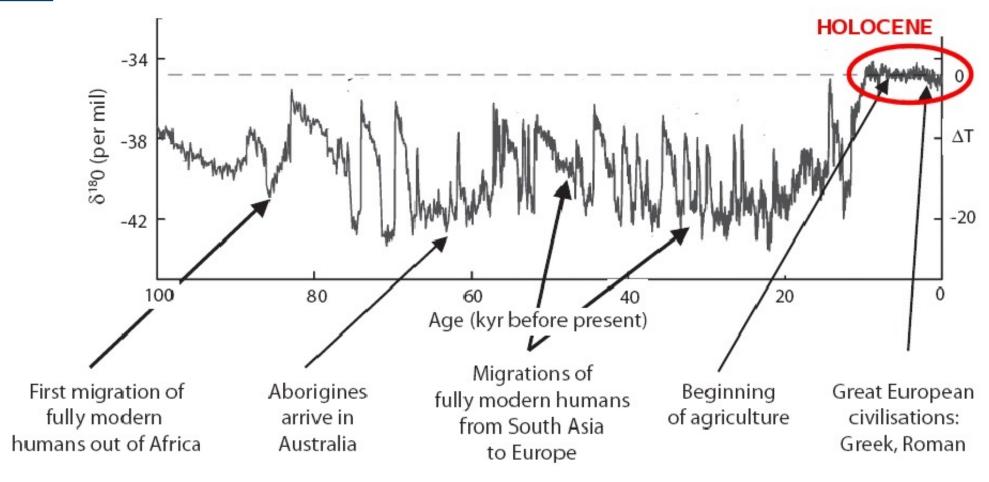




Planetary Boundaries





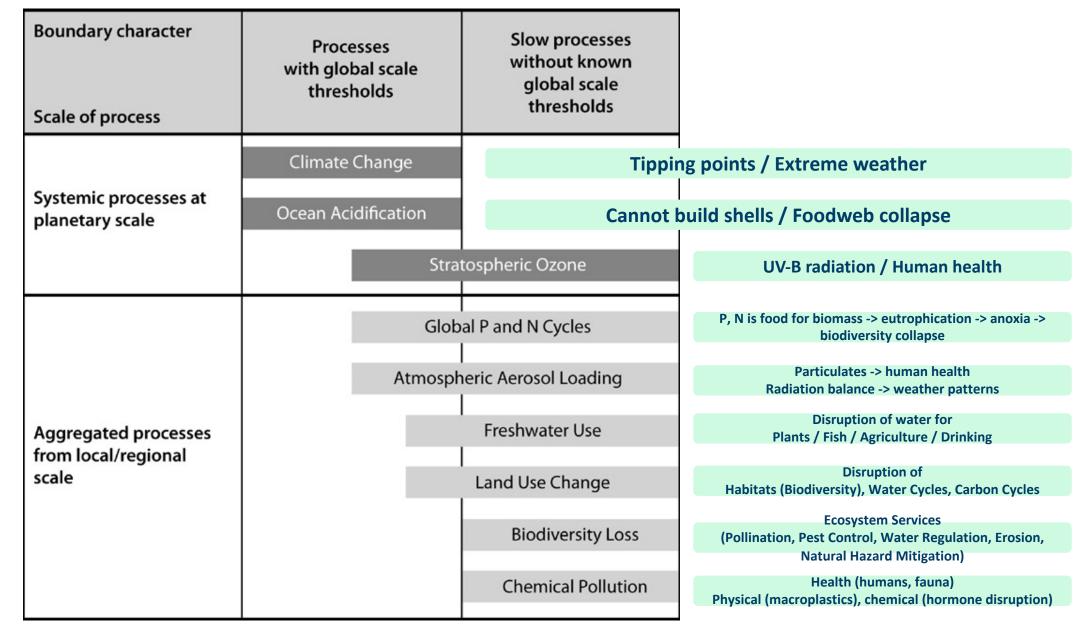


Boundary character Scale of process	Processes with global scale thresholds	Slow processes without known global scale thresholds
Systemic processes at planetary scale		
Aggregated processes from local/regional scale		



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



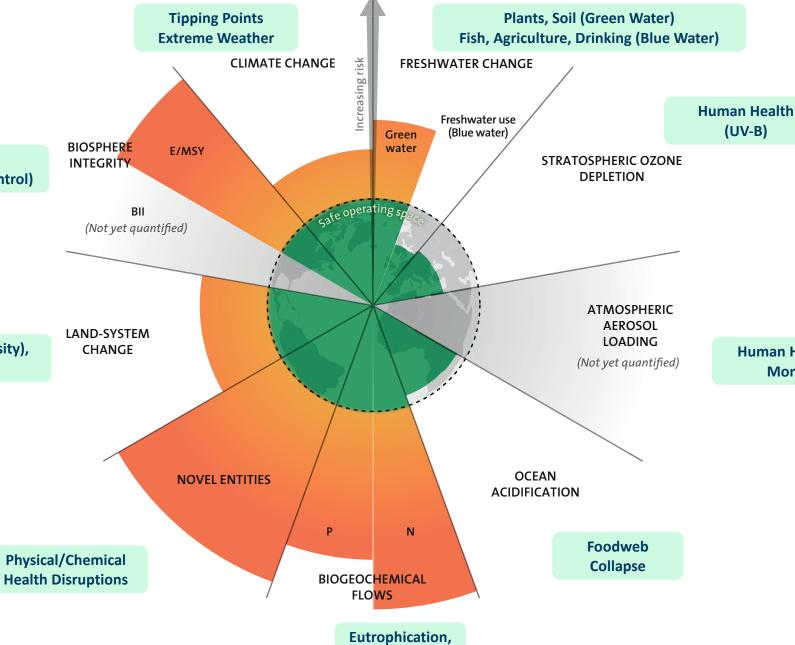


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Loss of Ecosystem Services (Pollination, Soil Erosion, Pest Control)

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



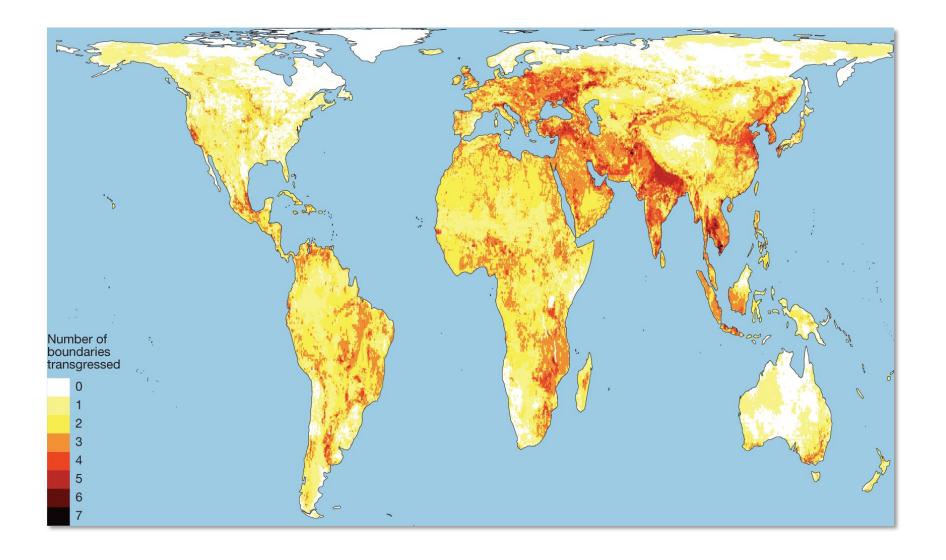
Human Health (Air Quality) Monsoon Patterns

(UV-B)

Anoxic Events

Technology for a better society



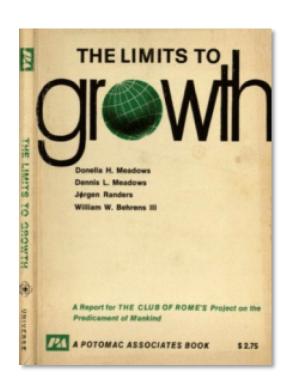


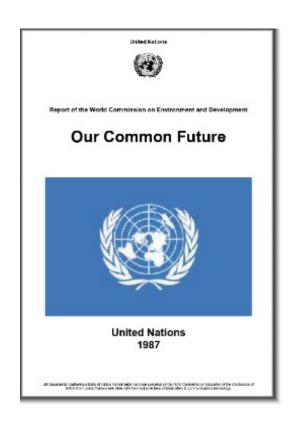


Sustainable Development Goals



Sustainable Development Goals







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

AGENDA 21





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.

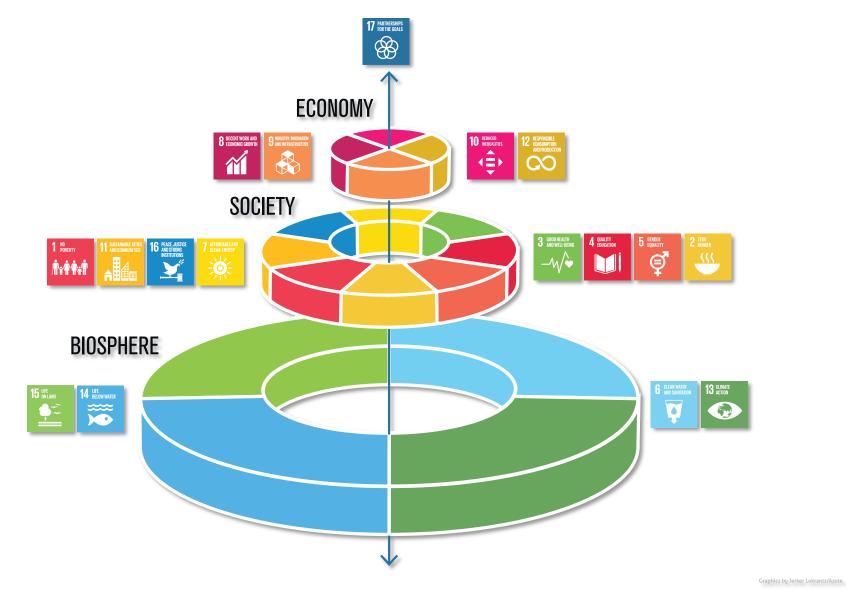
 Yellow boxes also mark Indicators for which there are no official metrics, but for which closely related estimates are available that allow informative but imperfect monitoring.
 - = Indicators for which to the best of our knowledge global monitoring is not currently possible.

NO	O 7FRO	O GOOD HEALTH	■ NIJALITY	☐ GENDER	C CLEAN WATER	7 AFFORDABLE AND	O DECENT WORK AND	INDUSTRY INNOVATION	40 REDUCED	A SUSTAINABLE CITIES	40 RESPONSIBLE	40 CLIMATE	4 A LIFE RELOW	4E UFF	40 PEACE JUSTICE	47 PARTNERSHIPS
NO POVERTY	2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	4 QUALITY EDUCATION	5 GENDER EQUALITY	6 CLEAN WATER AND SANITATION	CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	17 PARTNERSHIPS
i i i i i	(((<i>-</i> ₩•		₫"	Å	- Ø -	M		√ ‡≻	A⊞⊞	CO		***	♣ ~~	Y	***
ktreme poverty	Undernourishment	Maternal mortality	Reading proficiency	Frameworks for gender	Safe drinking water	Electricity access	GDP per capita growth	Rural road access	Income growth inequality	Urban slum population	Sust consumption plans	Disaster deaths/injury	Marine pollution	Forest area	Homicide rate	Gov't revenue (%
ional poverty lines	Food insecurity	Health staff at births	Children on-track	Violence by partner	Sanitation & handwashing	Access to clean fuels	GDP growth per employed	Passenger-freight volumes	Pop <50% median income	Public transport access	Material footprint	Disaster risk reduction	Marine ecosystems	Protected biodiversity sites	Conflict-related deaths	Domestic tax
ational poverty	Child stunting	Child mortality	Pre-primary participation	Violence by non-partner	Treated wastewater	Renewable energy	Informal employment	Manufacturing value	Discriminatory practices	Sustainable urbanization	Domestic consumption	Local disaster risk	Ocean acidification	Forest management	Violence prevalence	ODA (\$\$) from O
ocial protection	Child wasting/obesity	Neonatal mortality	Access further education	Forced marriage	Ambient water quality	Energy intensity	Material footprint	Manufacturing employment	Labour share of GDP	Urban planning Mgmt	Global food loss	Integration climate policies	Fish stock levels	Degraded land	Public safety	Foreign Direct Inve
Basic services	Prod per labour unit	New HIV infections	ICT skills	Genital mutilation	Water use efficiency	Clean energy investment	Domestic consumption	Small-scale industry value	Financial soundness	Cultural heritage	Hazardous waste agreement	Climate change education	Marine protected areas		Violence against children	Personal remitta
cure land rights	Small-scale farmer (\$\$)	Tuberculosis incidence		Time on domestic work	Freshwater stress	Energy service investment	Hourly earnings	Small-scale industry credit	Equal int'l participation	Disaster deaths/injury	Hazardous waste	Climate capacity-building	Illegal/unregulated fishing	Red List Index	Human trafficking	Debt service
Disaster deaths	Sustainable production	Malaria incidence		Women in parliament	Integrated water Mgmt		Unemployment rate	CO ₂ emissions intensity	Migration recruitment cost	Disaster losses (\$)	Recycling rates	Green Climate Fund (\$\$)	Sustainable fishery income	Genetic resource sharing	Sexual violence	Investment for I
saster costs (\$)	Genetic resources	Hepatitis B incidence		Women in management	Transboundary cooperation		Youth education/training	R&D spending	Planned migration policy	Solid waste management	Corporate sust reports	Support for Mgmt plans	Research for marine tech	Wildlife poaching	Victim reports of crime	
aster risk reduction	Local breed extinction Agri orientation index	Neglected tropical disease Non-communicable (NCD)	Inclusive & safe schools ODA (\$\$) for scholarships	Own health decisions Sexual health access	Water ecosystems		Child labour	R&D researchers ODA (\$\$) for infrastructure	Differential tariffs Development assistance	Urban air pollution Open city spaces	National sust plans Sustainable lifestyles		Small-scale fisher support Implementing int'l sea law		Unsentenced detainees Illicit financial flows	Broadband subsci
cal disaster risk	ODA (\$\$) to agri		Qualified teachers		ODA (\$\$) for water Local sanitation Mgmt		Occupational injuries Compliance labour rights	High-tech industry value	Remittance costs	Safe city spaces	Support sust production		implementing incress law	ODA (\$\$) for biodiversity	Seized or surrendered arms	Internet us
ov't spending	Agri export subsidies	Substance use treatment	Qualified teachers	Female land rights	Local sanitation wight		Tourism GDP contribution	Mobile network coverage	Herrittance costs	Urban planning	Sustainable tourism			ODA (\$\$) for forests	Bribery in public	SDG suppo
	Food price anomaly	Alcohol intake]]	Mobile phone ownership			Sustainable tourism jobs	moone network our days		Integrated risk Mgmt				Wildlife poaching	Bribery in business	Tariff rates
, , , , , , , , , , , , , , , , , , , ,	r dea price ariemaly	Road traffic injuries		Tracking gender equality			Financial services access			Local risk Mgmt					Gov't expenditure in budget	
		Family planning					Financial account access			Sustainable buildings					Public service satisfaction	Developing nation
		Adolescent births	ĺ				Aid for Trade				'				Institutional representation	Macroeconomic das
		Healthcare coverage	j				Youth employment strategy								Inclusive decision-making	Policy for sust devel
		Health expenditure													Inclusive int'l participation	National results fra
		Air pollution deaths													Birth registration	Multistakeholder pr
		Water, sanitation deaths													Journalist & media killings	Society partner
		Unintentional poisoning													Public information access	Statistical cap
		Tobacco use													Human rights institutions	Statistical legis
		Vaccine coverage													Public discrimination	National statistica
		ODA (\$\$) to health														Statistical capacity
		Medicine availability														Census comple
		Health workers														

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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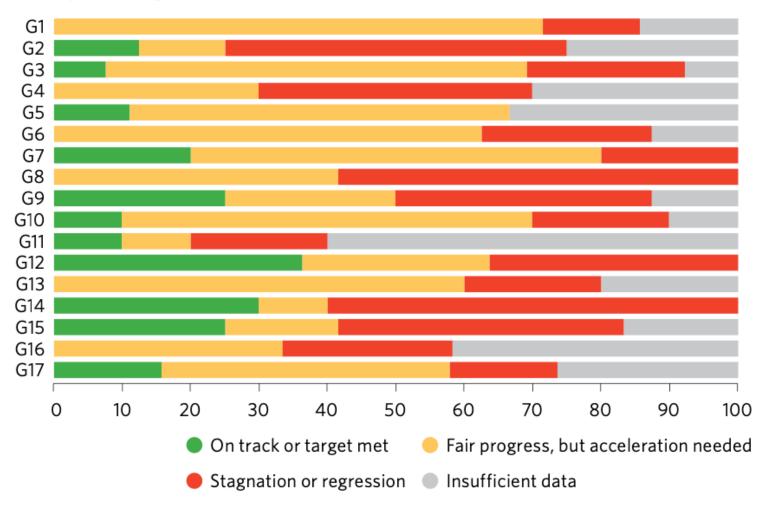




Technology for a better society



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





Catch-22

Achieving the 17 Sustainable Development Goals within 9 planetary boundaries

Jorgen Randers¹, Johan Rockström², Per-Espen Stoknes¹, Ulrich Goluke¹, David Collste³, Sarah E. Cornell³ and Jonathan Donges²

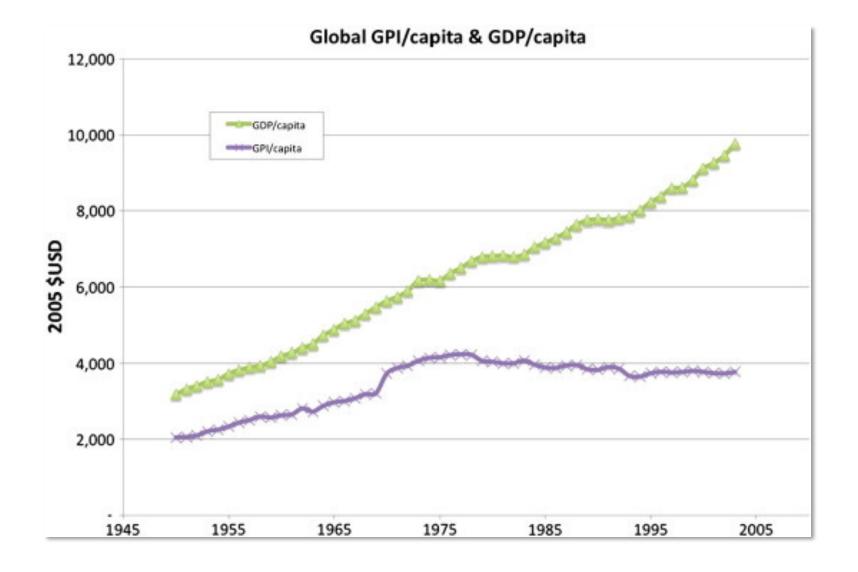
[...] Conventional efforts to achieve the 14 socio-economic goals will raise pressure on planetary boundaries, moving the world away from the three environmental SDGs. [...]

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

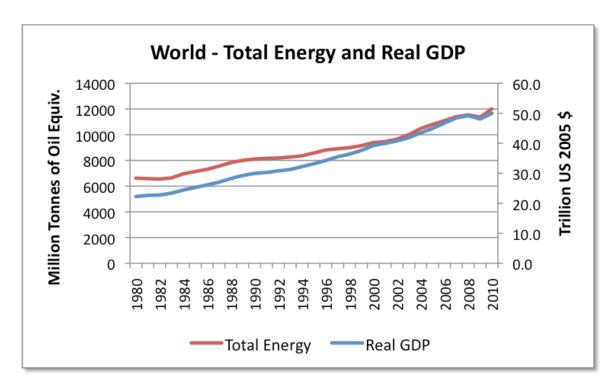


Post-Growth

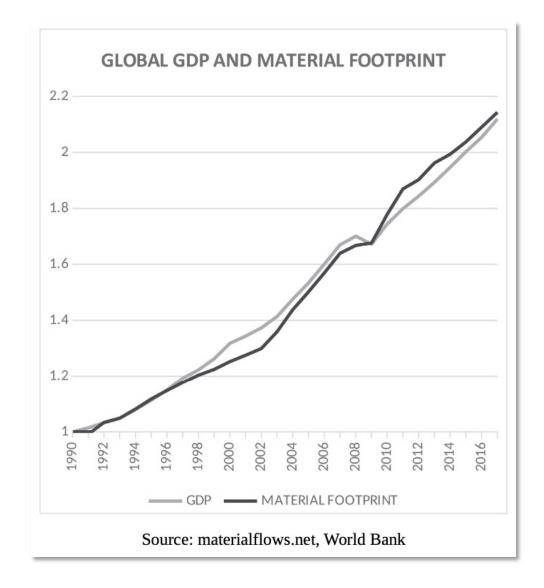






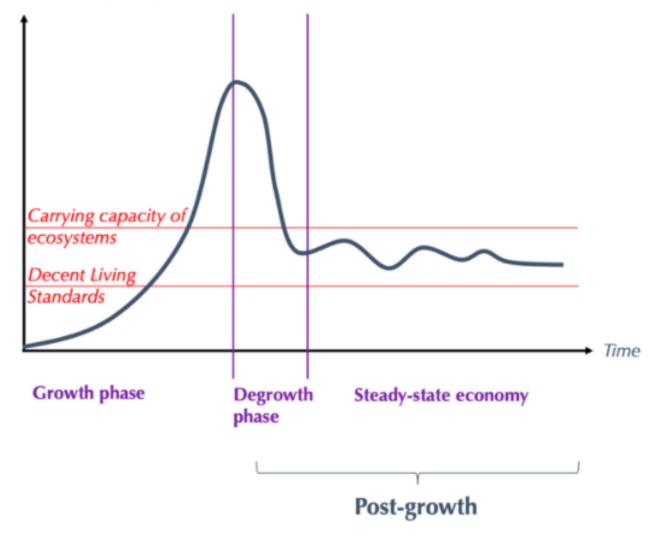


Source: World Bank, BP, Madison









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



"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



The Role of Applied Research / Innovation

Does innovation really make a dent?

or

Does Jevon's paradox always win?



Appendix Comments, Further Reading, What Now?

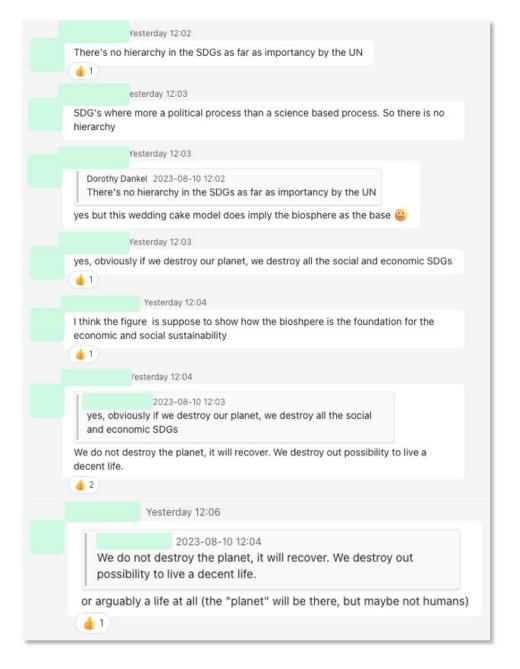


Scientist A

- 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).



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





Scientist A

Post-growth is a growing field and as such encompasses many different ideas and theories. 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)



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 F

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
- 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
 - o 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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