Is the sustainable population less than 4B? – Most probably yes.

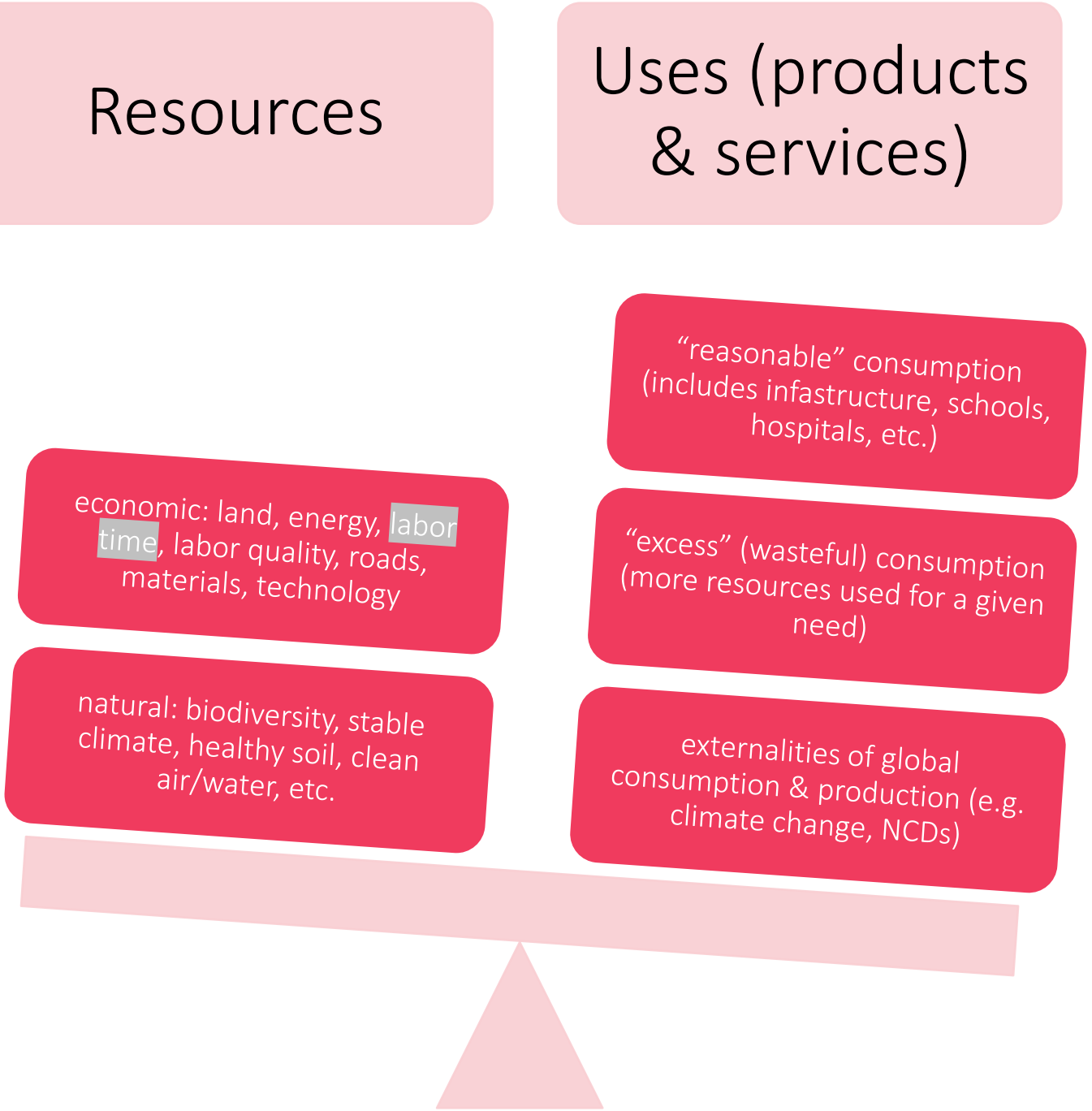
IUSSP debate “The population of humans that can be supported sustainably on the planet at reasonable standard of living is below 4 billion”. October 16, 2023.

Anastasia Pseiridis, Panteion University

BA Economics (U Athens), MPhil & PhD (U Cambridge)

Plant Based Nutrition Professional, T Colin Campbell Center for Nutrition Studies

The economic context: Resource scarcity



Resource scarcity exists

Current consumption patterns and production methods make it more severe

*the only non-scarce resource is uneducated labor

Resource scarcity limits attainable production

=> the planet cannot produce infinitely large quantities of goods and services every year. At least given current technology.

=> there is a limit to the population that can be supported at any non-zero level of well-being.

=> there is a limit to the volume of goods and services (=well-being) that can be enjoyed by each person.

Sustainability poses additional limits

- If, further, we want the economy to function at ecological equilibrium, then the maximum attainable production is even lower.
- How much lower?
  - *~ 40% lower. 40% of global **annual** production (GWP) corresponds to ecological deficit*
  - *Since 1971, accumulated deficit of 19 Earths*
  - *A debt to the future humans (intergenerational justice)*
- This is not our only debt.
  - *We have a debt to today's humans: ~85% of existing population lives with <60% of global average GDP (intragenerational justice)*

Lianos and Pseiridis (2021). "Adjusting GDP for Ecological Deficit: The Index of Debt to the Future (IDF)." *SN Business & Economics*.

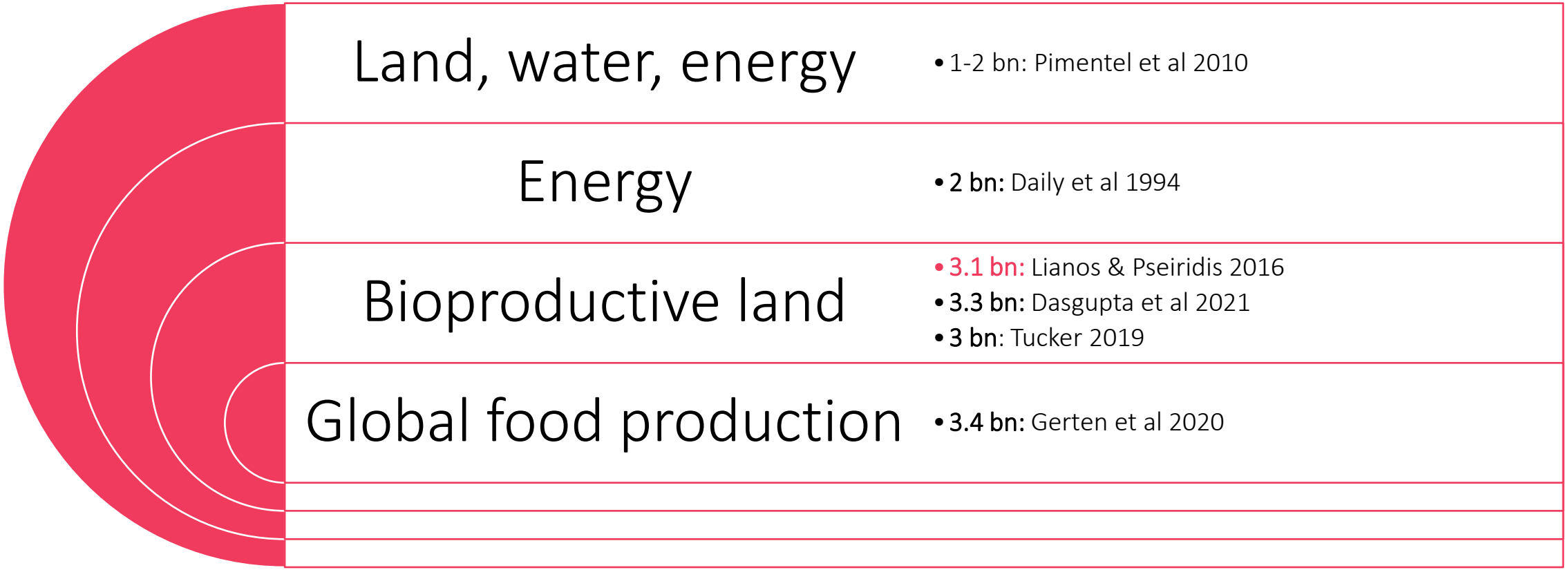
Estimation of optimum population

- We econometrically estimated the relationship between ecological impact and global production.
  - *data: 1961-2011 (50 years).*
- We assumed that "sustainability" means "ecological footprint EQUALS biocapacity"
  - *found the sustainable ("ecological impact-free") global production to be **~35 trillion** (US_{2010}$ PPP).*
- We assumed that a $11,000 (the 2011 global average) per capita production can provide a comfortable (dignified but not wasteful) life
  - *found a corresponding sustainable population size of **~3.1bn**.*
- Alternative combinations could be
  - *8 bn and $4,300 (60% less than global average in 2011)*
  - *9 bn and $3,800 (65% less than global average in 2011)*
  - *(But we should be reminded of the debt to humanity that was mentioned earlier: currently 85% of people are living below 60% of the global average)*

Lianos (2013). "The World Budget Constraint." *Environment, Development and Sustainability*.

Lianos & Pseiridis (2016). "Sustainable Welfare and Optimum Population Size." Environment, Development and Sustainability.

Optimum population <4B

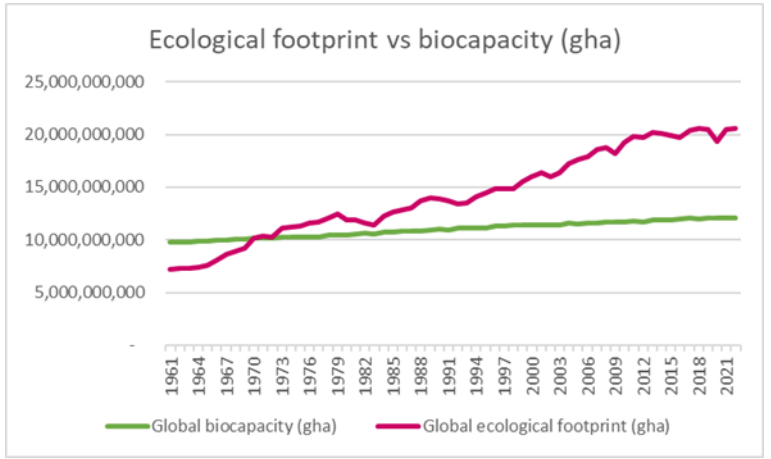


Even if we accept that these estimates contain a good dose of error, they all suggest that the current population size is too high (at least given current technology and consumption patterns).

Conclusion - Take home message

- Growth of global production since 1960 has not been "green"
  - *There is **relative** decoupling, but…*
  - ***Absolute** decoupling has not occurred*

Bithas and Kalimeris (2022). "Coupling versus Decoupling? Challenging Evidence over the link between economic growth and resource use." Sustainability.



- Resource scarcity & sustainability concerns limit the size of population that can live comfortably to less than 4 billion.
- So far, technology has not been enough to counteract demand on resources and the environment created by:
  - *increasing per capita incomes of an increasing portion of the population*
  - *increasing human numbers*
- Maybe AI will be the deus ex machina? Who knows… But will it be soon enough? It is safer to act based on the precautionary principle instead of being (over)optimistic.

With less than 4 billion we can avoid Derek Parfit's repugnant conclusion and have all a good life in the Aristotelian sense.

Thank you for being here

Slides used in discussion

Low income countries

16/26 are already in ecological deficit, none reversed it.

Up to 1960: 4

1961-1970: +4

1971-1980: +2

1981-1990: +2

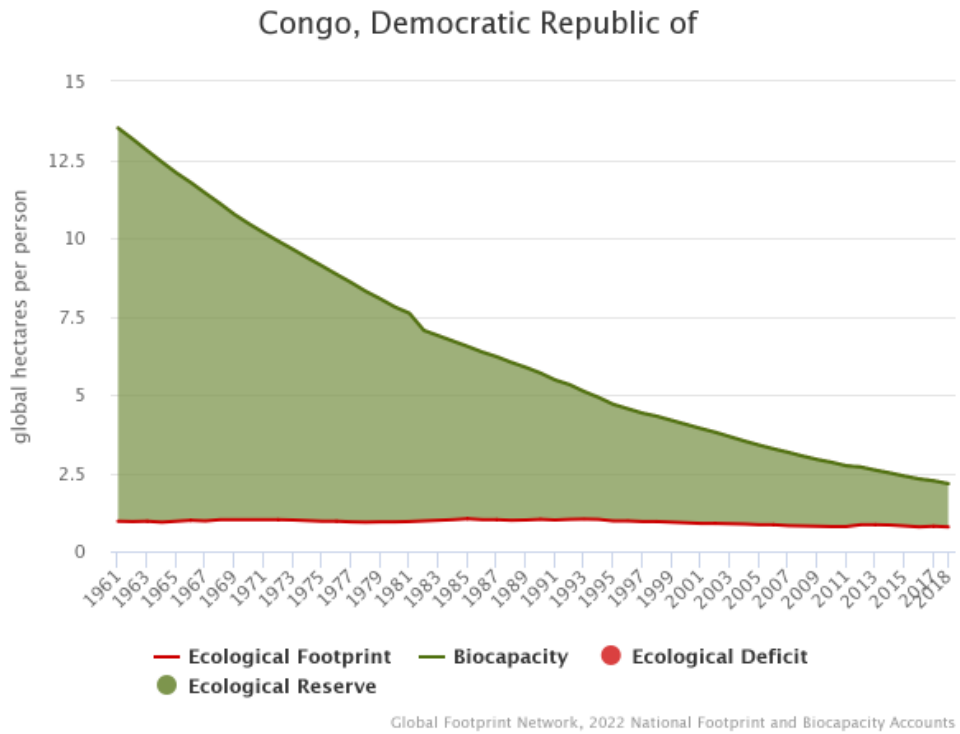
1991-2000: +2

2001-2010: +2

2011-2020: +1

10 will soon be in ecological deficit

It looks like this”



*The numbers above add up to 17 countries because they contain both Sudan (which went into deficit in 2010) and Sudan after the 2011 split of the country in two (“new” Sudan went in deficit in 2012 while South Sudan is still in ecological surplus).

*DR Congo – a case study

Per person biocapacity (biocapacity/population) steadily declining (–86% in 1961-2020).

Two reasons:

(1) reduction in country biocapacity

1961-2020: 182-214 mil gha = –32 (–15%)

(2) increase in population

1961-2020 = 93-16 mil = +77 (+480%) almost x6

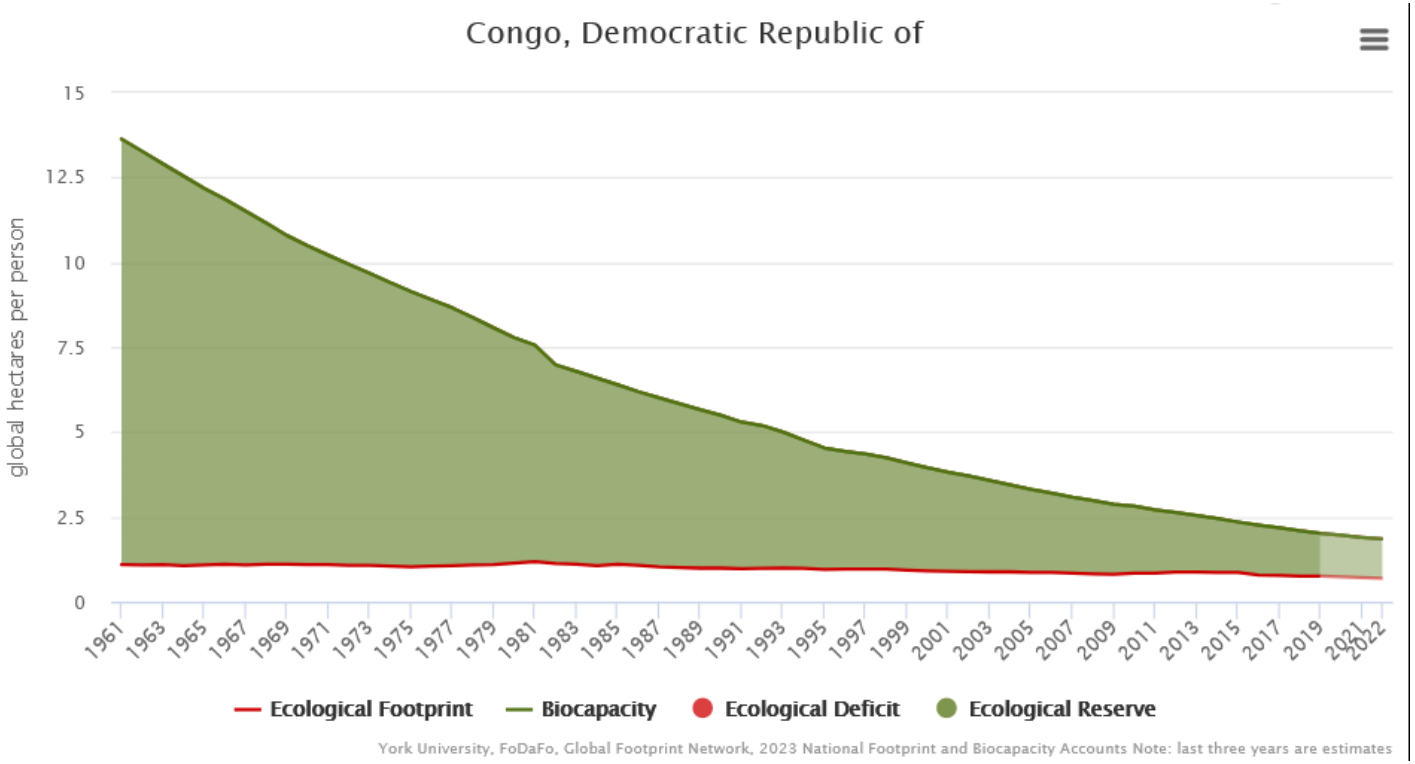
Also:

Country GDP (+165%) x2.5

Per capita GDP (–55%) x0.45

Population x5.8

Red line: Ecological Footprint of consumption (per person)
Green line: Biocapacity (per person)



Data: Global Footprint Network and FoDaFo by York University

Impact wise:
One person in the USA = 31 in Sierra Leone

2019		-11.01	-6.00	-4.06	-2.67	-0.87	-0.84	-0.36
	per person ecological deficit (gha)	Qatar	Belgium	United States of America	Greece	Sri Lanka	Ghana	Haiti
Nepal	–0.48	23	13	8	6	2	2	1
Kenya	–0.48	23	13	8	6	2	2	1
Bangladesh	–0.46	24	13	9	6	2	2	1
Romania	–0.39	28	15	10	7	2	2	1
Nigeria	–0.37	30	16	11	7	2	2	1
Haiti	–0.36	31	17	11	7	2	2	1
Niger	–0.29	38	21	14	9	3	3	1
Somalia	–0.19	58	32	21	14	5	4	2
Sierra Leone	–0.13	85	46	31	21	7	6	3

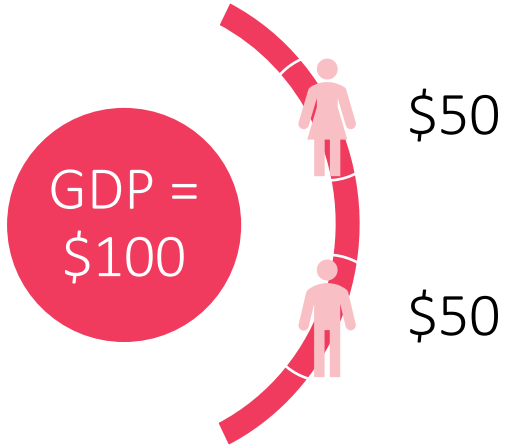
A minus sign signifies deficit (biocapacity – footprint <0)

Additional slides

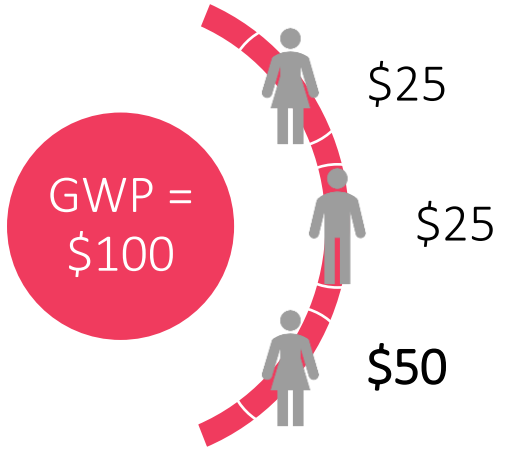
(not used during the debate)

Language used

- Gross World Product (GWP) = value (at market prices) of annual global production of goods and services
  - *Both goods and services need resources for their production*
  - *GWP = Sum of GDP (Gross Domestic Product) of all countries*
  - *Per capita GWP = GWP / population (e.g. $50 = $100/2)*



Our 3bn may be an overestimate



Three reasons:

- It is questionable that a good life is compatible with the per capita product we set as adequate (depends on consumption paradigm, values, infrastructure).
- The ecological footprint and biocapacity accounting underestimates the human impact on the planet.
  - *Non-CO_2 GHGs, biodiversity needed for non-human interests, etc.*
- The existence of economic inequality reduces the sustainable population size (figure 1).

  - *The above discussion is about the interests of humans (only). If we took into account the interests of non-humans and nature, maximum sustainable GWP would be smaller (figure 2).*

Is this progress?

Size of per capita GWP in 2020 compared to 1960-2020 (in constant prices).

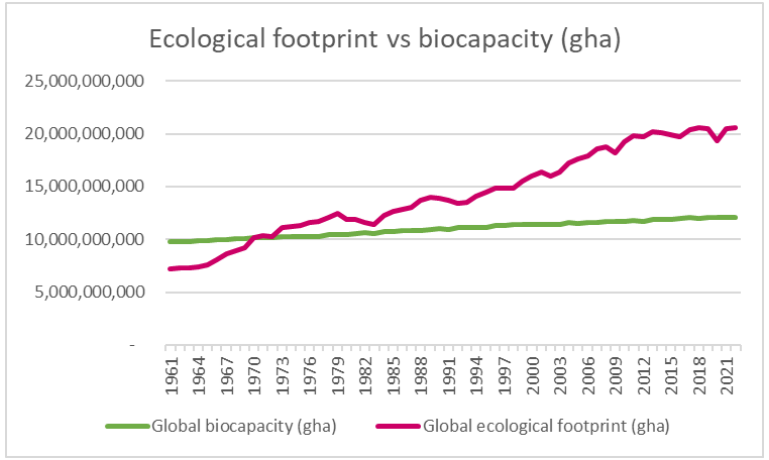
Cumulative ecological debt (1971-2022) is 19 Earths.

BUT: 85% of global population does not have a good life (lives with <60% of global average per capita GDP).

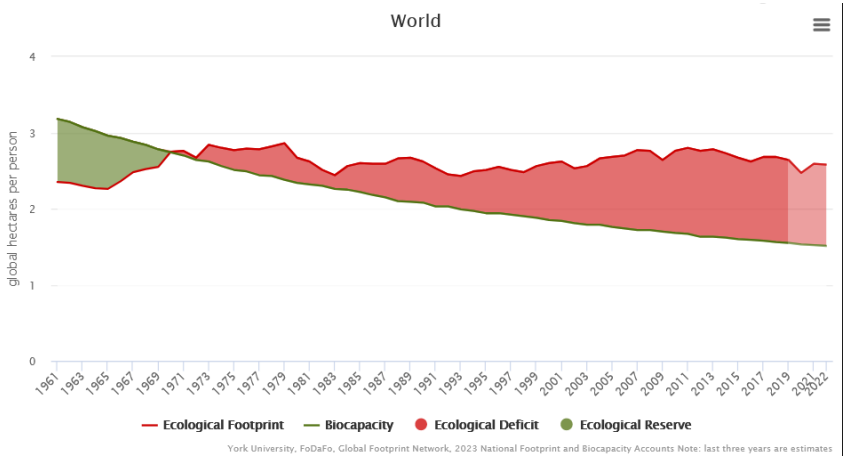
Deus ex machina still behind the scene

If technology was enough, then total ecological footprint would equal total biocapacity (graph 1); similarly for the per capita figures (graph 2).

- Technology has helped
  - *to increase global biocapacity by 15% and*
  - *to keep quite constant the per capita footprint (graph 2).*
- But it has not helped counteract the steep decline of global per capita biocapacity created by population increase. Maybe AI? If yes, when? And will it be soon enough?



Total (World)



Per person

Sustainable combinations

- There is a trade-off between sustainable population and per capita product.
  - *a 1% increase in population has to be coupled with a ~2% decrease in per capita product – otherwise the economy creates an ecological debt*
- Alternative combinations
  - *3.1 bn with a per capita product of $11,000 (global average GDP)*
  - *8 billion with a per capita product 60% less*
  - *9 billion with a per capita product 65% less*

Lianos (2013). "The World Budget Constraint." *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-013-9460-2.

Shots of poverty

Real life with per person income <900 USD_{2017} (in PPPs)
i.e. <60% of global average GDP of 2017

Credits: Dollar Street

Bed

$306/MONTH/PERSON, ETHIOPIA

2 ADULTS, 3 CHILDREN, 2 BEDROOM HOUSE

$654/MONTH/PERSON, BULGARIA

3 ADULTS, 3 KIDS, 2 BEDROOM HOUSE

Places where guests are served dinner

$117/MONTH/PERSON, CAMBODIA

1 ADULT, 2 KIDS, ONE ROOM

$417/MONTH/PERSON, CHINA

2 ADULTS, 4 KIDS, 2 BEDROOM HOUSE

Bathroom/toilet

$27/MONTH/PERSON, BURUNDI

1 ADULT, 4 KIDS, 2-BEDROOM HOUSE

$592/MONTH/PERSON, MYANMAR

5 ADULTS, 5 KIDS, 2-BEDROOM HOUSE

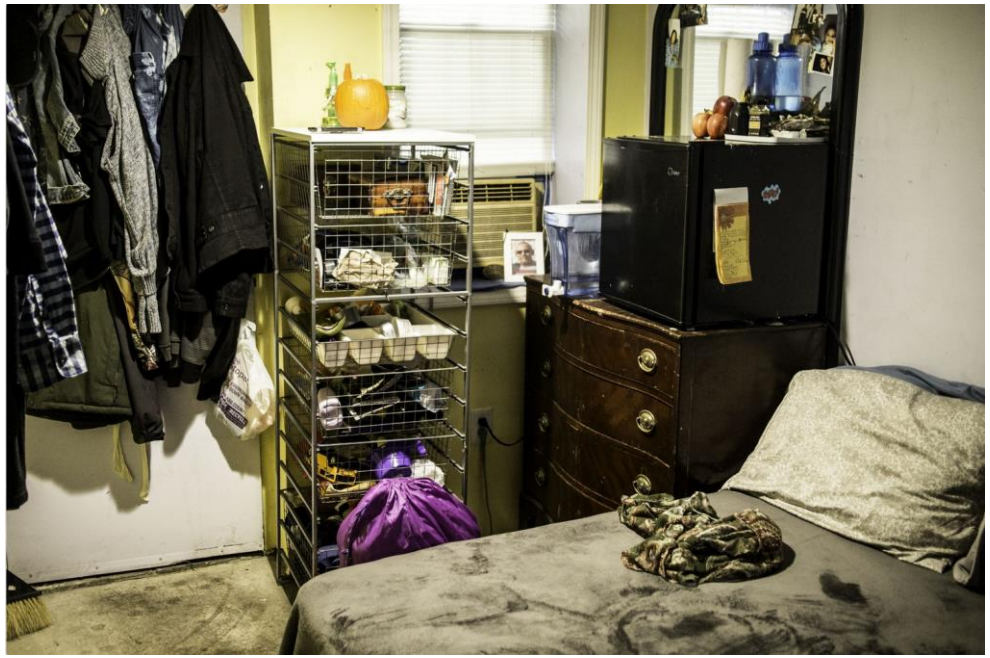
Living room

$195/MONTH/PERSON, CAMBODIA

1 ADULT, 3 CHILDREN, 1 ROOM HOUSE

$898/MONTH/PERSON, USA

1 ADULT, 2 CHILDREN, 1 BEDROOM APPT



Children’s room

$198/MONTH/PERSON, KENYA

3 ADULTS, 6 KIDS, 3-BEDROOM HOUSE

$210/MONTH/PERSON, TUNISIA

2 ADULTS, 4 KIDS, 2-BEDROOM HOUSE

Data sources

Data for our 2016 article (Lianos & Pseiridis, "Sustainable Welfare and Optimum Population Size."): Earth Policy Institute (2010); Global Footprint Network (2013).

Data for our 2021 article (Lianos & Pseiridis, "Adjusting GDP for Ecological Deficit: The Index of Debt to the Future (IDF).": Global Footprint Network (2019) National Footprint and Biocapacity Accounts Data Set (1961–2016).

Current data on Ecological Footprint accounts used for this presentation: Miller, E., Basturk, S., Dworatzek, P., & Nithianantha, A. 2023. National Ecological Footprint and Biocapacity Accounts, 2023 Edition. (Version 1.0). [Data set and metadata]. Produced for Footprint Data Foundation by York University Ecological Footprint Initiative in partnership with Global Footprint Network. https://footprint.info.yorku.ca/data/