



frdo
cfdd

*Sustainable mines in my backyard?
Analysis and debate on a controversial topic*

Critical Raw Materials

System Change Approach

JANEZ POTOČNIK

Brussels, 23rd October 2023

Main Challenges

The diagnosis of the problem

Let's start the story in my home country Slovenia

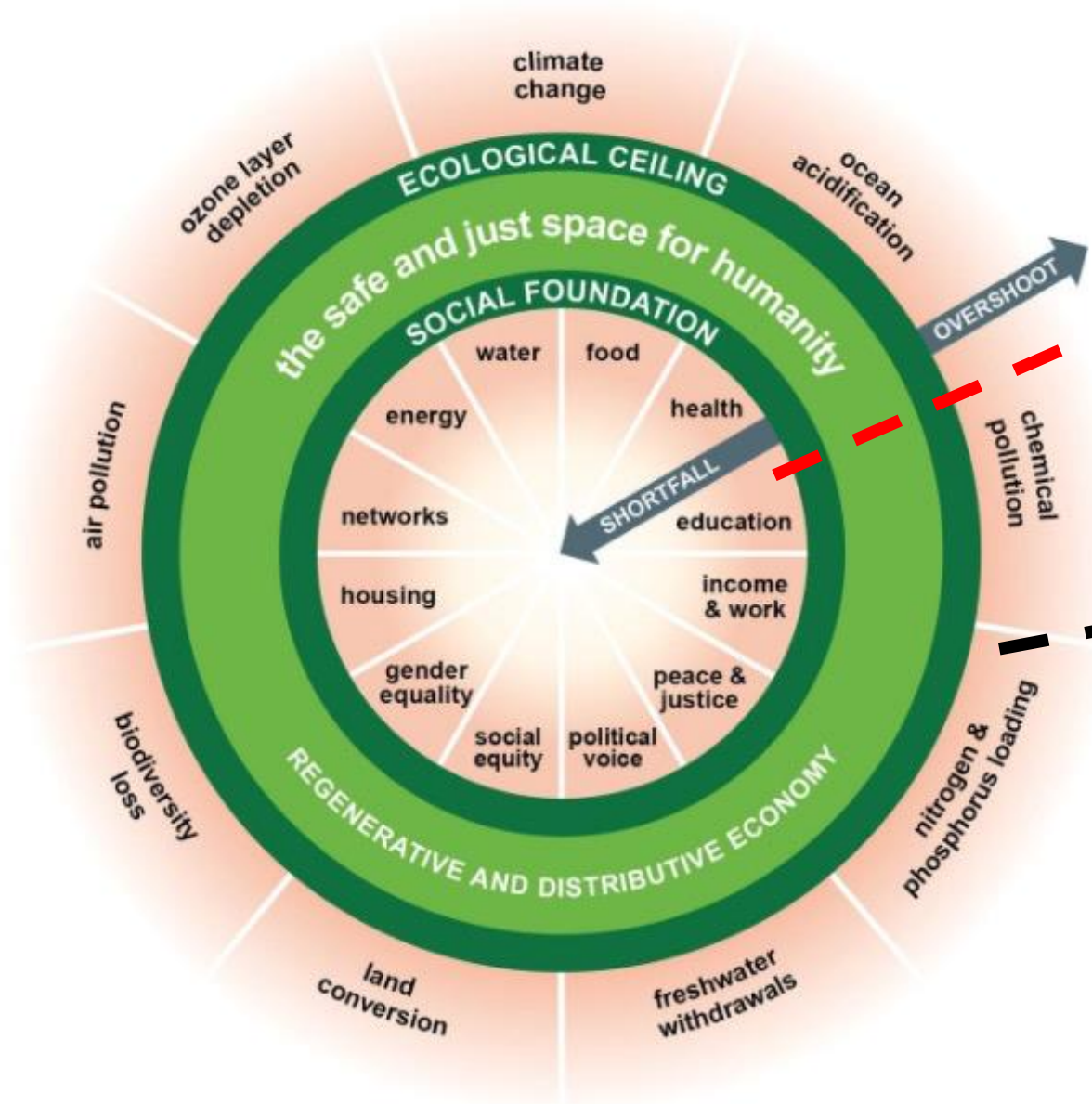
Slavoj Žižek



“It is clear that we are approaching the ecological and digital apocalypse ... but we should not loose nerves.”

*“Everything under heaven is in **utter chaos**; the situation is excellent.”*

A compass for human prosperity

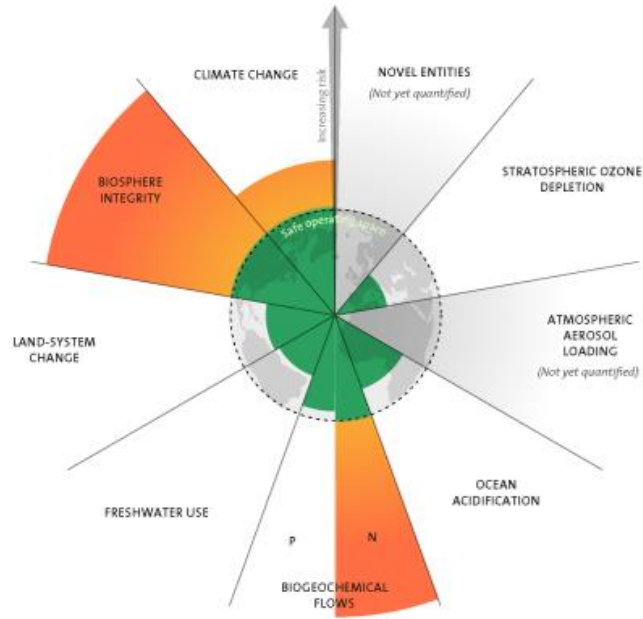


*Basis human needs
incl. minimum requirements
of resource supply*

*Outer limit by Planetary
Boundaries*

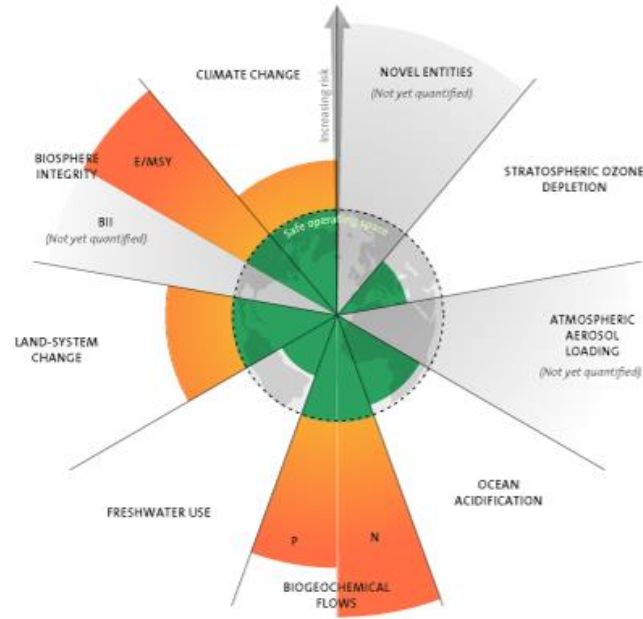
Adapted from Raworth 2017

2009



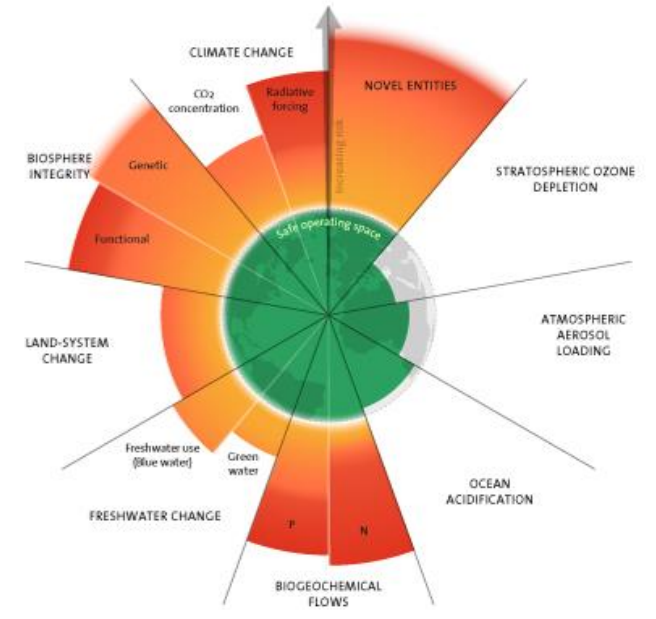
3 boundaries crossed

2015



4 boundaries crossed

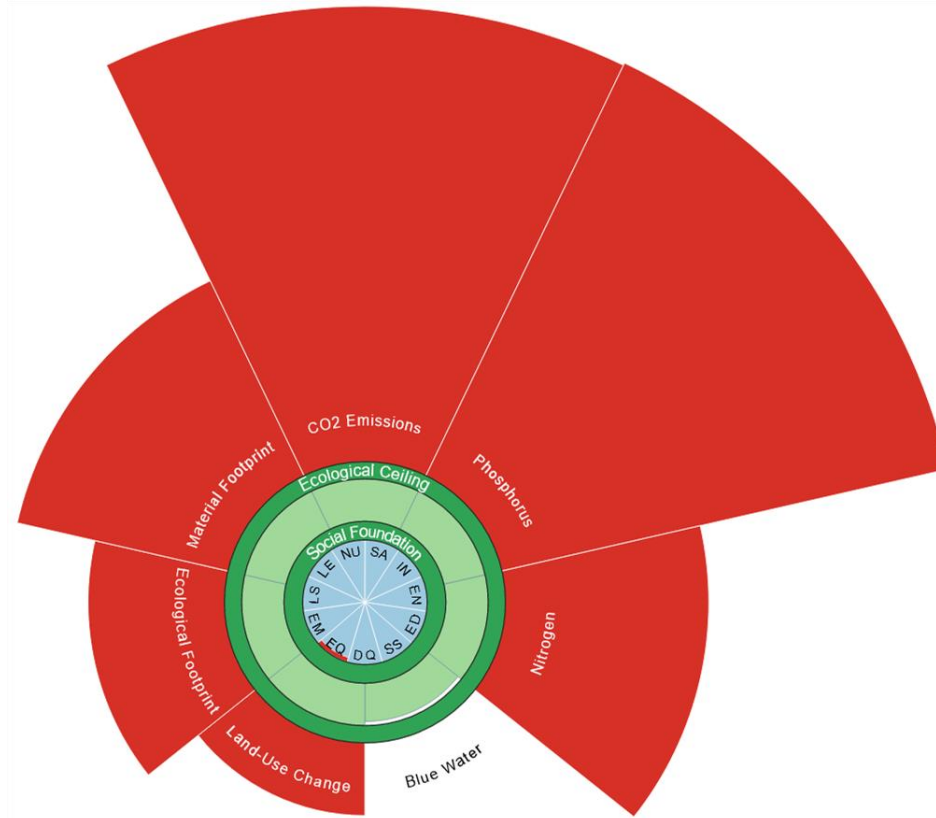
2023



6 boundaries crossed

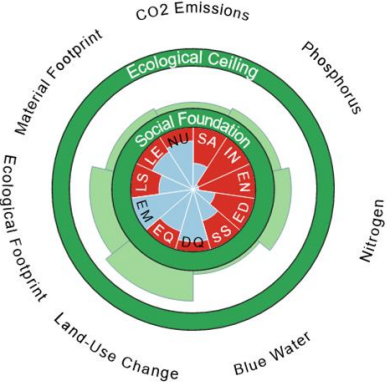
Source: Azote for Stockholm Resilience Centre, based on analysis in Richardson et al 2023

Divergent national contexts

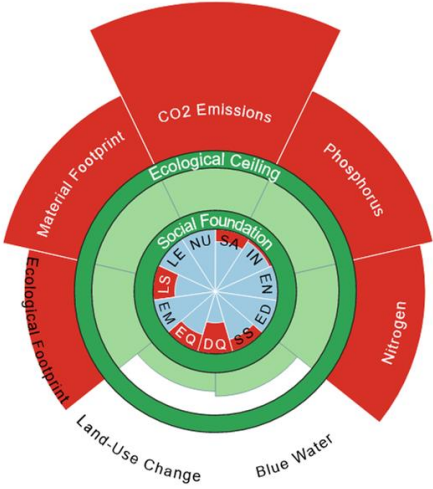


Divergent national contexts

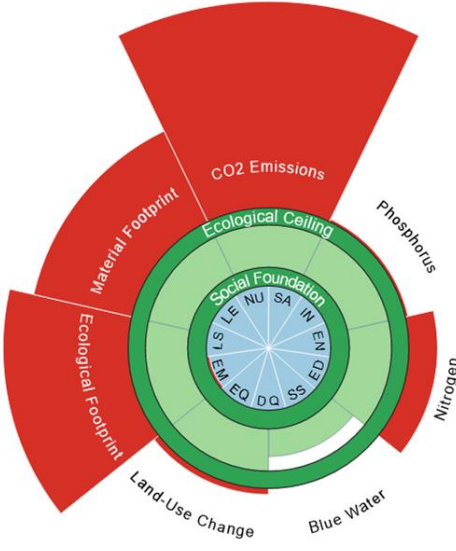
goodlife.leeds.ac.uk



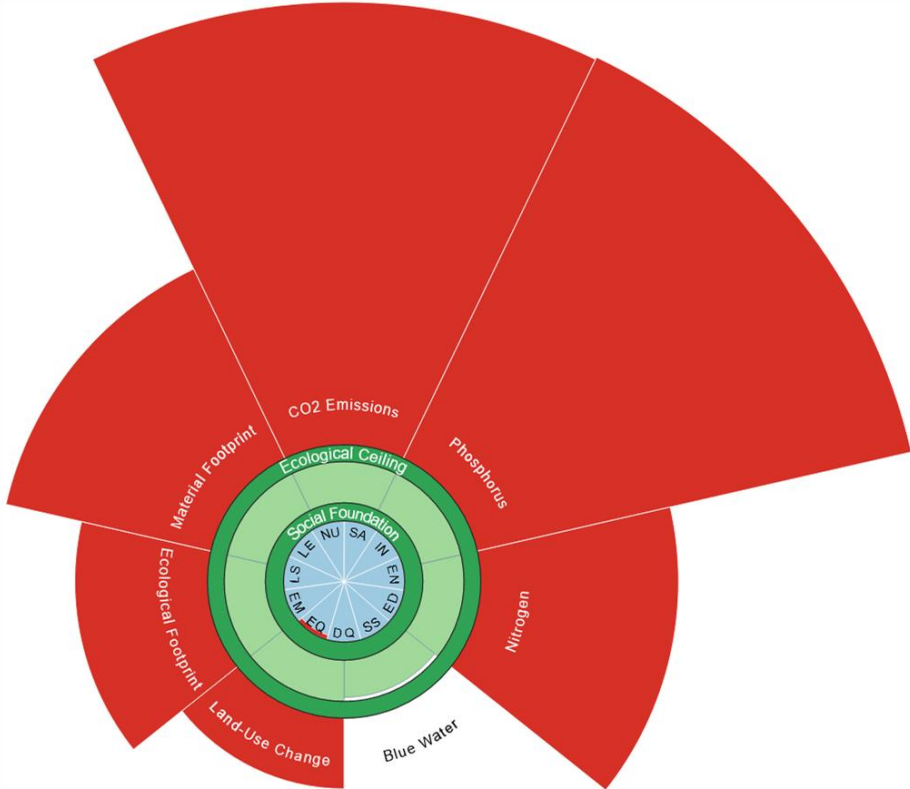
Malawi
\$1,000 pc



China
\$17,200 pc



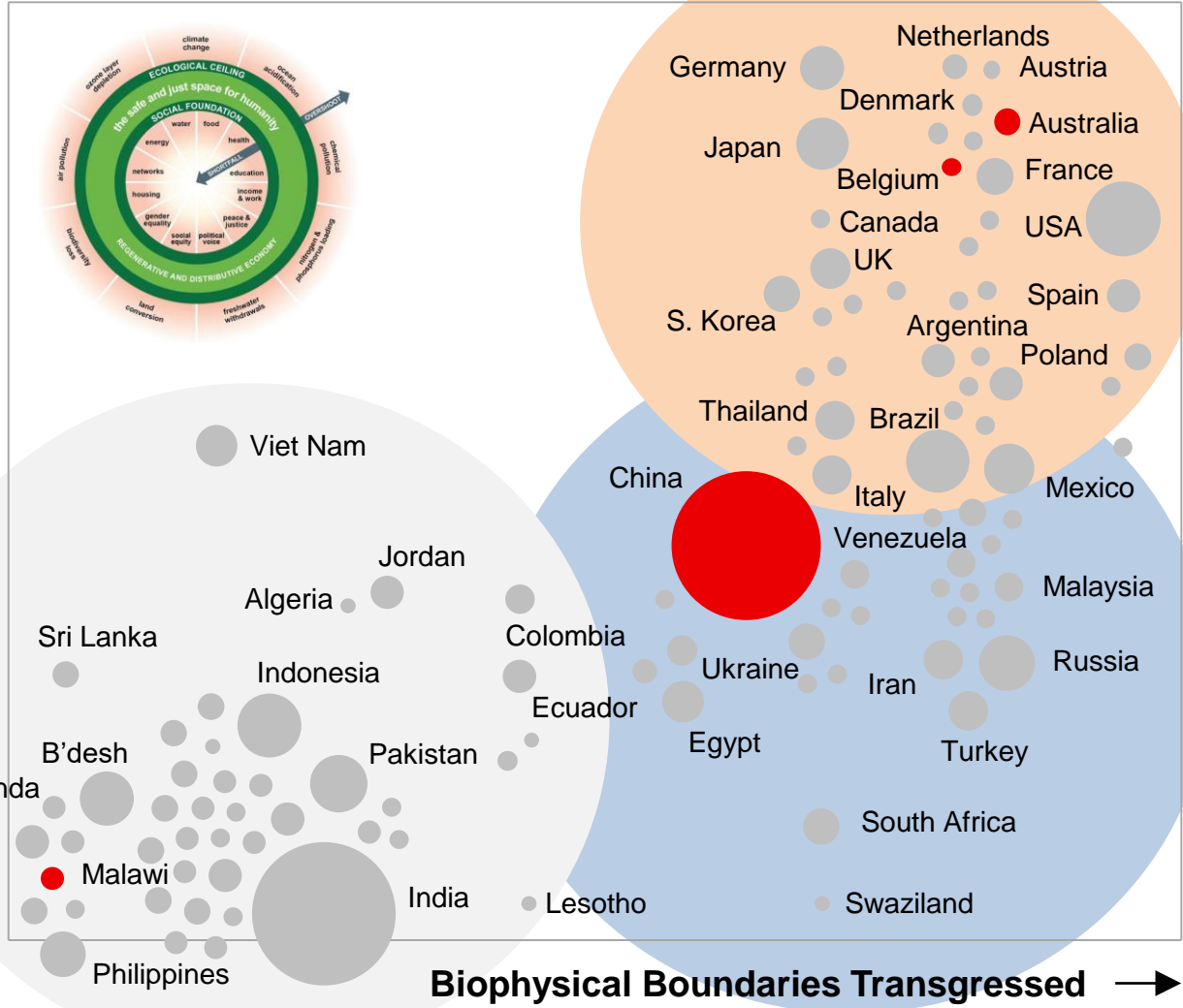
Belgium
\$54,000 pc



Australia
\$54,900 pc

Humanity's sweetspot

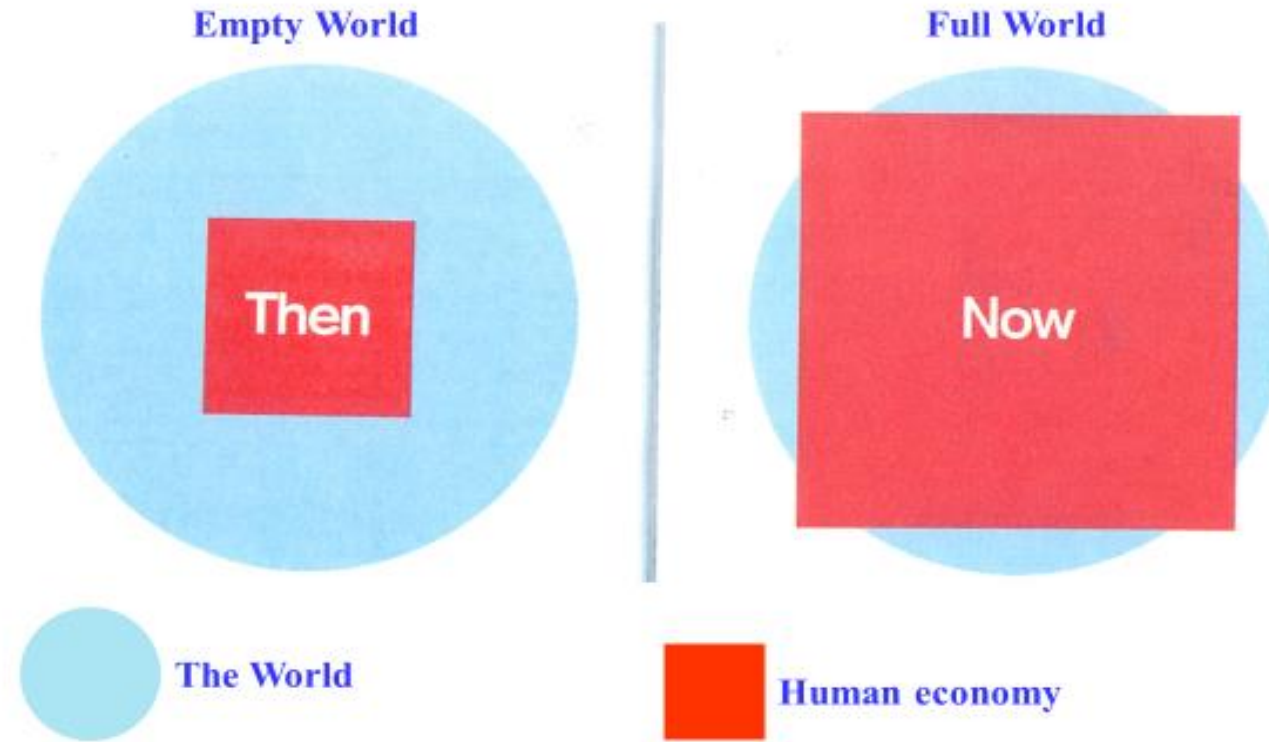
Social Thresholds Achieved →



- colonialism*
- military power*
- trade & finance rules*
- resource extraction*
- climate-change impacts*

Biophysical Boundaries Transgressed →

From “Empty” World to “Full” World



Source: Club of Rome: Simplified after Herman Daly

Labour and Infrastructure limiting factors of human wellbeing



Natural resources and Environmental sinks limiting factors of human wellbeing



*For the first time in a human history, we face the emergence of a single, tightly coupled human **social-ecological system of planetary scope.***

*We are more **interconnected** and **interdependent** than ever.*

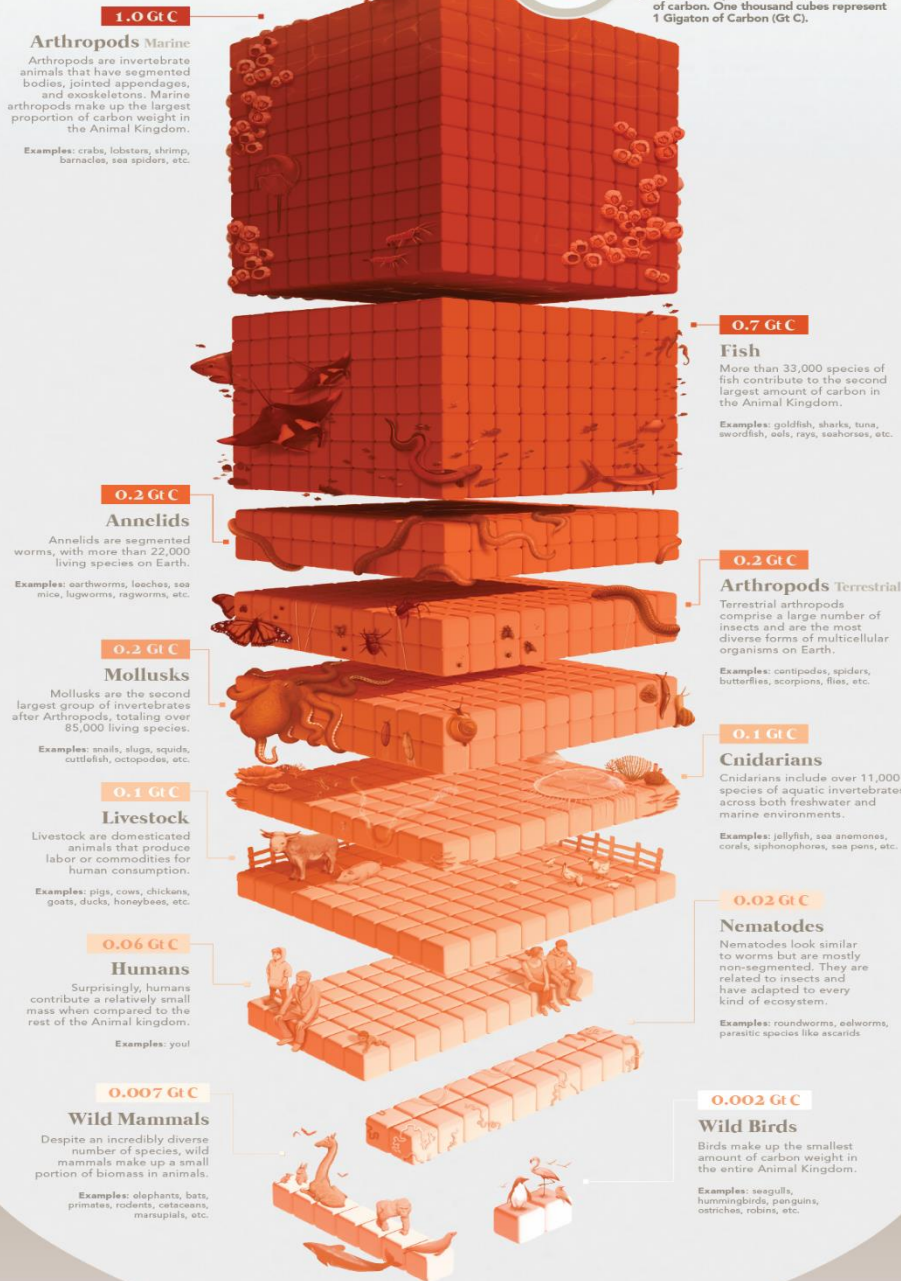
*Our individual and collective **responsibility** has enormously increased.*

Extraction and Processing of Resources
Drives triple Planetary Crisis
Material Use Trends and Impacts

The Biomass of Animals

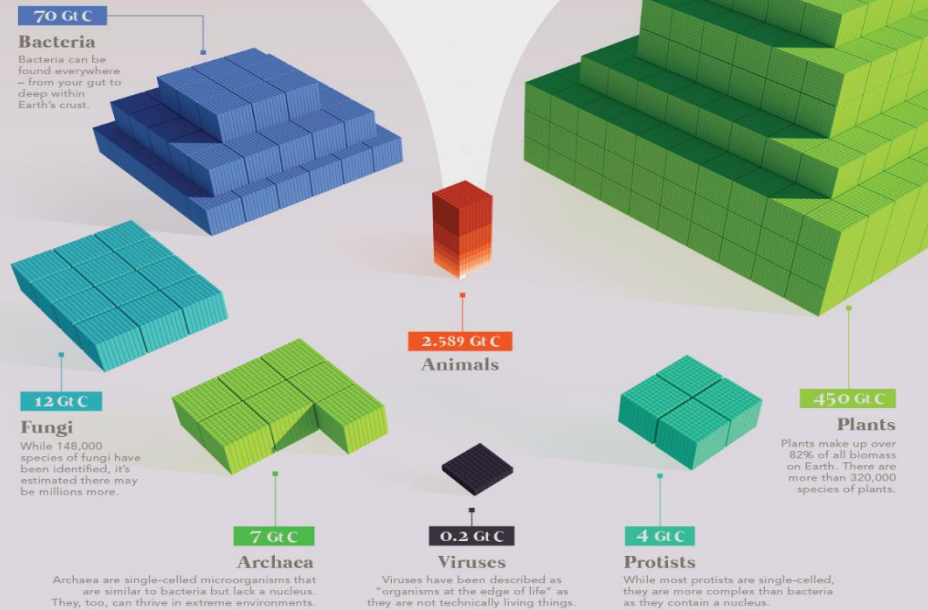
Biomass is measured by the amount of carbon an organism contains. Carbon is a primary component of all known life on Earth, used in complex biological molecules and compounds.

One cube represents 1 million metric tons of carbon. One thousand cubes represent 1 Gigaton of Carbon (Gt C).



*All other species, like reptiles and amphibians, contribute a negligible amount of carbon when compared to other animals.

Comparing All Biomass of Life on Earth



Humans make up approximately **0.01%** of all biomass on Earth.

SOURCE: Bai-Chi, Y.M., Phillips, R., Miles, R., 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115, 4506–4511. doi:10.1073/pnas.1711842115



COLLABORATORS RESEARCH + WRITING Anupa Inan Ghosh | DESIGN Mark Belan | ART DIRECTION Mark Belan

f /visualcapitalist t @visualcap v visualcapitalist.com

Biomass of Life Humans in Perspective

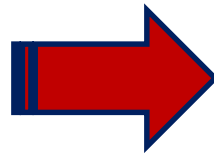
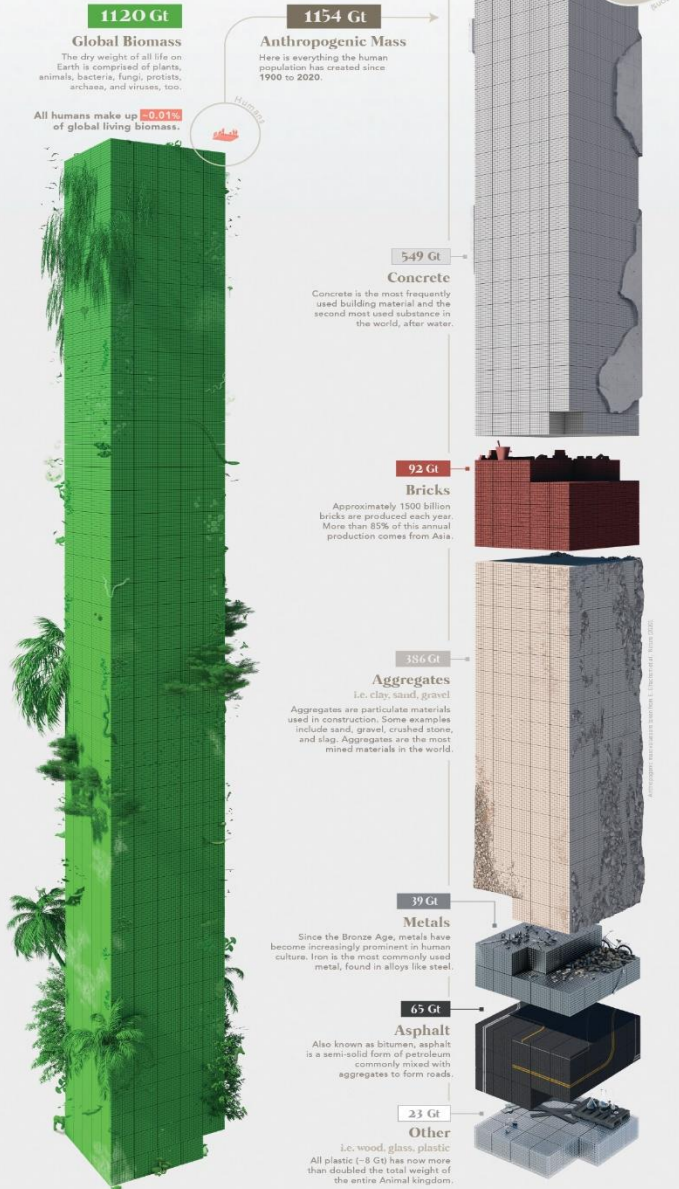
Source: Visualcapitalist.com

Visualizing the Scale of Anthropogenic Mass

Anthropogenic mass, or human-made mass, refers to the materials embedded within inanimate solid objects that are made by humans.

In 2020, the amount of anthropogenic mass exceeded the weight of all global living biomass.

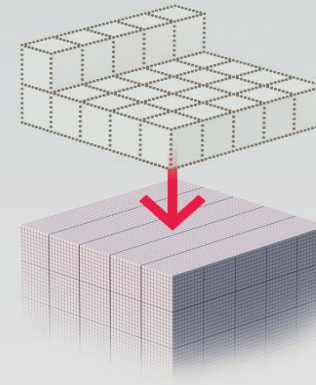
As humans continue to dominate Earth, questions surrounding our material output are increasing. We break down the composition of all human-made materials and the rate of their production.



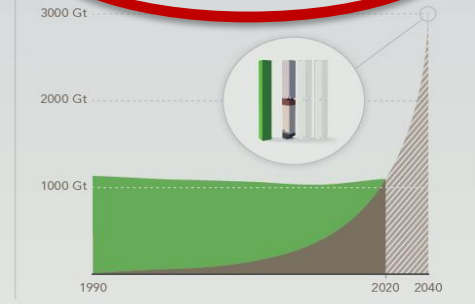
The Accumulation of Anthropogenic Mass

The current rate of accumulation for human-made mass is approximately **30 Gt of mass per year**.

This is equal to each person on Earth producing their own weight in human-made mass every week.



As accumulation rates increase, the amount of human-made mass is predicted to almost **triple the total amount of global living biomass by 2040**.



These trends highlight the alarming speed and volume in which human contributions are impacting the world.

SOURCE Elhacham, E., Ben-Ur, L., Grozovski, J., Bar-On, Y.M., Milo, R., 2020. Global human-made mass exceeds all living biomass. Nature 588, 442–444. doi:10.1038/s41586-020-3010-5

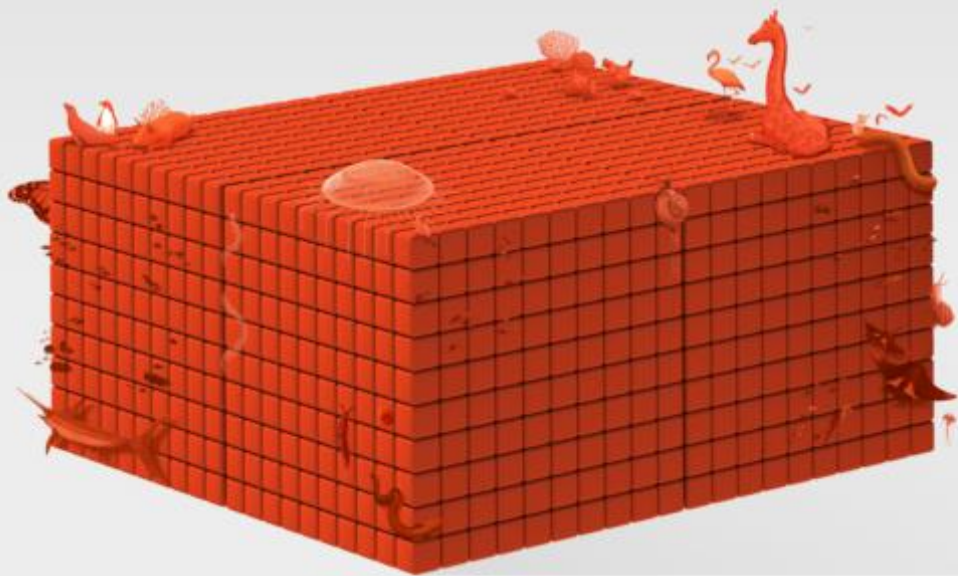


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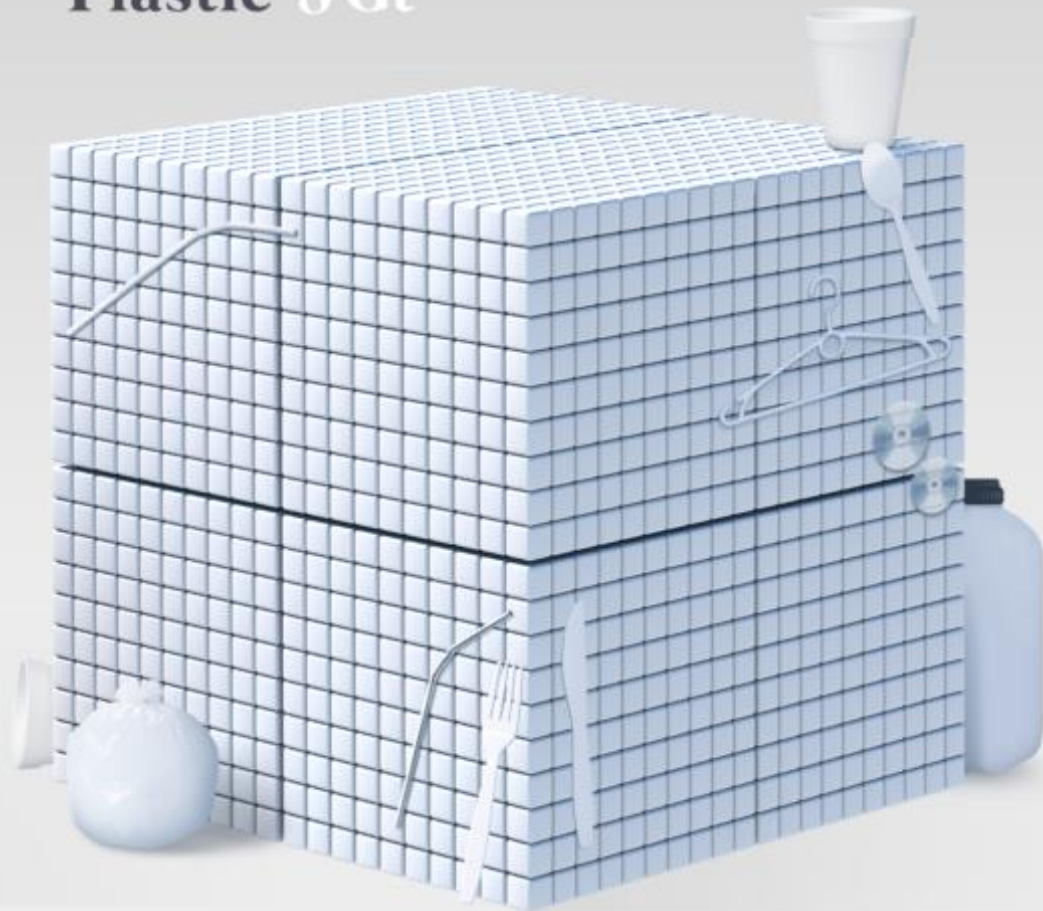
Facebook icon /visualcapitalist Twitter icon @visualcap Instagram icon visualcapitalist.com

Source: Visualcapitalist.com

Animal Kingdom 4 Gt



Plastic 8 Gt



Natural Resources:

Provide the foundation for the goods, services and infrastructure that make up our current socio-economic systems



Biomass (wood, crops, including food, fuel, feedstock and plant-based materials)



Fossil fuels (coal, gas and oil)



Metals (such as iron, aluminum and cooper...)

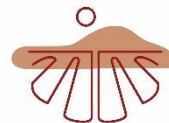


Non-metallic minerals (including sand, gravel and limestone)

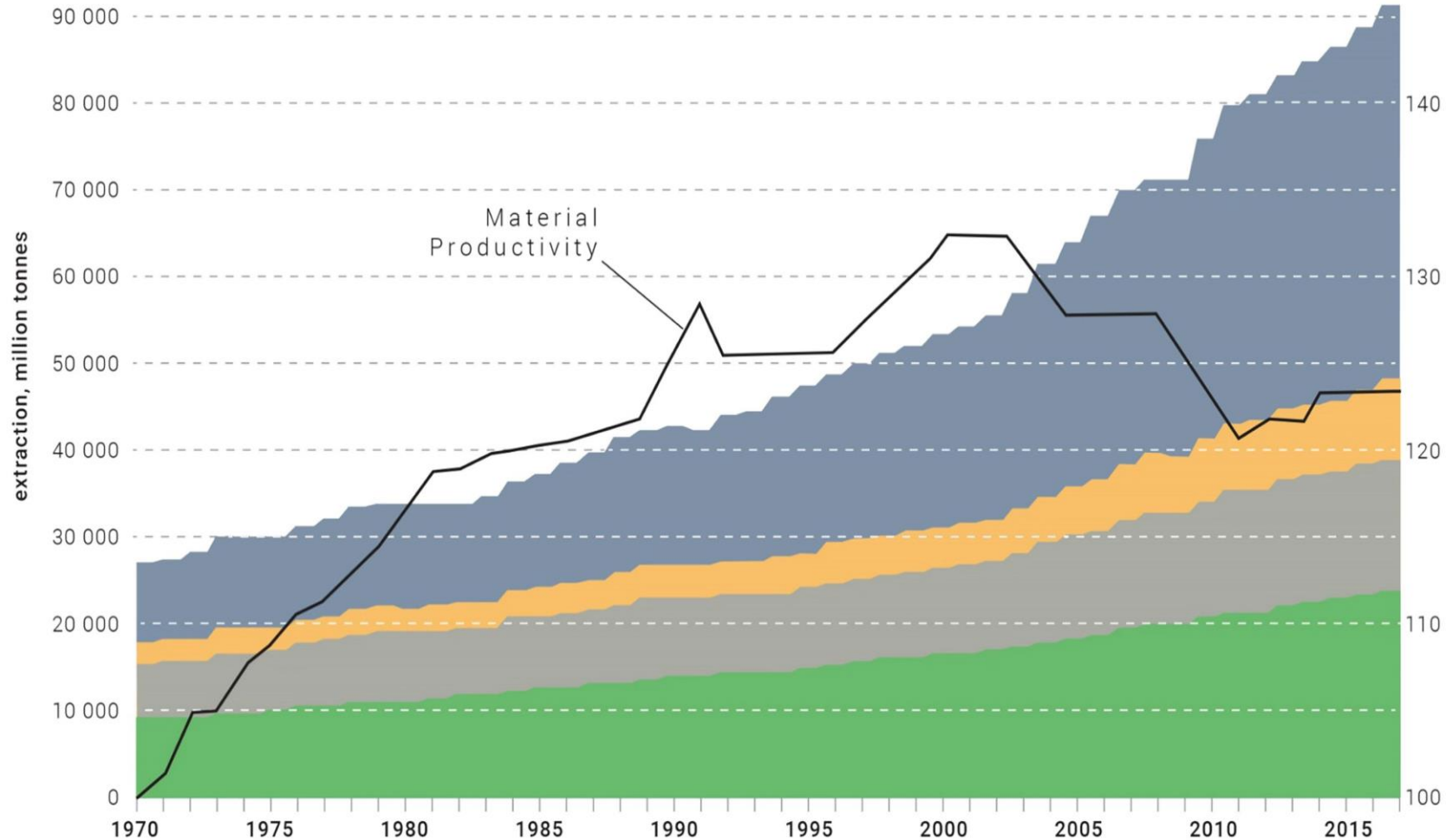
Materials
Extracted from
earth



Water and Land







Global Material Use, Demand per capita and Material Productivity in the years 1970-2017



Global material use has more than tripled since 1970

Global material demand per capita grew from 7.4 tons in 1970 to 12.2 tons per capita in 2017

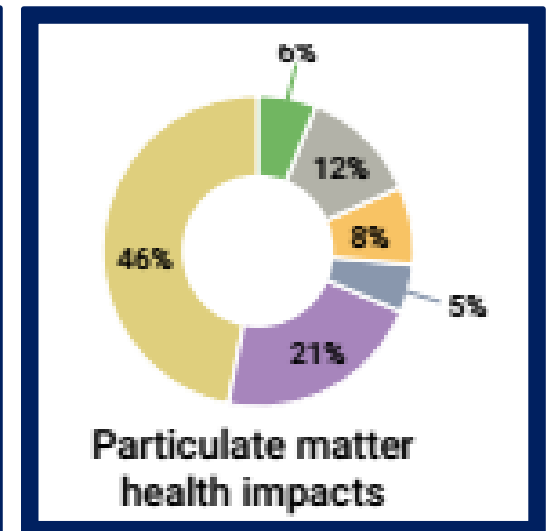
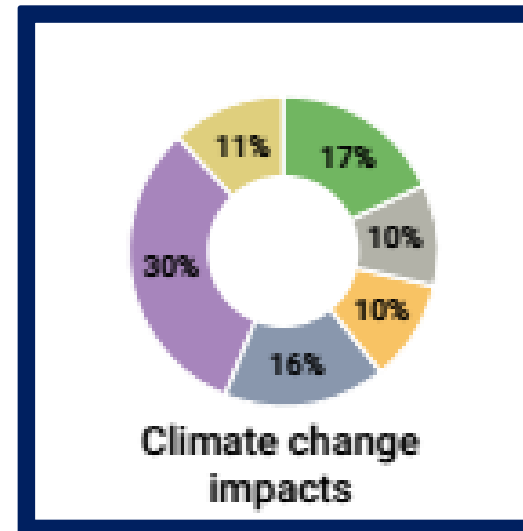
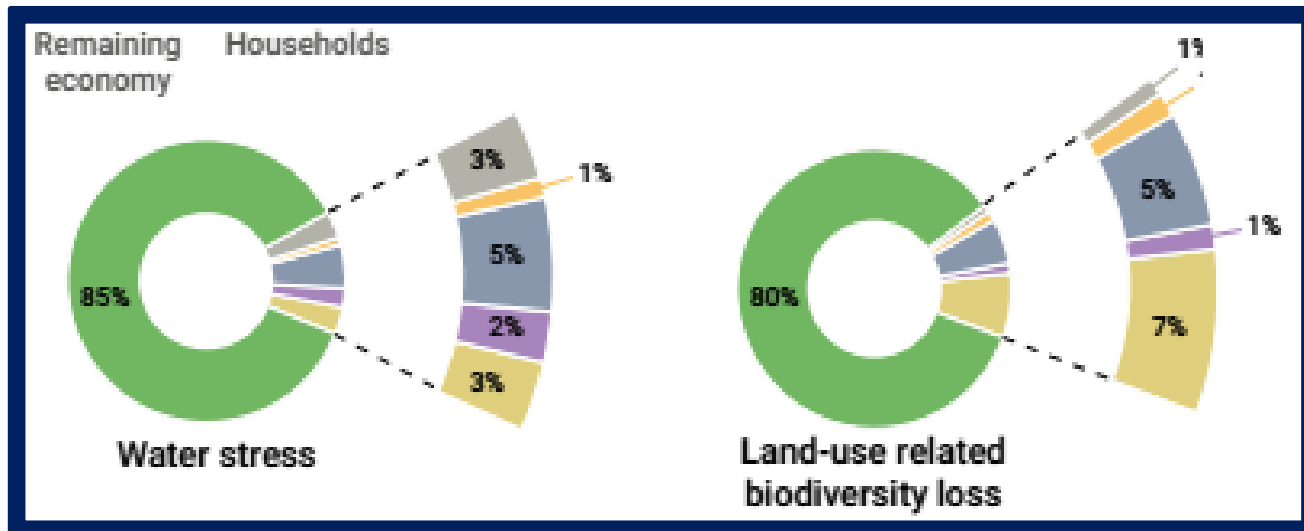
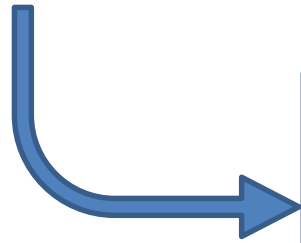
Material productivity started to decline around 2000 and has stagnated in the recent years

-  Non-metallic minerals
-  Metals
-  Fossil fuels
-  Biomass

Extraction and Processing of Natural Resources Drives all Aspects of the Triple Planetary Crisis

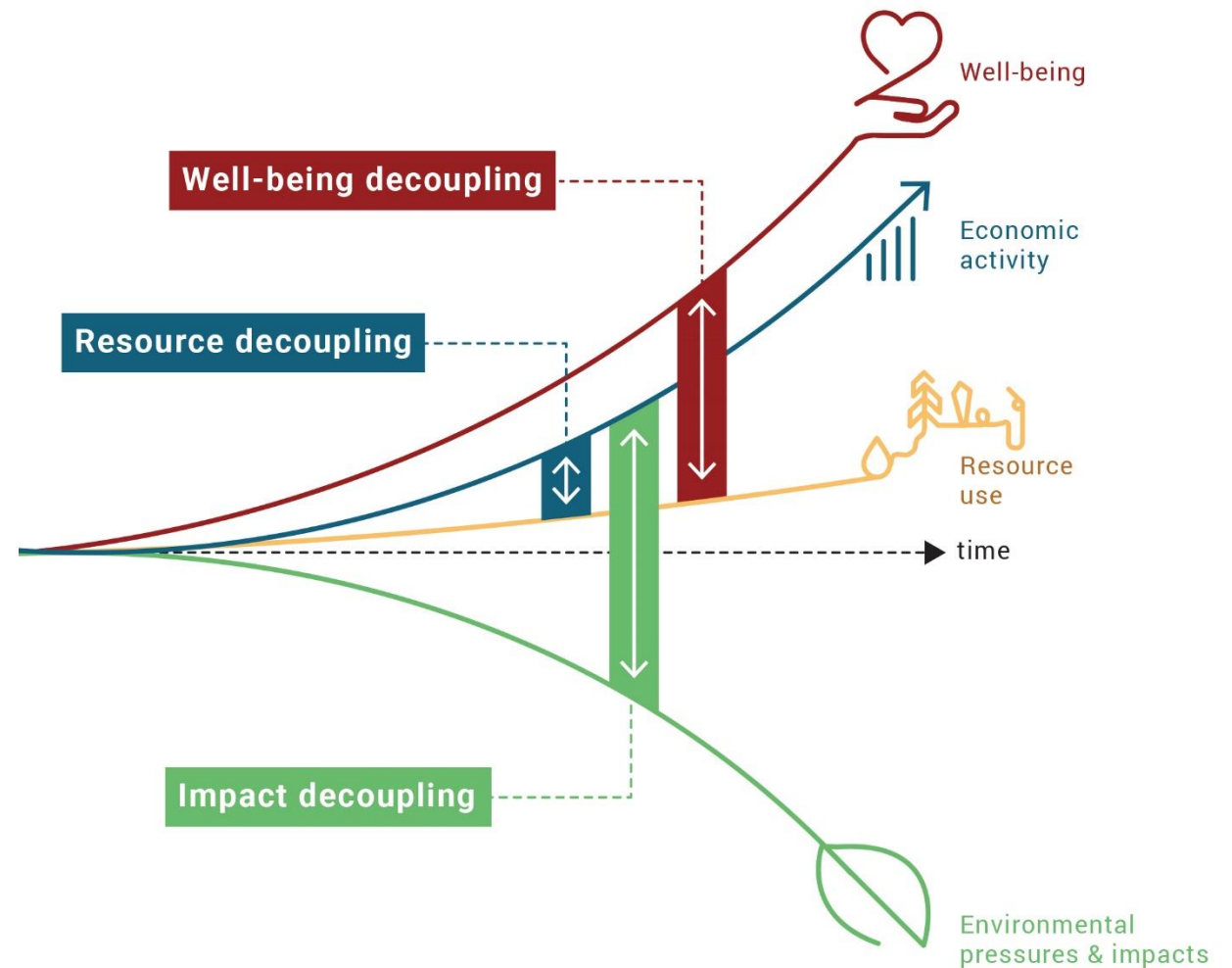
Environmental impacts of materials in the value chain in extraction and processing phase

90% of global land related biodiversity loss and water stress
50% of global climate change impacts
1/3 of air pollution health impacts



If current trends would continue, global material consumption is predicted to double by 2060

Decoupling



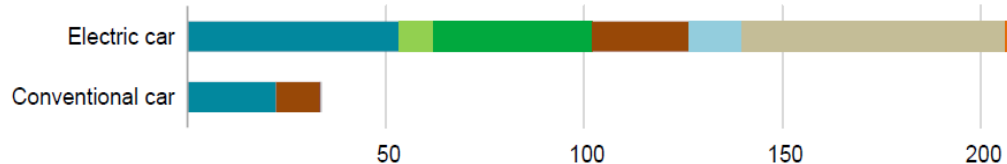
Critical Raw Materials
High-Income Countries Perspective

Transition to net zero GHG target is materials demanding on the supply (energy production), and on demand (energy use) side

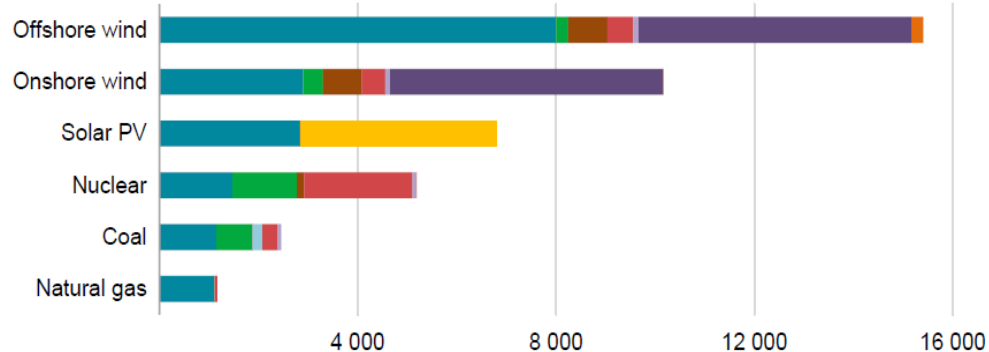


Minerals used in selected clean energy technologies

Transport (kg/vehicle)



Power generation (kg/MW)



- Copper
- Lithium
- Nickel
- Manganese
- Cobalt
- Graphite
- Chromium
- Molybdenum
- Zinc
- Rare earths
- Silicon
- Others

IEA. All rights reserved.

Electric vehicles use close to ten times the material of conventional cars – using at least eight different critical material types, compared to just three for conventional cars.

Reaching net zero by 2050 will require about six times today's critical mineral use in 2040. And even meeting today's under-ambitious national climate plans would require more than doubling of critical minerals we are using today.

Notes: kg = kilogramme; MW = megawatt. Steel and aluminium not included. See Chapter 1 and Annex for details on the assumptions and methodologies.

Average time required for opening of new mine is 15 to 17 years

How High-Income Countries are Approaching Increased Material Needs

The EU CRM Act

“...streamline Strategic Projects in mining, extraction, and recycling. [...]. Member States are responsible for circularity efforts and promoting material efficiency

US strategy on CRM

“...prioritizes a Made in America Supply Chain, with investments in domestic production for critical minerals and materials.”

G7 Strategy

The G7 ministers prioritize strengthening critical minerals supply chains for a net-zero economy with high ESG standards and human rights. “... aiming for efficient international recovery, capacity building, and research for sustainable alternatives.”

*There are multilateral and national strategies on managing the supply chain risks of CRM but **too little focus on environmental impacts and missed opportunities to reduce demand through systemic circular economy strategies. In short: CRM related solutions would need to deliver the energy transition and zero net GHG 2050 should be aligned also with EDG decoupling target.***

Source: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661

<https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/22/fact-sheet-securing-a-made-in-america-supply-chain-for-critical-minerals/>

<http://www.g8.utoronto.ca/environment/2023-communique.html>

Illustration: not exhaustive of all CRM strategies

Current solutions to mitigate CRM Risks



2

Use all CRM circularity options

EV and Energy Storage: More intensive use; substitution; lightweighting; recycling

Electricity Networks: More intensive use; recycling

Electricity Production (Solar PVs): Substitution; restoration; recycling

Electricity Production (Wind): More intensive use; lifetime extension; lean design



3

Provide the necessary CRMs with highest environmental and social standards

Securing enough supply: ensuring supply is sufficient to power the energy transition

Aligning expanded supply with sustainable development

Improving supply resilience by improving TM geographic diversification

Main question often-overlooked to be addressed

How to meet human needs in most energy and resource efficient way and optimize the provisioning systems through system change?



<https://edistaffing.com>

From Product Maximisation to Providing Human Needs

It is not not about owing it is about using

We do not need cars

...

We need mobility

We do not need light bulbs

...

We need light

We do not need chairs

...

We need to sit

We do not need refrigerators

...

We need chilled and healthy food

We do not need CDs

...

We want to listen to the music

We do not need pesticides

...

We want healthy plants



The first dimension of Circular Economy is often not on policy radar

Resource Efficiency ↑

Dimensions	
1 BETTER: Minimise product need through better system design	Refuse and Rethink strategies
2 LEANER: Optimise product design	Reduce strategies in manufacture and use
3 LONGER: Maximise lifespan of products and its parts	Reuse, Repair, Refurbish, Remanufacture, Repurpose and Recycle strategies
4 CLEANER: Minimise waste and pollution	Recovery strategies

Often overlooked, but crucial for effectiveness



An effective solution to mitigate CRM Risks has 3 indispensable pillars



1

Optimize delivery of human needs in energy and material intensive systems

Most energy and material intensive systems (GRO24)

Mobility: reduced need for travel through work from home, balanced urban design; communal and active transport

Buildings: better utilisation of buildings; space-efficient, balanced neighbourhoods

2

Use all CRM circularity options

EV and Energy Storage: More intensive use; substitution; lightweighting; recycling

Electricity Networks: More intensive use; recycling

Electricity Production (Solar PVs): Substitution; restoration; recycling

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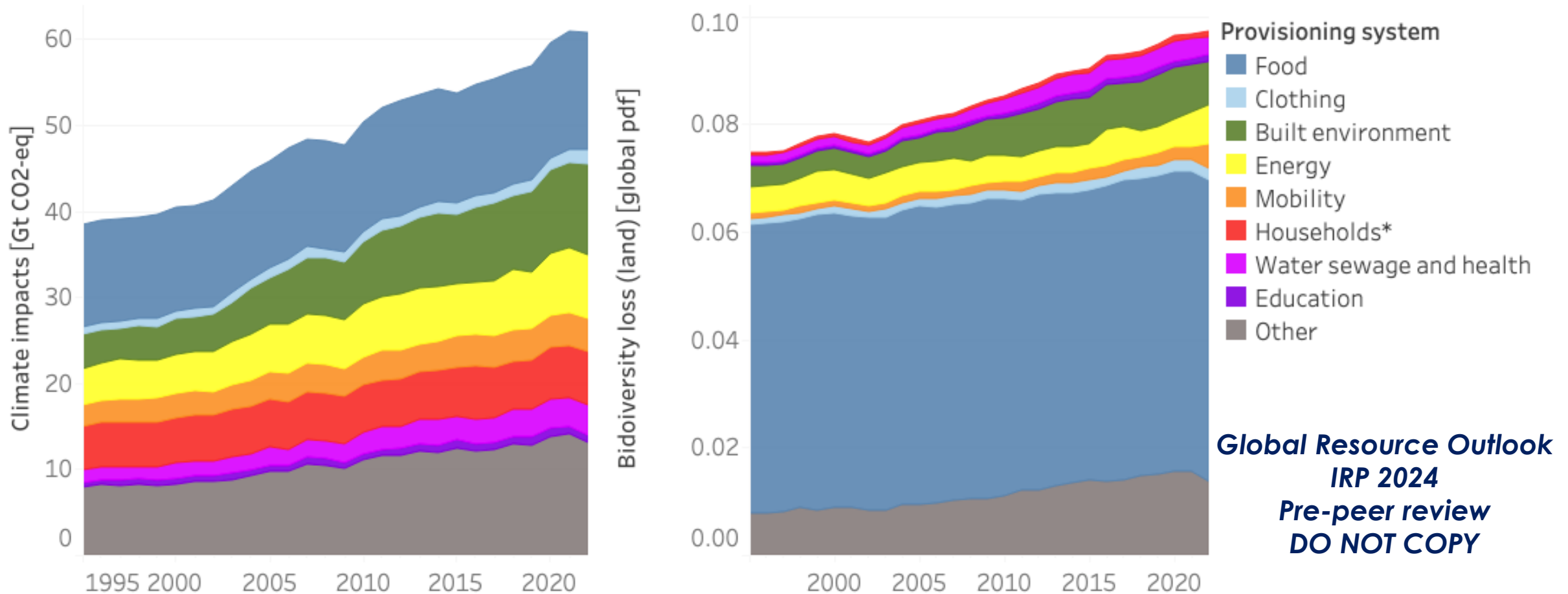
Improving supply resilience by improving TM geographic diversification

New in GRO 24

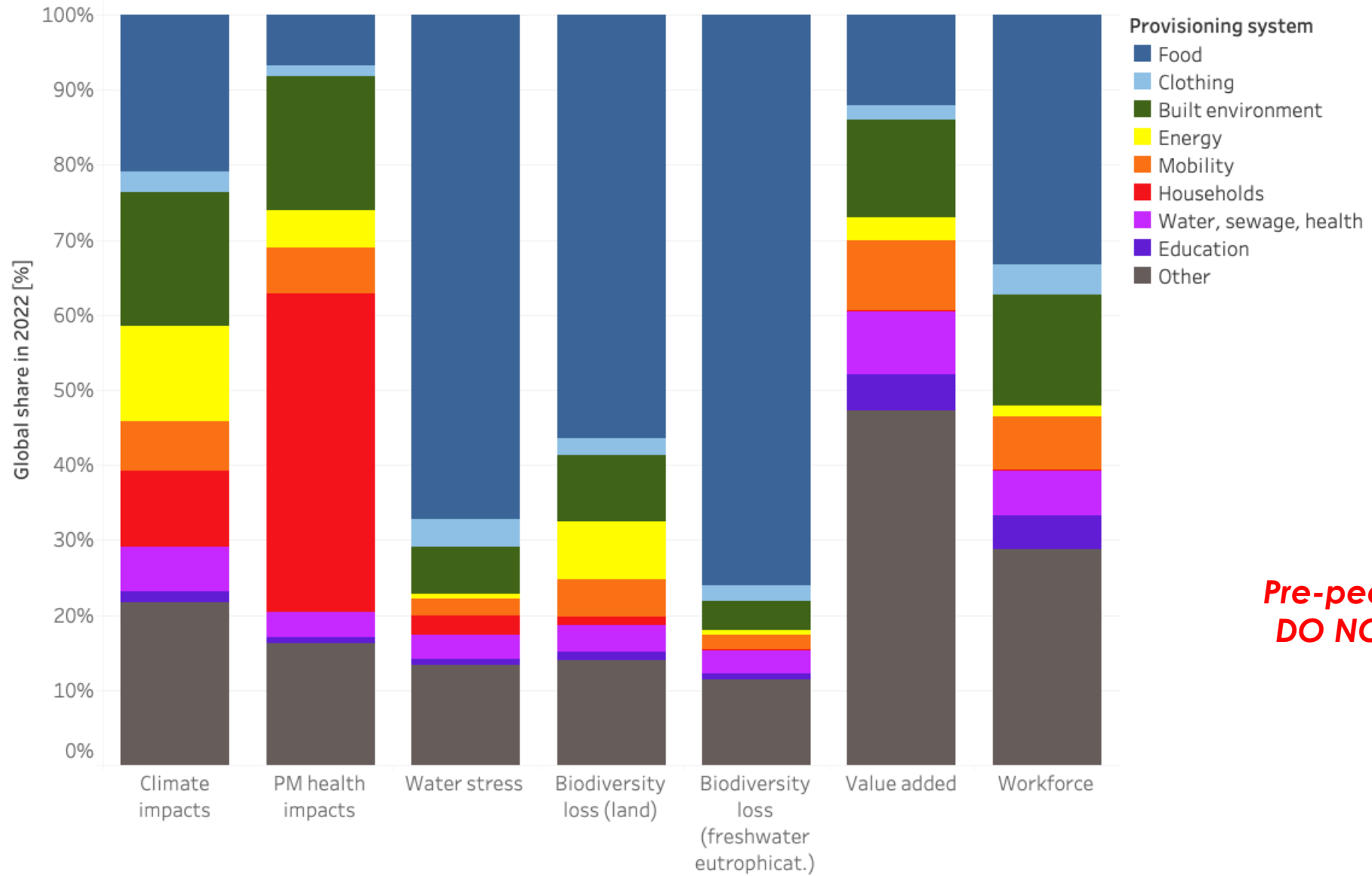
Provisioning Systems Approach

From Car and Road Transport to Mobility

Five provisioning systems with most environmental impacts we should be focusing on are
Food and nutrition, Mobility, the Built Environment, Water and Sanitation, and Energy



Impacts by Provisioning Systems 2022



**Pre-peer review
DO NOT COPY**

Mobility related example: Economic sector approach leading to a resource intensive economy and production model

A 'Glasgow Breakthrough' was announced on *road transport* aiming for zero emission vehicles to be the new normal, accessible, affordable, and sustainable in all regions by 2030.



**UN CLIMATE
CHANGE
CONFERENCE
UK 2021**

IN PARTNERSHIP WITH ITALY

System change in road transport means less and more efficient traffic, for more value, and less environmental/health impacts



Five Levers for Sustainable Car-Based Transport

Reduce demand for car-based transport



- *Reduce overall mobility need* (e.g., through remote work)
- *Modal shift* from cars to foot, bike, & public transport
- *Higher utilization of vehicles* through sharing

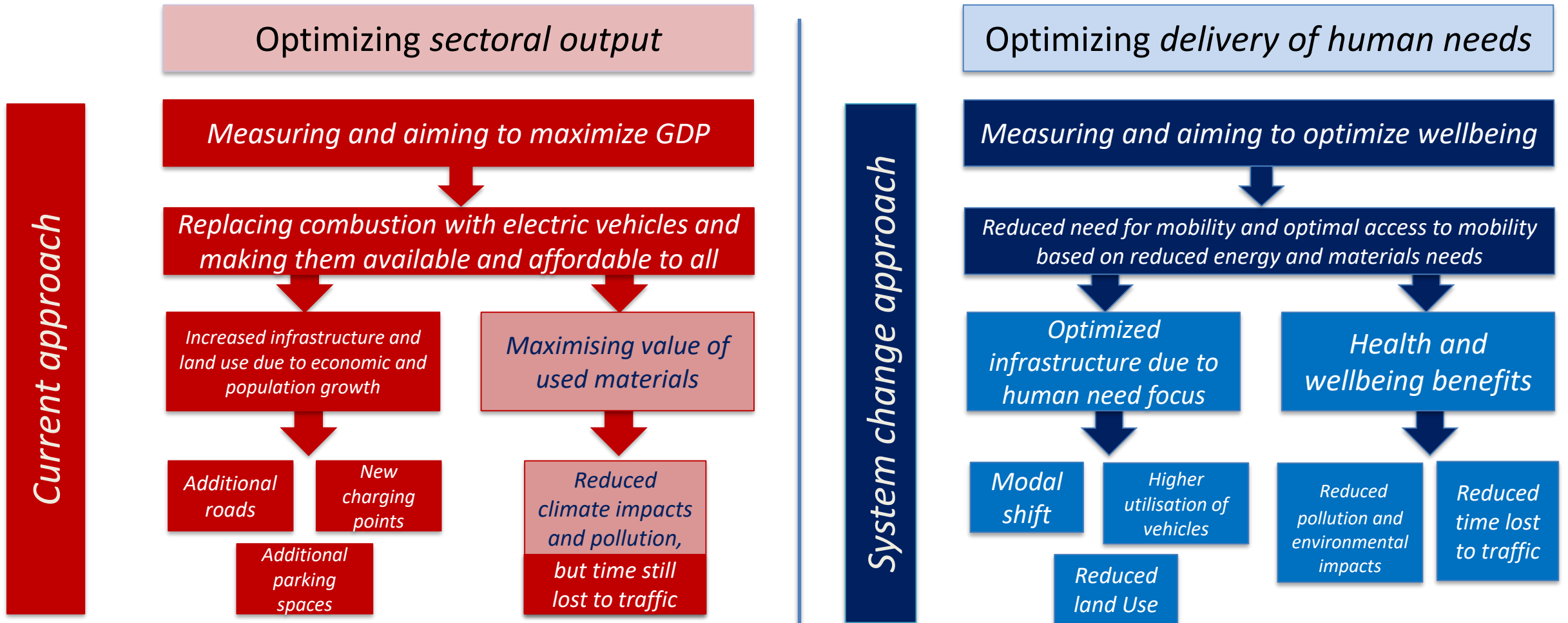
Ensuring remaining vehicles are as sustainable as possible



- *Electrification* based on renewable energy
- *Circularity*, maximizing value of used materials

Systems change logic deploys the whole sustainability potential and unlocks societal co-benefits

Example: optimizing the automotive sector OR mobility system

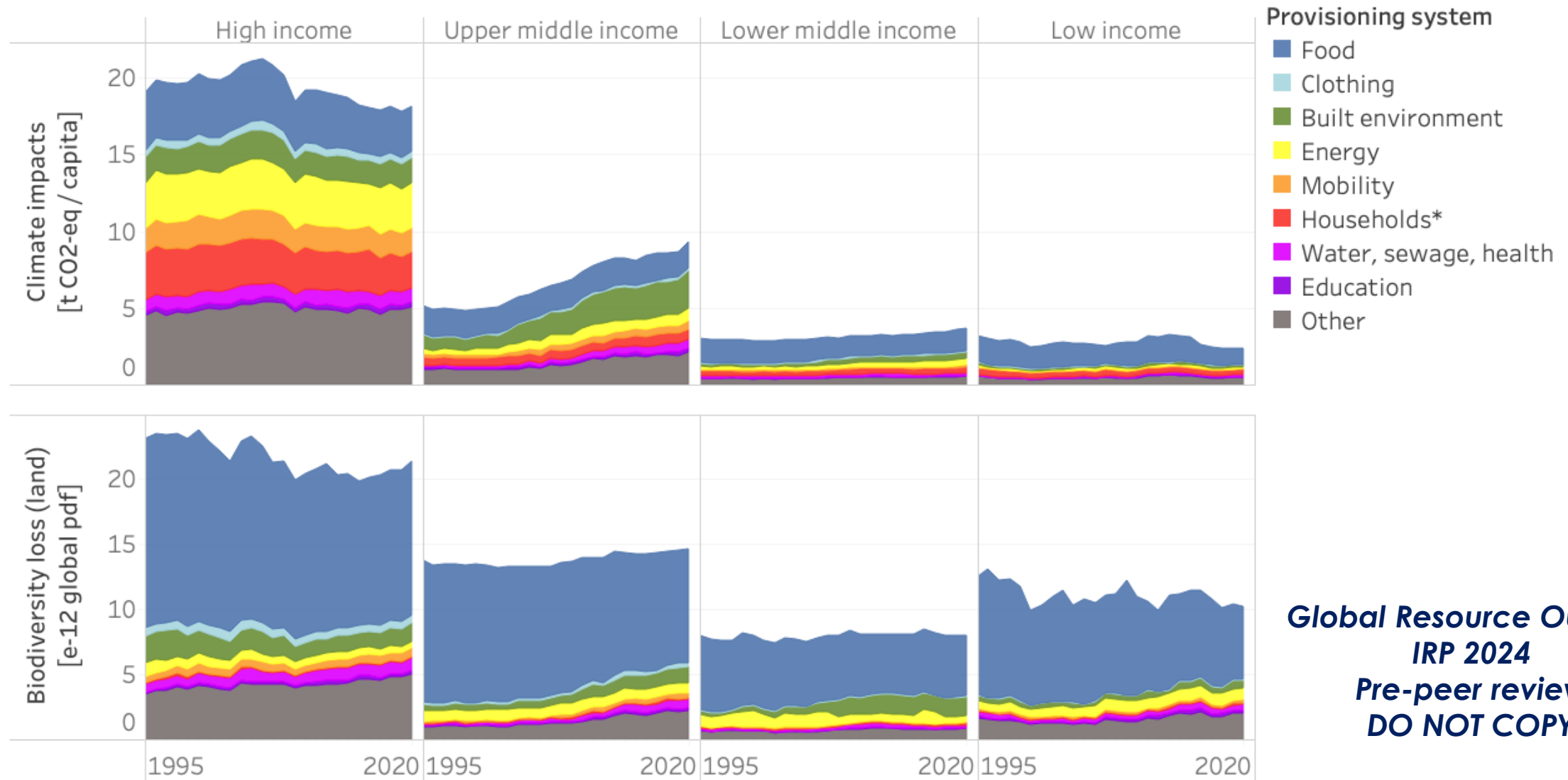


New in GRO 24

The Equity Dimension

*Demand Side Perspective is a Necessary and
Critical Ingredient*

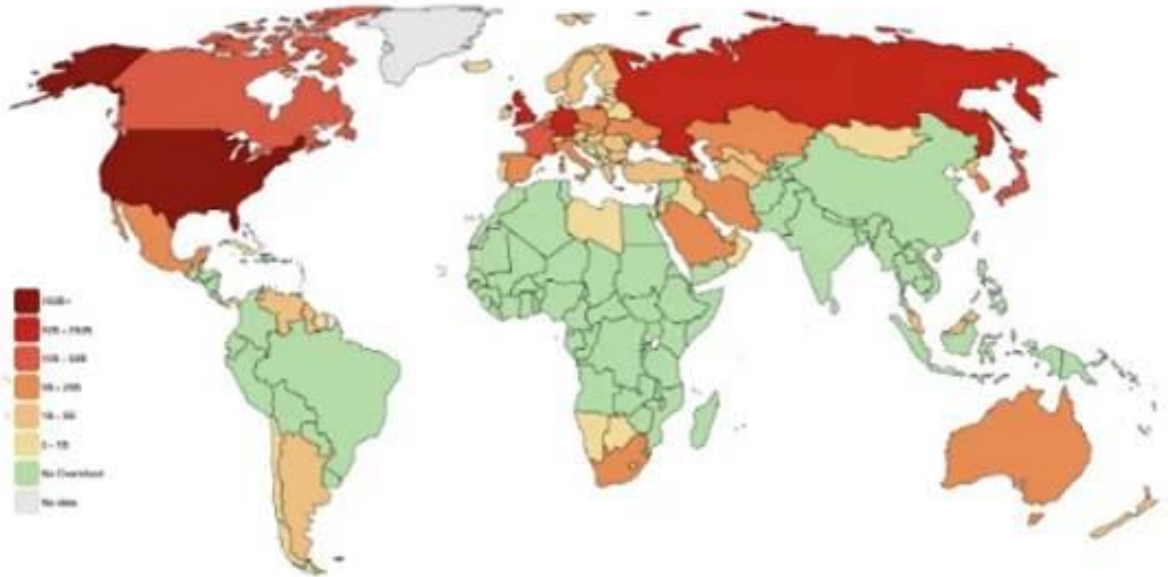
Impacts of need-delivery in high-income countries compared to the impacts in other income groups



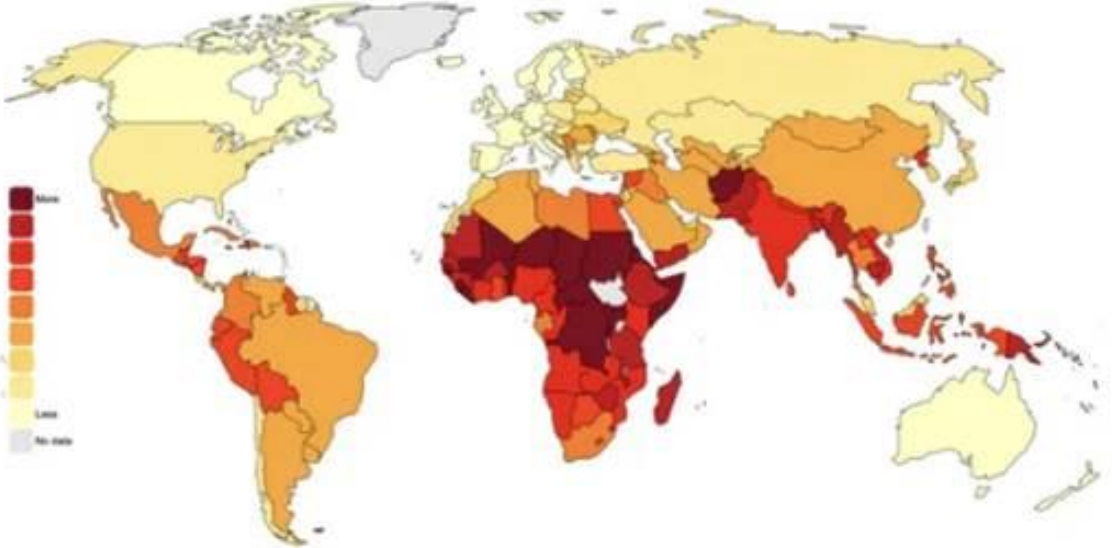
**Global Resource Outlook
IRP 2024
Pre-peer review
DO NOT COPY**

Those Benefiting Most, and Those Facing Worst Consequences

Overshoot emissions
(Lancet Planetary Health)



Multi-dimensional climate
vulnerability
(ND-GAIN)





- *To unpack the standstill in our climate efforts and make them effective, to start closing the existing gap among high-income and low-income countries, we must **stop ignoring the inherent wastefulness of our production and consumption systems**, in particular in high-income countries. **For example**, it would be in vain to decarbonize the production of steel, as important as this is, if it is used to produce under-used cars and houses, which contribute to traffic and property market bubbles, but not to real social prosperity.*
- *Efficiency policies should be complimented by **sufficiency policies**. We should start looking how to integrate **material and consumption footprints** in NDC's structure and logic.*

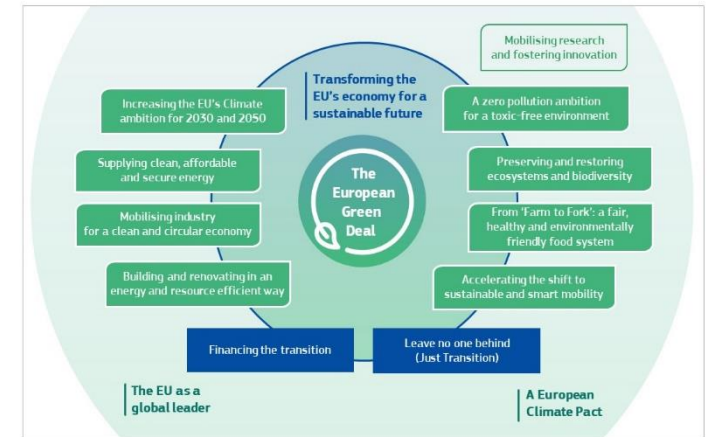
Critical Raw Materials
From Global to European Perspective

European Economy is Fragile due to Energy and Materials Import Dependency

*According to Eurostat **EU dependency on energy imports** did not substantially change over the last decades. EU's net imports of energy have been greater than its primary production; in other words, more than half of the EU's gross available energy was supplied by net imports. **Russia being the major provider**, what we have all quickly learned and understood after aggression to Ukraine.*

*But also, **for most of the critical materials Europe is import dependent** – According to EC for more than 50 scarce and economically important raw materials, Europe in its entirety depends 90% on raw materials imported from outside Europe. More recent data are showing that of the 30 raw materials that the EU classifies as critical, majority are predominantly **imported from China**.*

European Green Deal - In its most quoted paragraph, we can find the targets »of reaching no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use.«



Attention is mainly given to the goal related to no net emissions of greenhouse gasses, while decoupling is somehow set aside, rarely mentioned.

It is only recently getting more attention, but again only in the context of the need to reach the no net GHG emissions target, due to the acknowledgment that success of energy transition depends on securing the access to increased critical material needs.



Main blind spots in policy approach

Lack of Holistic System approach

Public leaders (and many others) lack capacity of **system change visions** or knowledge of how to translate into their concrete policies/investment structures which ends in conflicting **silos policy logics** that hinder real transformation

Lack of Drivers and Pressures Perspective

Policy attention does not focus on the roots of the problem and address the drivers and pressures. It lack focus on **systemic natural resource use and management**, as well as on **market signals** leading consumers and producers' behaviour.

Lack of Demand Side Focus

Policy attention is mainly given to the **supply side** of the economy, to the cleaning of the existing economic system - lacking the attention to the **demand side** which is leaving out an important solutions potential and questions of responsibility and equity.



- *EGD was a visionary document, setting the new way of policy making, **not important only for the EU, but also globally** - role model, consistent with the agreed SDGs, many were admiring, and trying to follow.*
- ***To maintain the leadership, it is essential to continue, and broaden the efforts, through better integration of the demand/consumption side and the system change approach.***

*If we want to avoid
extinction of elephants
in nature ...*

*we must extinct
elephants in our rooms*



[Source: Hop distance - The elephant in the room ...blogs.bmj.com](http://blogs.bmj.com)

To Conclude

*Science is Clear and System Change is Unavoidable
Towards the SDGs*



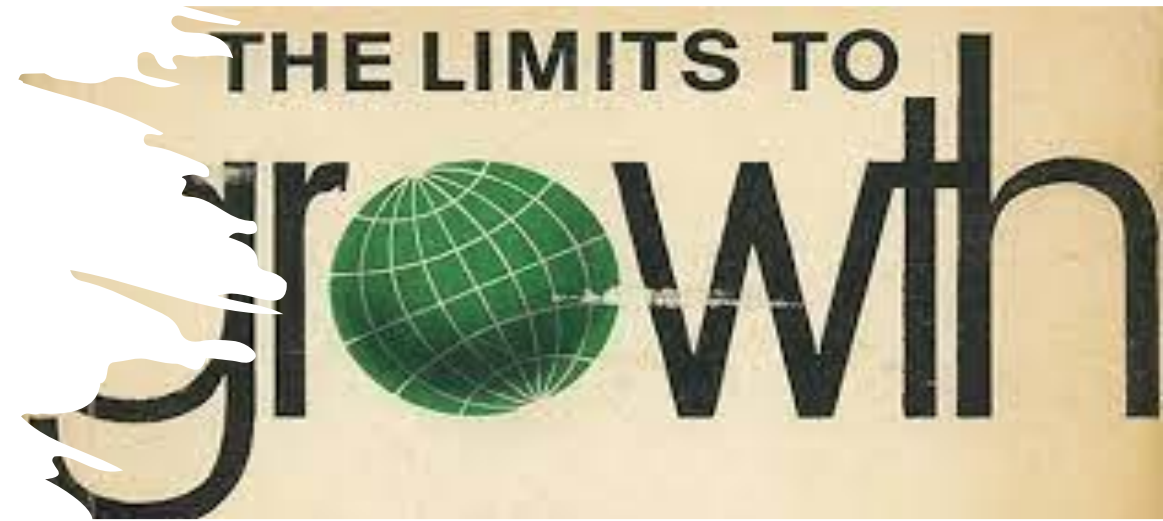
*The world has enough for
everyone's need, but not for
everyone's greed"*
Mahatma Gandhi

Warned that unlimited material growth and consumption on a finite planet would eventually lead to collapse and decline.

Two scenarios:

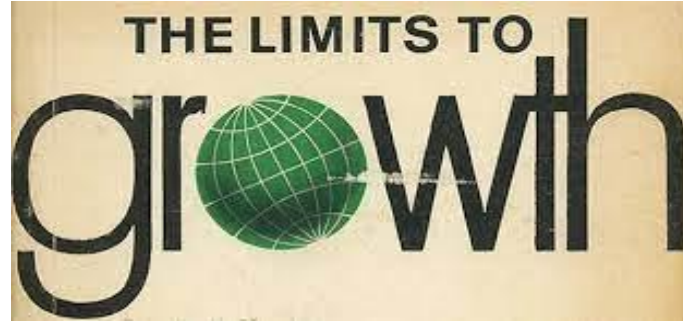
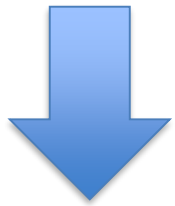
Too Little, Too Late: continue our current destructive path and **The Giant Leap:** the fastest economic transformation in history.

The key outcome is that *we will see negative social tipping before severe environmental tipping points* and that equality and poverty alleviation is key if we want people to be concerned about regenerative economics and decarbonisation. *Even in the Giant Leap scenario Climate change stabilises at below 2°C.* This brings serious consequences for societies including extreme heatwaves, flooding, drought and food security ...



The World has Changed

1972



*Population on the Planet
3.8 billion*

2022

The Growth of Limits
*Climate Change,
Pandemics, Biodiversity
Loss, Security Threats ...*

*Population on the Planet
8 billion*

***To make our necessary transformation implementable
some basic shifts would be needed:***



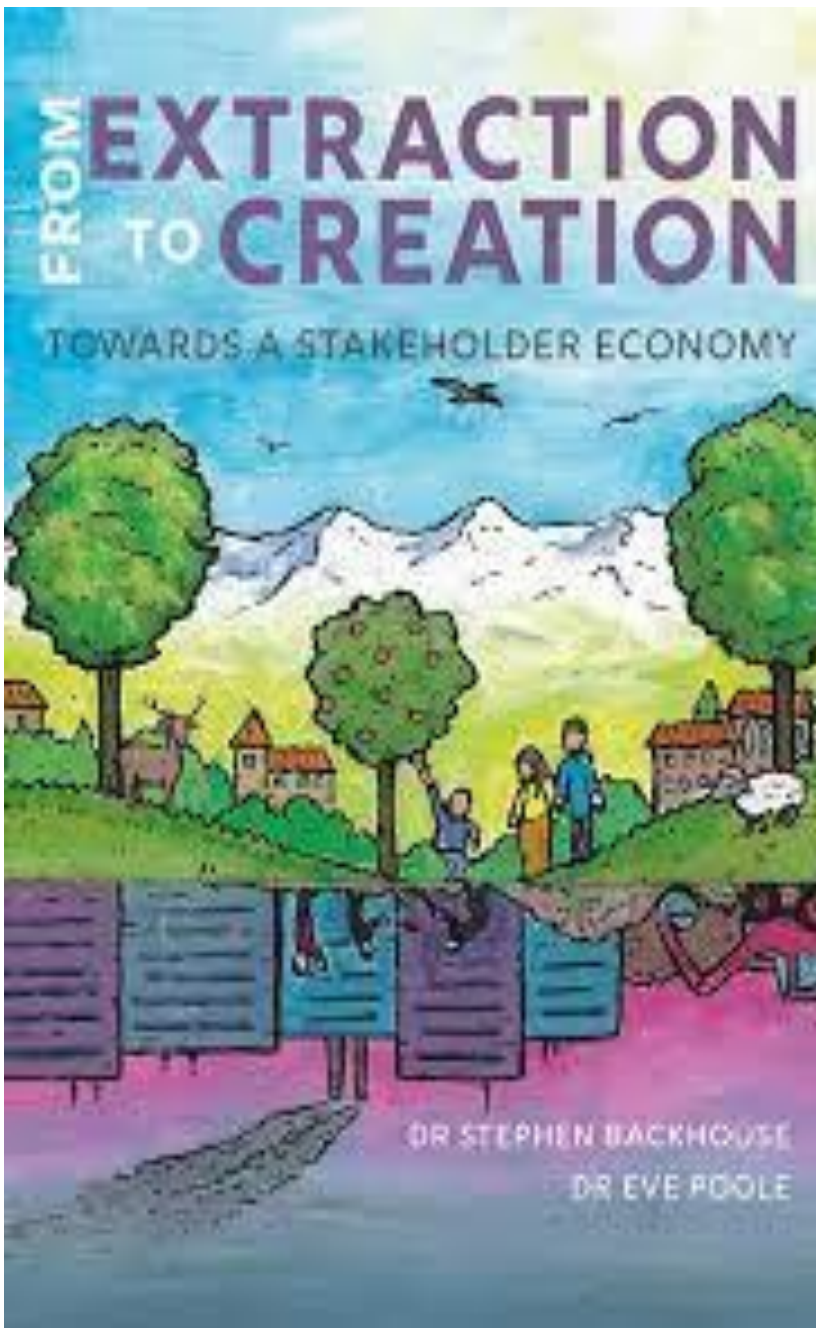
1

*From Humans in function of economic success and development to an economy in function of delivering human needs
We must set the order right!*

2



From economy considering Humans as external/superior to Nature to an economy acknowledging that we are embedded with Nature
Destroying Nature is destroying ourselves!



3

From extraction-based production to a creation-based production

We should stop stimulating extraction based economic success and reward responsible, innovative, creative ways of meeting human needs!



4

From an egoistic, short-term based interests' governance structures and logic to cooperation and sharing sovereignty.

We must improve our collective resilience. We need a convincing intergenerational pact!



This System Change Transformation is also in the Interest of the Business

Global Risks Report 2023

Top 10 Risks

“Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period”



2 years



10 years



Risk categories

■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological



It is getting green !!!

*Taking pain-killers to remove the acute pain
do not heal chonical diseases ...
rather hides them and make them worse*

This Transformation is not only about Environmental Sustainability

*Access to and use of natural resources have been in the human history **closely related to the level of the achieved wellbeing, but also to stability, security, conflicts, wars** (Access to Land, Water, Oil and Gas, Minerals, Precious Metals ...)*

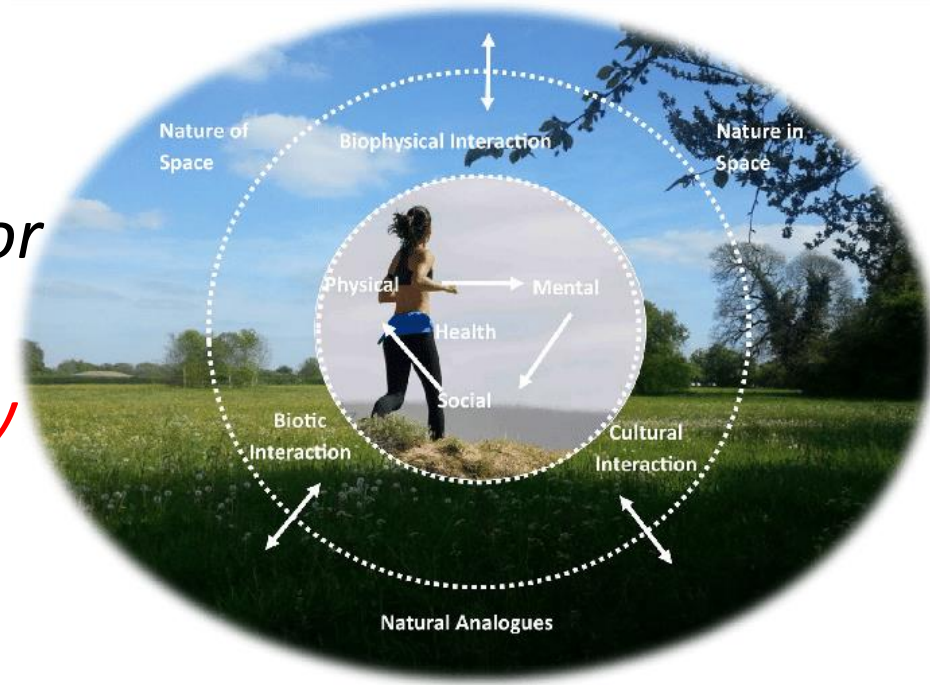
*And the whole history of the colonialisaton of nature, is also central to **fairness and equity**.*



Changing our Relationship with (the rest of) Nature, is ultimately an Economic, Equity and Security Imperative to strengthen collective Resilience

*The lessons learned recently (war, pandemic, the hottest summer) are more than convincing to understand that. This relationship is not stable, nor balanced, and it will be **resolved either with collective wisdom and effort, or in a hard and very painful way** (conflicts, pandemics, migration ...)*

The future will be green ... or there will be no future.



And finish the story in my former country and in country I do spend most of my time currently



[Source: Diplomacy and commerce exhibition-alan-ford-running-a-lap-of-honor-in-the-museum-of-yugoslavia](https://www.diplomacyandcommerce.com/exhibition-alan-ford-running-a-lap-of-honor-in-the-museum-of-yugoslavia)

Quote from *Alan Ford*, most famous comics from Ex-Yugoslavia, explaining well where the current rules of capitalism and the established practice of the economic system are leading us ...

*It is not the problem to drive without the breaks ...
The problem is to stop.*

And essential advice from the most famous Belgian

HERCULE POIROT



When asked why he is speaking about himself always in a third person he replied something like that:

If one is such a genius like me, it is very important to establish a healthy distance to himself.



THANK YOU

for helping us delivering the future we want!