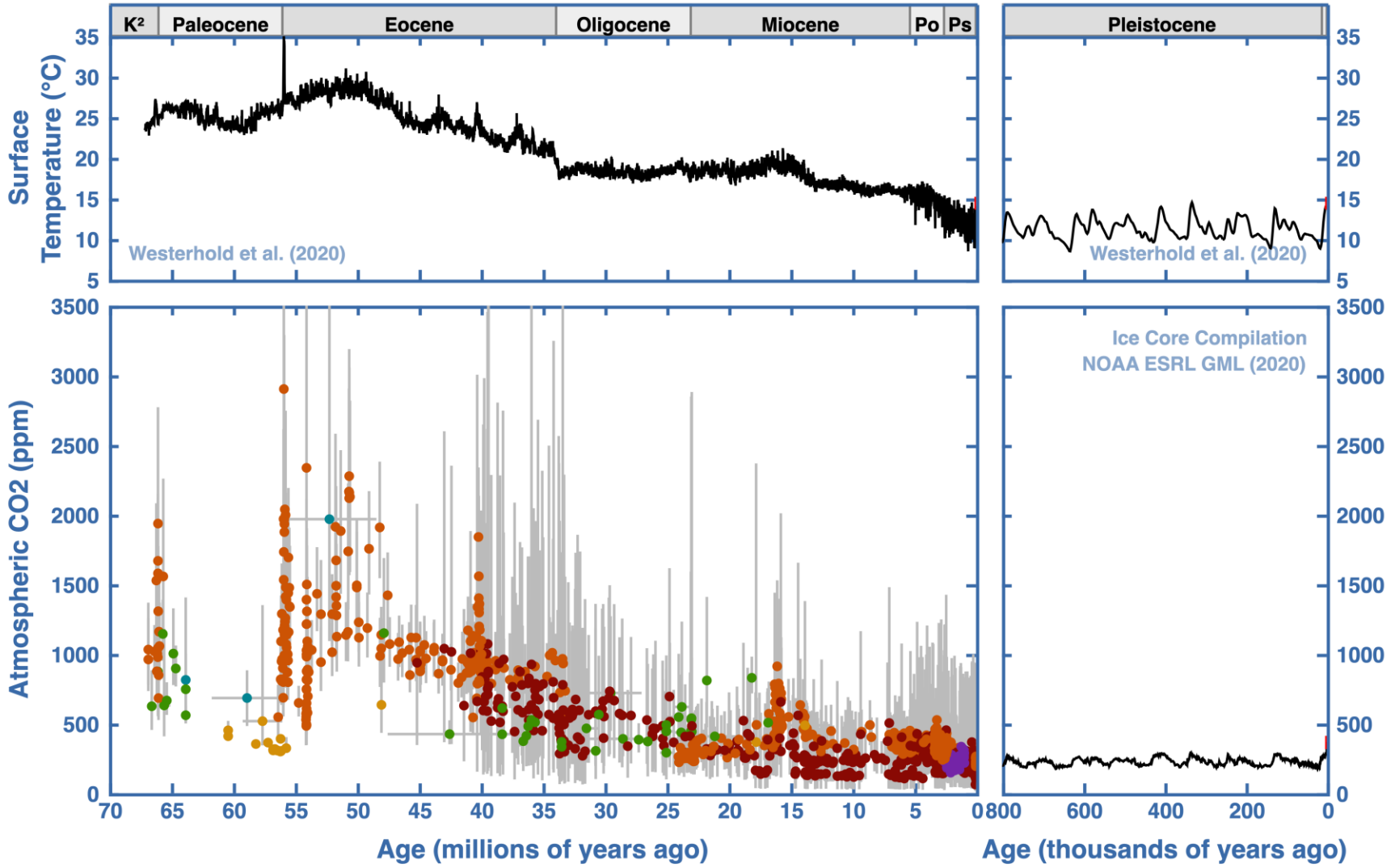




https://mynasadata.larc.nasa.gov/basic-page/about-earth-system-background-information
https://www.universetoday.com/39012/milankovitch-cycle/

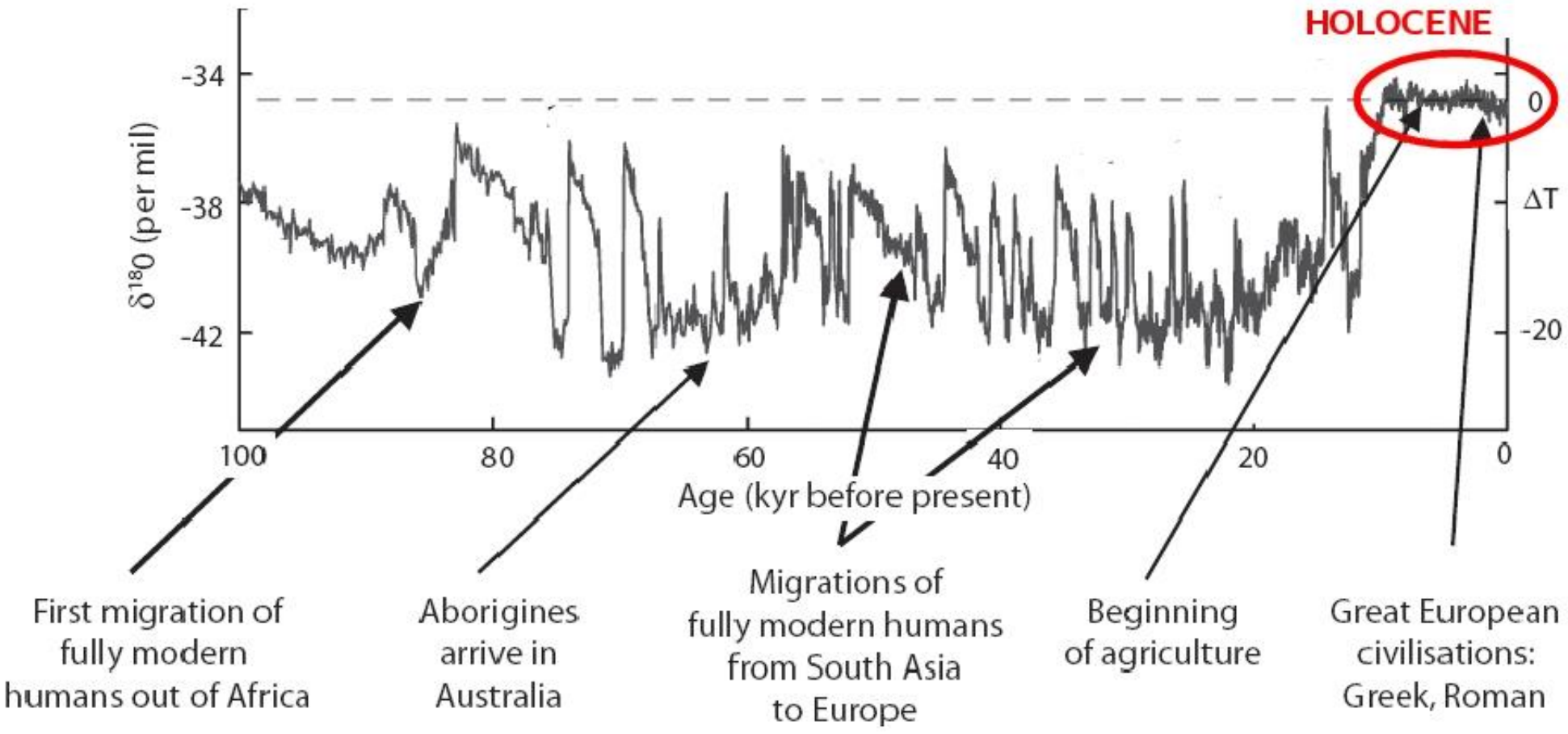
70 Million to 100’000 Years Ago

- Phytoplankton
- Boron Proxies
- Stomatal Frequencies
- Leaf Gas Exchange
- Liverworts
- Land Plant $\delta^{13}C$
- Paleosols
- Nahcolite



https://www.paleo-co2.org

Past 100’000 Years



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https://www.ecologyandsociety.org/vol14/iss2/art32/, Rockström et al. 2009, Fig1

Planetary Boundaries

Boundary character / Scale of process	Processes with global scale thresholds	Slow processes without known global scale thresholds
Systemic processes at planetary scale		
Aggregated processes from local/regional scale		

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https://www.ecologyandsociety.org/vol14/iss2/art32/, Rockström et al. 2009, Fig4

Boundary character / Scale of process	Processes with global scale thresholds	Slow processes without known global scale thresholds
Systemic processes at planetary scale	Climate Change	
	Ocean Acidification	
	Stratospheric Ozone	
Aggregated processes from local/regional scale	Global P and N Cycles	
	Atmospheric Aerosol Loading	
	Freshwater Use	
	Land Use Change	
	Biodiversity Loss	
	Chemical Pollution	

https://www.ecologyandsociety.org/vol14/iss2/art32/, Rockström et al. 2009, Fig4

Boundary character / Scale of process	Processes with global scale thresholds	Slow processes without known global scale thresholds	
Systemic processes at planetary scale	Climate Change		Tipping points / Extreme weather
	Ocean Acidification		Cannot build shells / Foodweb collapse
	Stratospheric Ozone		UV-B radiation / Human health
Aggregated processes from local/regional scale	Global P and N Cycles		P, N is food for biomass -> eutrophication -> anoxia -> biodiversity collapse
	Atmospheric Aerosol Loading		Particulates -> human health Radiation balance -> weather patterns
	Freshwater Use		Disruption of water for Plants / Fish / Agriculture / Drinking
	Land Use Change		Disruption of Habitats (Biodiversity), Water Cycles, Carbon Cycles
		Biodiversity Loss	Ecosystem Services (Pollination, Pest Control, Water Regulation, Erosion, Natural Hazard Mitigation)
		Chemical Pollution	Health (humans, fauna) Physical (macroplastics), chemical (hormone disruption)

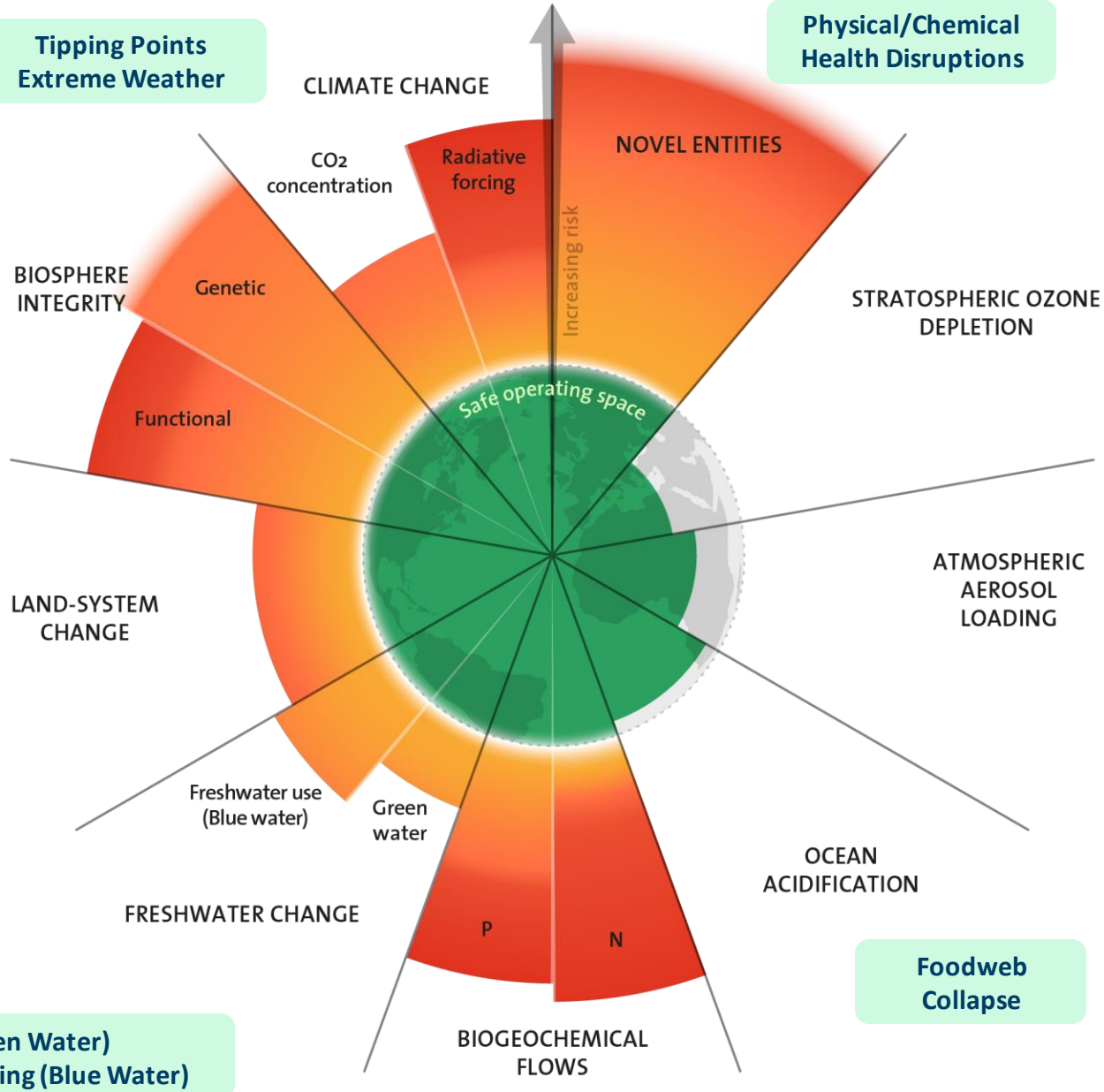
https://www.ecologyandsociety.org/vol14/iss2/art32/, Rockström et al. 2009, Fig4

Tipping Points
Extreme Weather

Physical/Chemical
Health Disruptions

Loss of Ecosystem Services
(Pollination, Soil Erosion, Pest Control)

Human Health
(UV-B)



Disruption of Habitats (Biodiversity),
Water Cycles, Carbon Cycles

Human Health (Air Quality)
Monsoon Patterns

Foodweb
Collapse

Plants, Soil (Green Water)
Fish, Agriculture, Drinking (Blue Water)

Eutrophication,
Anoxic Events

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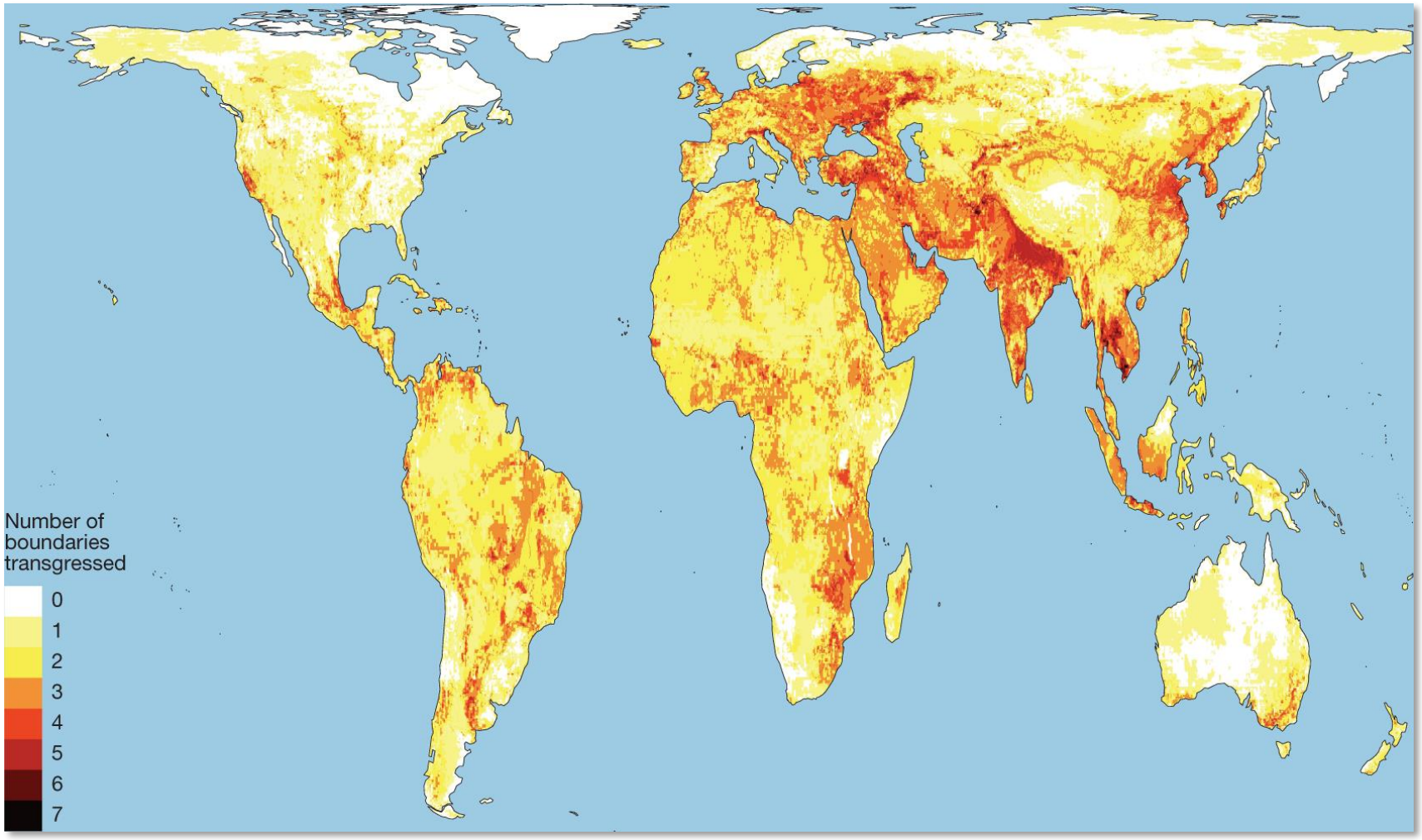
https://www.stockholmresilience.org/research/planetary-boundaries.html, Richardson et al. 2023



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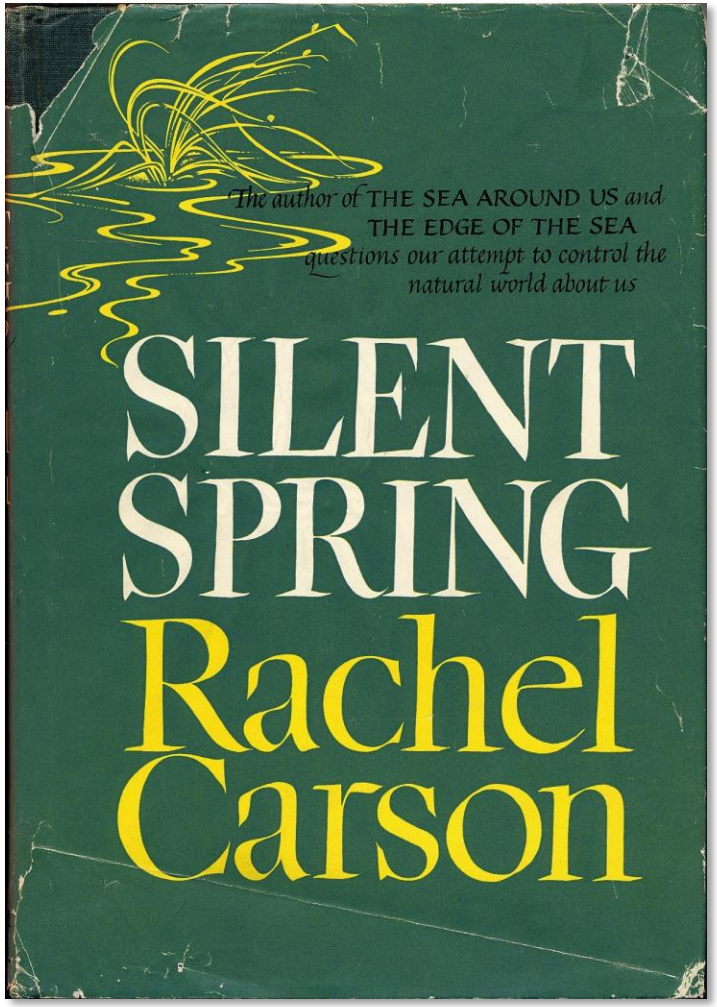
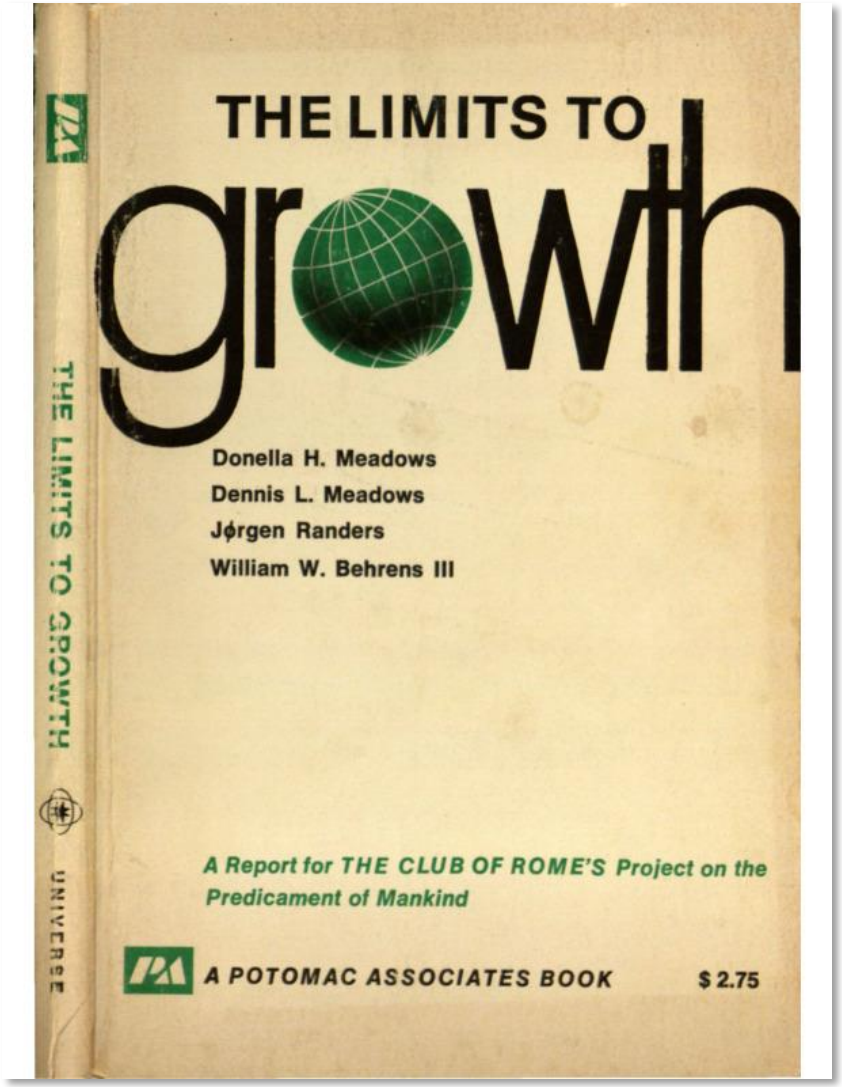
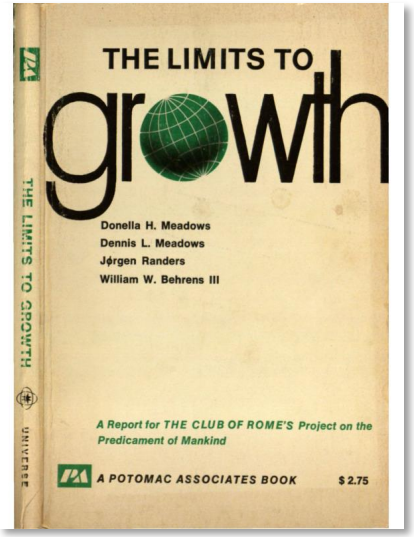
https://www.nature.com/articles/s41586-023-06083-8/figures/3, Rockström et al. 2022, Fig 3

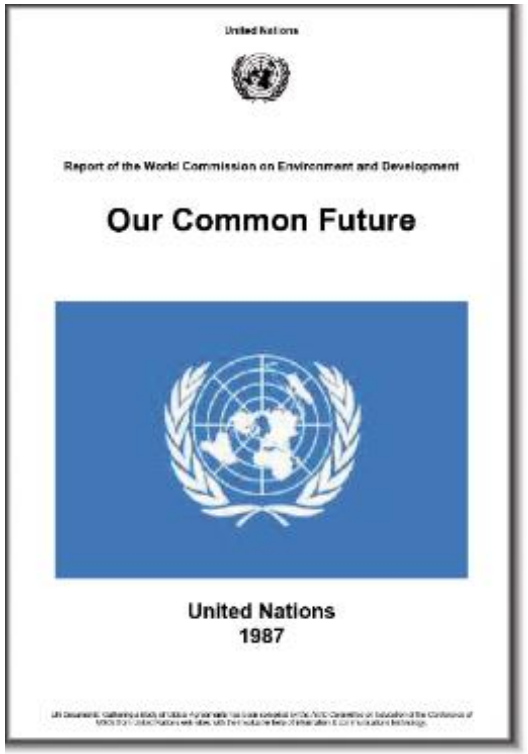
Sustainable Development Goals


The author of THE SEA AROUND US and THE EDGE OF THE SEA questions our attempt to control the natural world about us
SILENT SPRING
Rachel Carson


THE LIMITS TO growth
Donella H. Meadows
Dennis L. Meadows
Jørgen Randers
William W. Behrens III
A Report for THE CLUB OF ROME'S Project on the Predicament of Mankind
A POTOMAC ASSOCIATES BOOK
$ 2.75
THE LIMITS TO GROWTH
UNIVERSE

Sustainable Development Goals

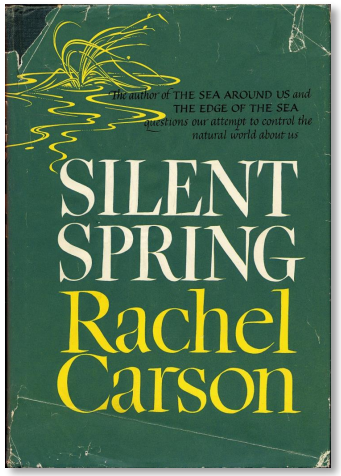




United Nations
Sustainable Development

United Nations Conference on Environment & Development
Rio de Janerio, Brazil, 3 to 14 June 1992

AGENDA 21



RIO+20
United Nations Conference on Sustainable Development

SINTEF

All 232 SDG Indicators: What data is available?

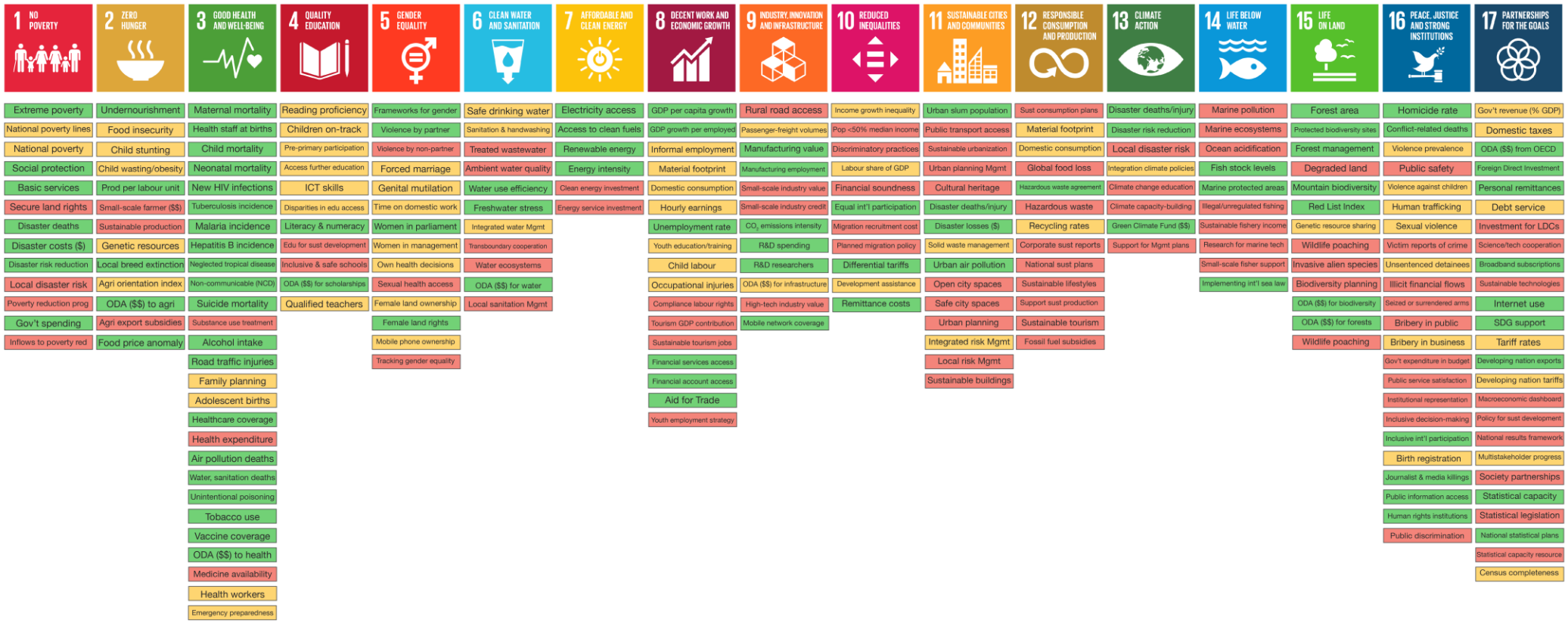
Our World in Data

This visualization shows for which of the 230 *Sustainable Development Goals (SDGs) Indicators* data is available at **SDG-Tracker.org**.

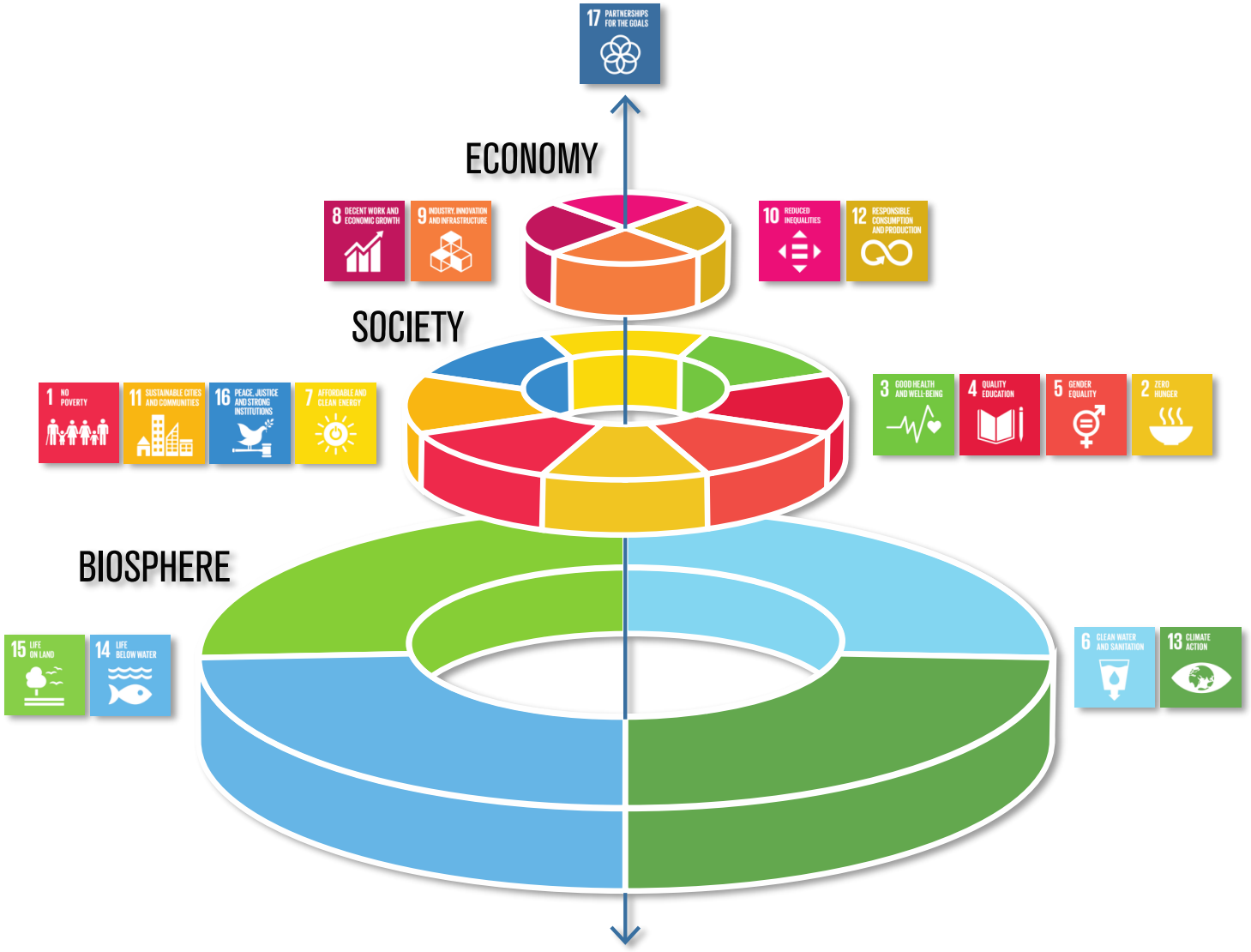
= Indicators for which recent global official metrics are available,
or for which alternative good-quality cross-country source are available (e.g. estimates from independent research institutes).

= Indicators that do have official metrics, but for which available data is very incomplete or outdated.
Yellow boxes also mark Indicators for which there are no official metrics, but for which closely related estimates are available that allow informative but imperfect monitoring.

= Indicators for which – to the best of our knowledge – global monitoring is not currently possible.



You find all data on SDG-Tracker.org, a sister project of OurWorldinData.org. In case you are aware of relevant data we have not included yet please let us know via SDG-Tracker.org.



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https://www.stockholmresilience.org/research/research-news/2016-06-14-the-sdgs-wedding-cake.html

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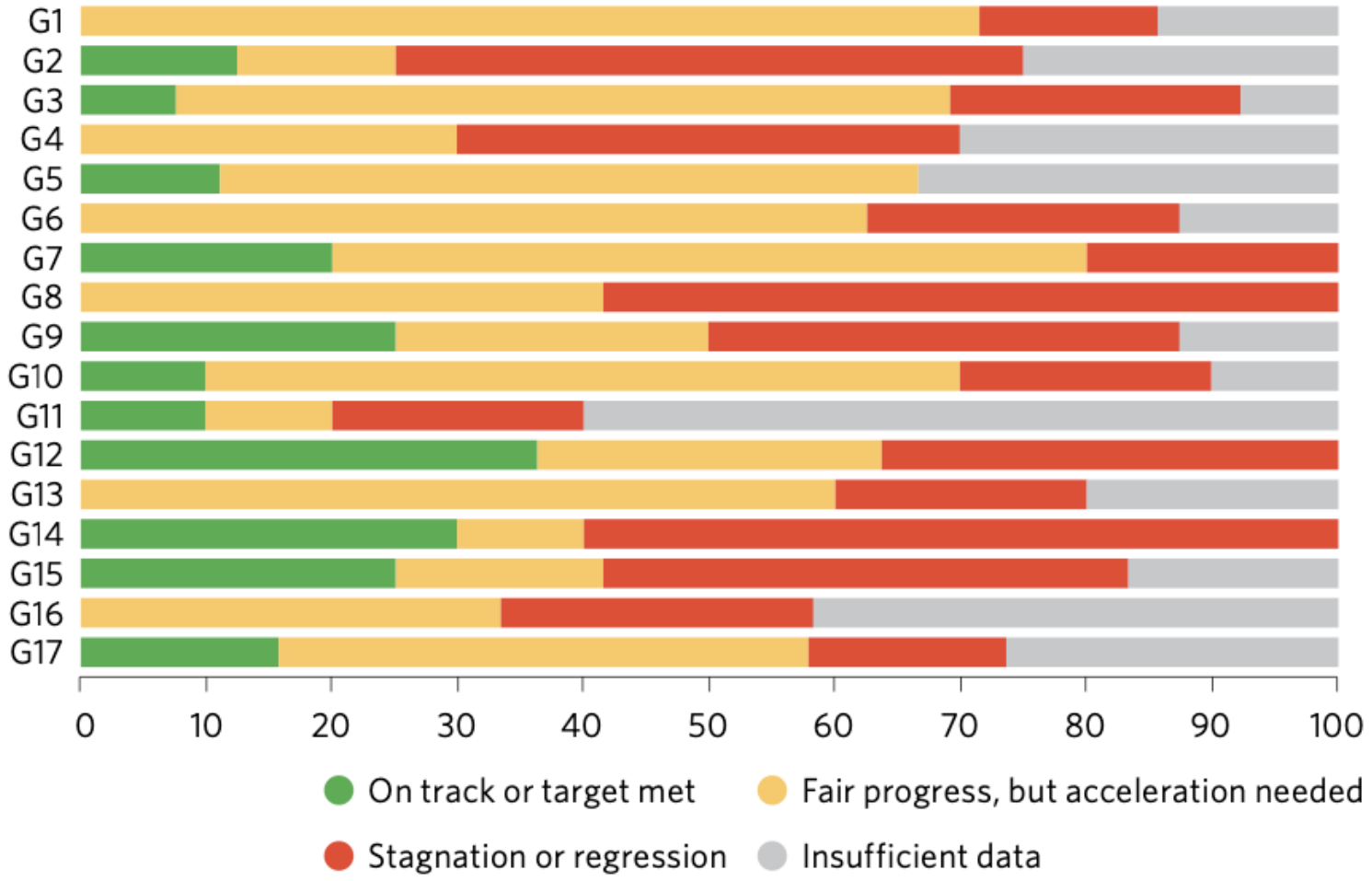
Progress assessment for the 17 Goals based on assessed targets, 2023 or latest data (percentage)



https://unstats.un.org/sdgs/report/2023/
https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf, p8

Catch-22

Achieving the 17 Sustainable Development Goals within 9 planetary boundaries

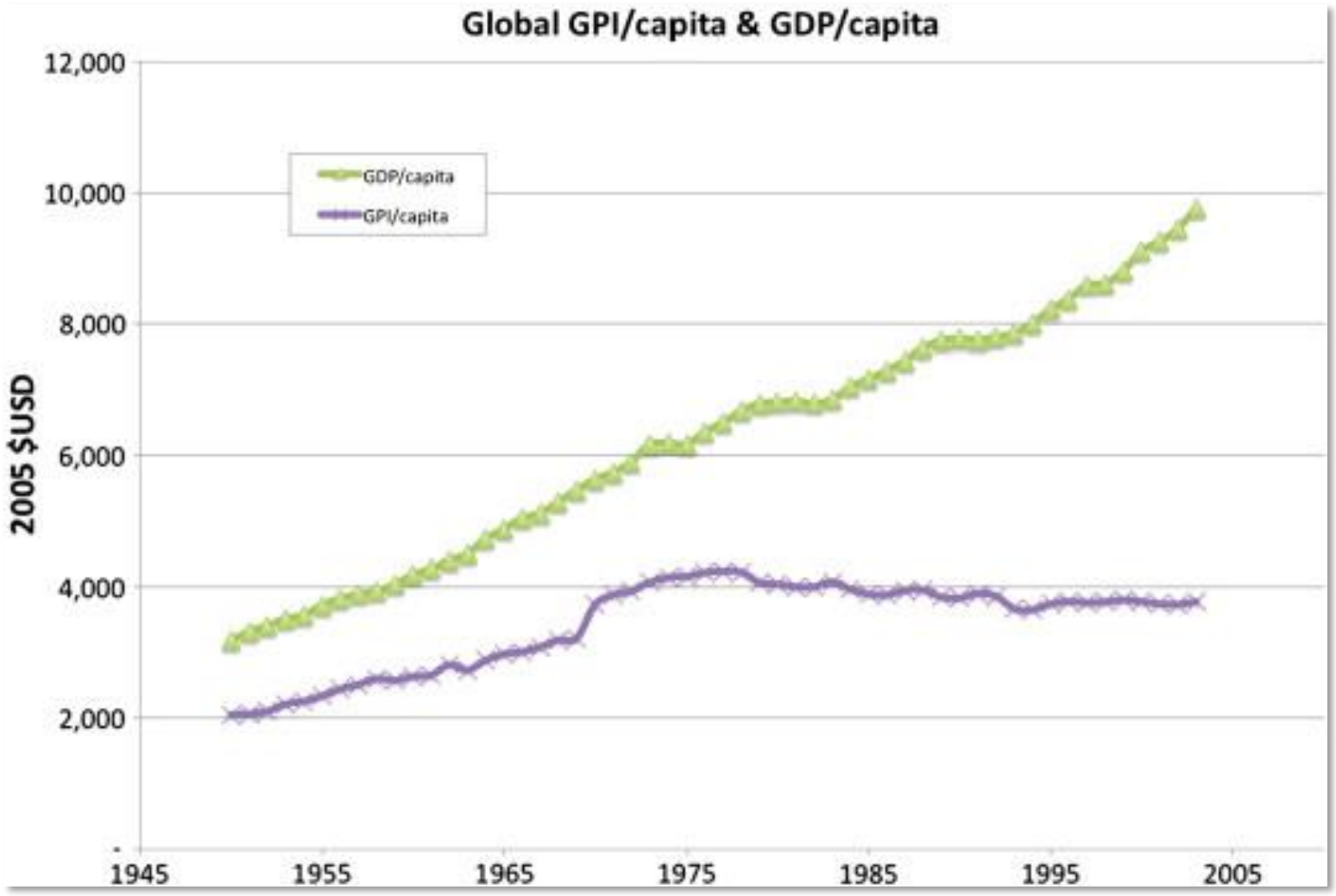
Jorgen Randers[1], Johan Rockström[2], Per-Espen Stoknes[1], Ulrich Goluke[1], David Collste[3], Sarah E. Cornell[3] and Jonathan Donges[2]

[1]BI Norwegian Business School, Oslo; [2]Potsdam Institute for Climate Impact Research, Potsdam and [3]Stockholm Resilience Center, Stockholm University, Stockholm

[…] Conventional efforts to achieve the 14 socio-economic goals will raise pressure on planetary boundaries, moving the world away from the three environmental SDGs. […]

https://doi.org/10.1017/sus.2019.22, Randers et al. 2019

Post-Growth



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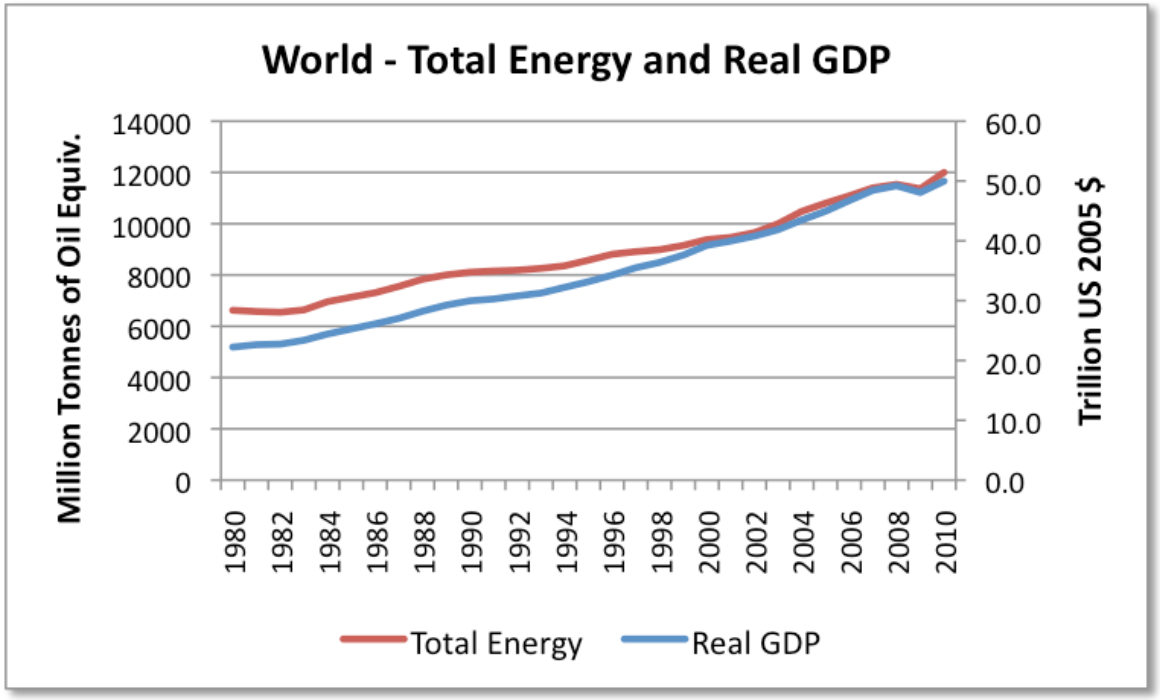
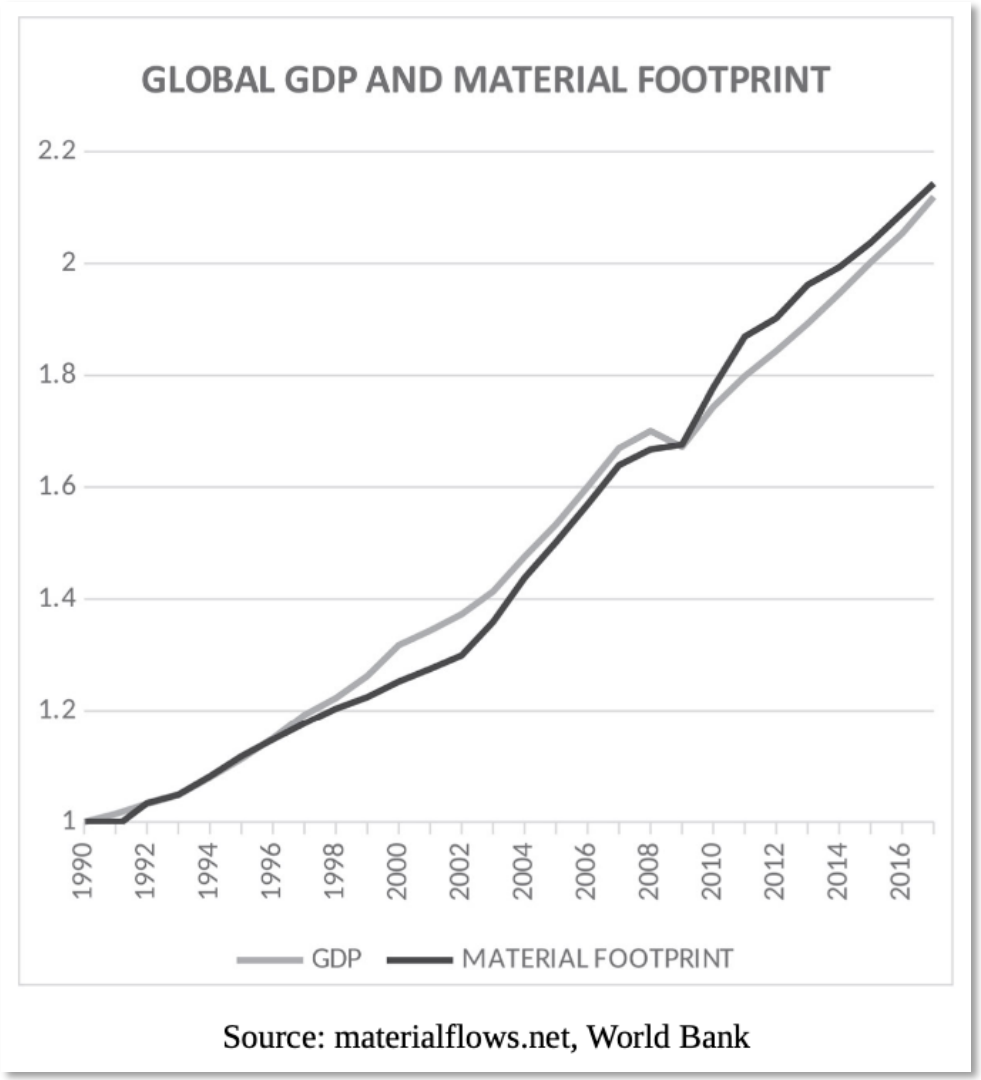
https://doi.org/10.1016/j.ecolecon.2013.04.019, Kubiszewski et al. 2013, Fig3

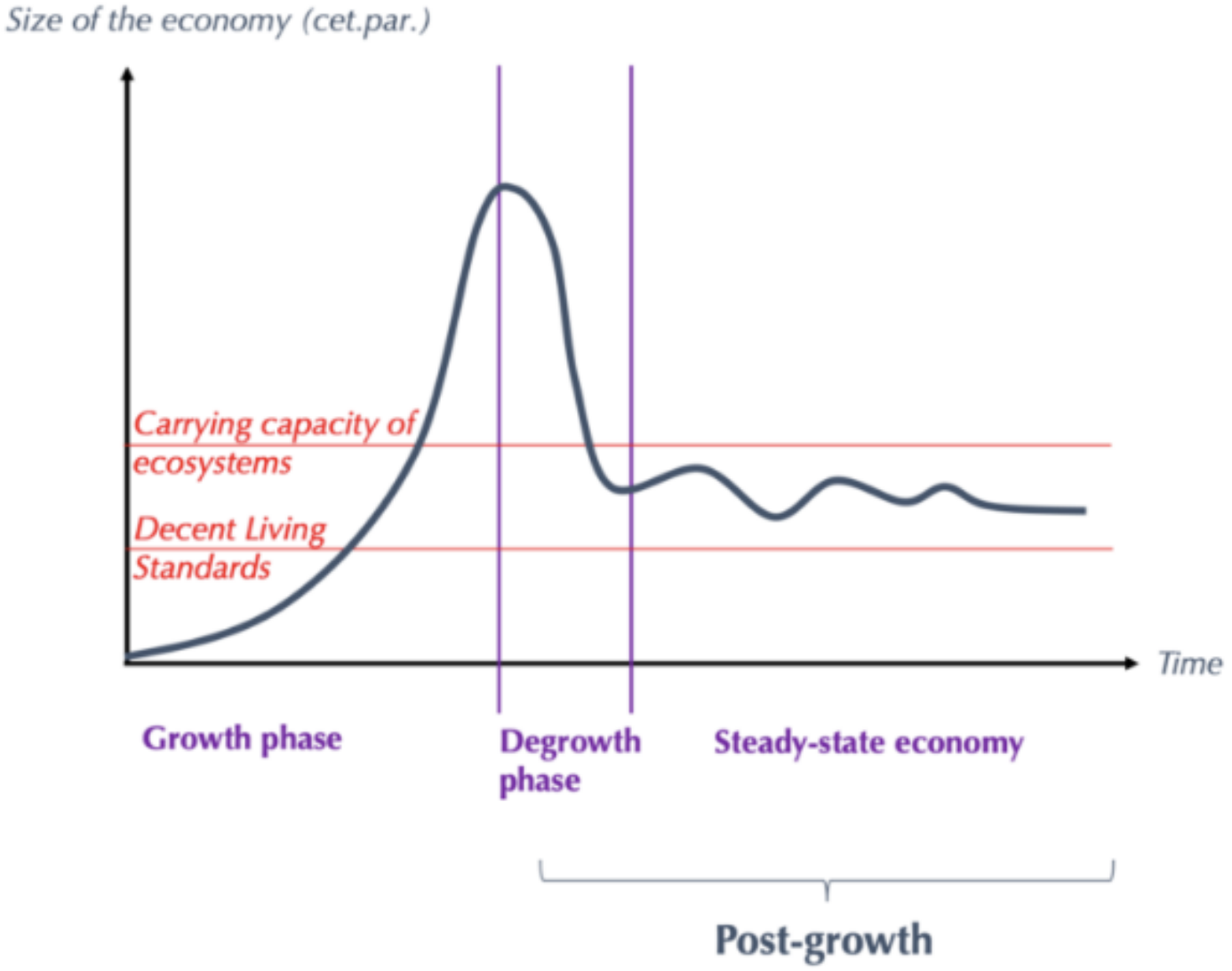


Source: World Bank, BP, Madison



Source: materialflows.net, World Bank

https://ourfiniteworld.com/2011/11/15/is-it-really-possible-to-decouple-gdp-growth-from-energy-growth/
https://www.jasonhickel.org/less-is-more, pp104



By Charles Duprez, inspired from O'Neill (2012), Rao and Min (2017) and Raworth (2017)

https://nbs.net/degrowth-can-support-business-sustainability/

"A performant economy should enable us to leave as much of nature safely untouched and as much of our time joyfully unworked."

— Timothée Parrique, Night of Ideas 2022

Conclusion

- There are 9 Planetary Boundaries
  - 6 are globally crossed
- There are 17 Sustainable Development Goals
  - Most are not on-track

- Economic growth
  - Has decoupled from wellbeing
  - Is coupled to energy and material consumption
  - Is incompatible with the planetary boundaries

Appendix
Comments, Further Reading, What Now?

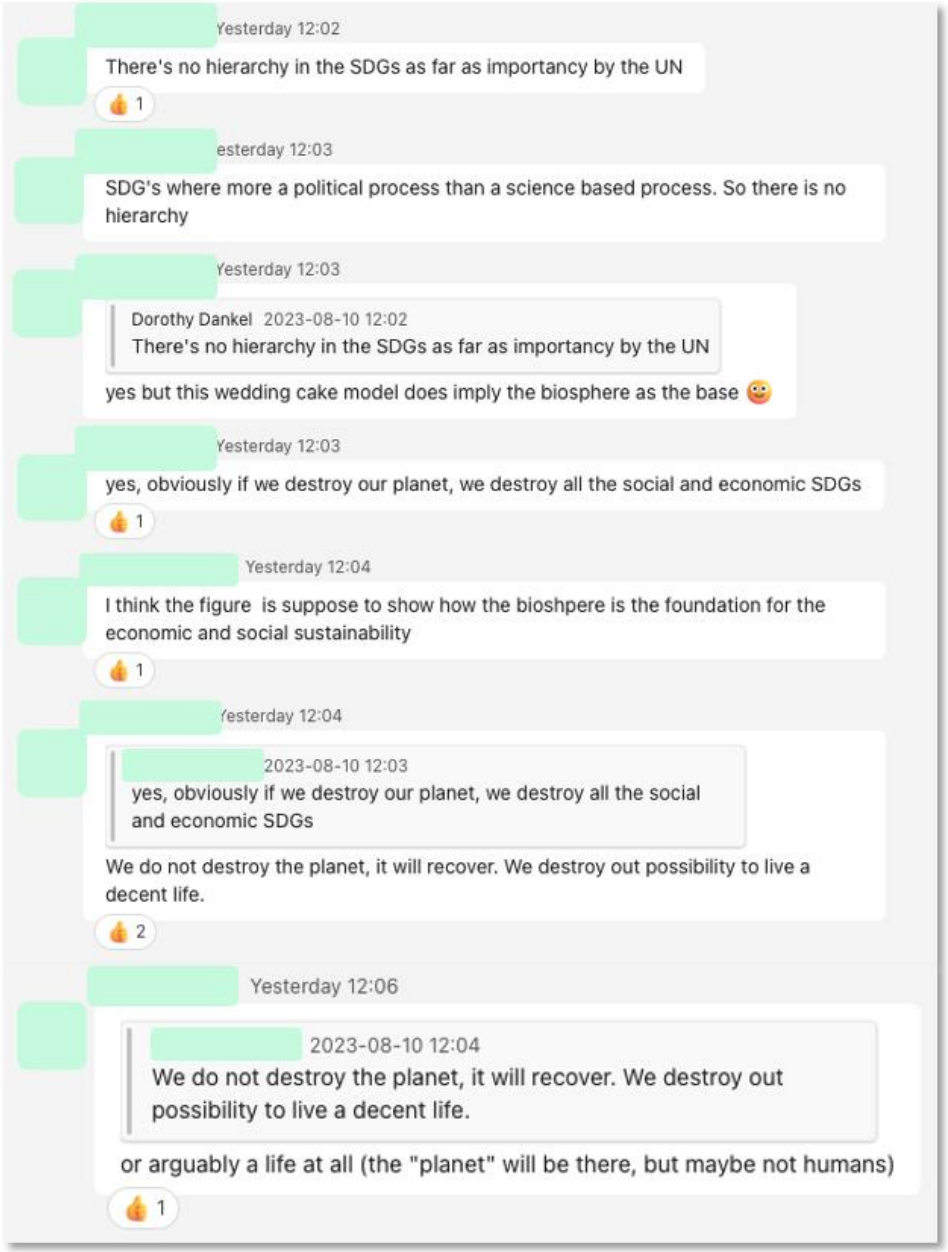
Comments from the Discussion

Comments, Pt1

- Scientist A
  - Something to clarify as the introduction was short due to time restrictions: The focus on growth was just a standardized measure, data availability at the time also limited other measurements of society's wellbeing. *Growth it is important in the sense that increasing availability of goods and services increases quality of life when you come from a very low subsistence level.* However, and what maybe will be discussed further (the post-growth idea) is the problems of how much it is produced, how it is produced, when are these things consumed and who consumes these things.
  - Bruntland report ("Our Common Future") is the base for what we called sustainability today, which is defined by three dimensions (social, economic, and environmental). Most of the time the term is used wrongly in the sense of favoring only the environmental dimension (plus other green-washing stuff).

Comments, Pt2

- Re: a question on whether there's an explicit order of importance to the SDGs



Comments, Pt3

- Scientist A
  - Post-growth is a growing field and as such encompasses many different ideas and theoriies. So it is not an structured body or framework but a recollection of different ways of framing the problem of production-consumption-distribution in a limited resources planet
- Scientist B
  - Also, a wonderful visual demonstration of Kate Raworth's de-growth paradigm with planetary boundaries, https://en.wikipedia.org/wiki/Doughnut_(economic_model)

Comments, Pt4

- Scientist C
  - The UN has started a Beyond-GDP process, which is a bit more encompassing than post-growth or degrowth. The project leader of the WISE Horizons project (SINTEF is a partner in the project) has written a short introduction into this process ~ https://beyond-gdp.world/wise-insights/the-un-beyond-gdp-process
- Scientist D
  - I think it's not only about the technology we develop but further thinking into how it can be used. If you speak with the client, an industrial partner let's say, you might realize that they don't only want to consume less energy but they will probably use the budget saved on energy consumption to upscale their production -> so overall our technologies would have 0 impact on their energy consumption
- Scientist E
  - Wars also have environmental impact, and sometimes cause radical destruction to that part of the planet destroying pretty much everything (flora/fauna/ people/ biodiversity/resources). ~ https://www.sciencedirect.com/science/article/pii/S0048969721054693
- Scientist F
  - Til info: Here is an article about "The fundamental links between climate change and marine plastic pollution" ~ https://www.sciencedirect.com/science/article/pii/S0048969721054693

Further Reading

Further Reading, Planetary Boundaries

- List of relevant papers and figures (including the wedding cake version of the SDGs)
  - https://www.stockholmresilience.org/research/planetary-boundaries.html
- Orginal paper (2009)
  - Paper ~ https://www.ecologyandsociety.org/vol14/iss2/art32/
  - "Editorial" Version ~ https://www.nature.com/articles/461472a | https://blogs.nature.com/climatefeedback/2009/09/planetary_boundaries_1.html | https://www.nature.com/articles/461447b
- Updated Boundaries (2015) ~ https://doi.org/10.1126/science.1259855 (2015) | https://www.science.org/doi/10.1126/sciadv.adh2458 (Sep 2023)
- Boundary on Novel Entities (2022) ~ https://pubs.acs.org/doi/full/10.1021/acs.est.1c04158
- Update on Biodiversity ~ https://www.nature.com/articles/s41598-021-98811-1 (particularly the Discussion for whether there really is a planetary boundary here)
- Boundary on Green Water ~ https://www.nature.com/articles/s43017-022-00287-8 (Paywalled for SINTEF)
- On Tipping Points ~ https://www.pnas.org/doi/full/10.1073/pnas.0705414105 | https://www.nature.com/articles/s41558-022-01558-4
- Attempt to adjust boundaries to include fairness & justice (cf. also Donut Economics / Science)
  - This paper is a bit messy, but the 64(!) page method supplement presents a good summary of the methods for all the boundaries and processes. The referee reports (and rebuttals) can also be read and can be a starting point to explore the types of criticism of the planetary boundary concept.
  - https://www.nature.com/articles/s41586-023-06083-8
- Videos
  - Clip from WEF 2023 on tipping points and fair boundaries ~ https://www.weforum.org/events/world-economic-forum-annual-meeting-2023/sessions/leading-the-charge-through-earths-new-normal
  - Recent Advances (2023) ~ https://www.youtube.com/watch?v=7KfWGAjJAsM
  - Netflix Documentary (2021) ~ https://www.netflix.com/title/81336476
  - Original TED Talk (2011) ~ https://www.youtube.com/watch?v=RgqtrlixYR4

Further Reading, Sustainable Development

- The Limits to Growth
  - https://www.clubofrome.org/publication/the-limits-to-growth/ (PDF link on the bottom)
  - 50 Years Later ~ https://www.clubofrome.org/ltg50/ (see links on the right for PDF on history and the key messages)
  - Retrospective Anthology ~ https://www.clubofrome.org/publication/limits-and-beyond/
  - Earth for All ~ https://www.clubofrome.org/publication/earth4all-book/
  - Comparison with 30 years of data ~ https://doi.org/10.1016/j.gloenvcha.2008.05.001
- "Our Common Future" Report (1987)
  - https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
  - https://digitallibrary.un.org/record/139811
- Agenda21 (Rio 1992)
  - https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf
- Sustainable Development Goals (SDGs)
  - Agenda 2030 ~ https://sdgs.un.org/2030agenda
  - UN Website ~ https://sdgs.un.org/goals
  - Progress Report 2023 ~ https://dashboards.sdgindex.org
- A (probably very simple) summary of the road to the Sustainable Development Goals and the Paris Agreement
  - https://thesustainablemag.com/environment/the-history-of-sustainable-development-goals-sdgs/
- The Road to Rio+ 20 and the SDGs (from a Colombian diplomat, great insight into what goes on behind the scenes)
  - https://impakter.com/short-history-sdgs/
- Tension between socioeconomic and biosphere SDGs
  - https://doi.org/10.1017/sus.2019.22
  - https://doi.org/10.1017/sus.2021.26

Further Reading, Post-Growth

- *Donut Economics* (Kate Raworth)
  - https://www.kateraworth.com/doughnut/
  - https://www.kateraworth.com
- Post-Growth (*Less is More* by Jason Hickel)
  - https://www.jasonhickel.org/less-is-more
- Beyond Growth Conference
  - https://www.beyond-growth-2023.eu
- Metrics Beyond GDP
  - GPI (Genuine Progress Indicator) ~ https://doi.org/10.1016/j.ecolecon.2013.04.019
  - 8 Other Indicators ~ https://intheblack.cpaaustralia.com.au/economy/8-ways-of-measuring-economic-health
  - OECD "Beyond GDP"
    - The "Trigger" ~ https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf
      - Commentary ~ https://www.project-syndicate.org/commentary/new-metrics-of-wellbeing-not-just-gdp-by-joseph-e-stiglitz-2018-12
    - Follow-Ups ~ https://www.oecd.org/publications/beyond-gdp-9789264307292-en.htm
- Timothée Parrique's Blog (on Degrowth) ~ https://timotheeparrique.com
- Donut Science
  - https://elifesciences.org/articles/84991

Further Reading, Fiction

- Ecotopia
  - https://en.wikipedia.org/wiki/Ecotopia
- The Ministry for the Future
  - https://en.wikipedia.org/wiki/The_Ministry_for_the_Future

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