

# Sustainability

## What is Sustainability?

- *Sustainability* was first mentioned in Hannß Carl von Carlowitz (1713) in the context of forestry in his seminal book *Sylvicultura oeconomica* discussing sustainable forest management. The field is known today as *sustainable yield of natural capital* required to maintain *ecosystem services* (Peter Kareiva et al. (2011)).
- Climate data visualization has a long history, starting with **Alexander von Humboldt**, who revolutionized cartography by inventing the first isothermal maps around 1816, showing areas with similar temperature, variations in altitude and seasons.
- *Alexander von Humboldt's Original Isotherms Circa 1838* (2023): computer models of Father of climatology Alexander von Humboldt Isotherms
- Honton (2022)
- Brohan et al. (2012) reports global temperature measurement starts from the 1880s where we have the first records from ships.
- Industrial revolution
- Le Provost et al. (2022): Contemporary studies have shown *biodiversity* as one key factor to maintain delivery of ecosystem services.
- Keeble (1988) reported in April 1987 (a few months after I was born) that '*residents in high-income countries lead lifestyles incompatible with planetary boundaries*'. While my home Estonia at the time was considered low-income, a small nation on the verge of poverty behind the Iron Curtain occupation of the Soviet Occupy, we now in 2023, have indeed reached high-income status.
- Commodities!!
- the most effective things are — food — transport — fashion? — plant trees
- Korosec (2021) reports that Amazon's 2B USD to a Climate Pledge Fund earmarked to fix climate problems is invested in energy, logistics, and packaging startups, which will reduce material waste. "Good intentions don't work, mechanisms do," Amazon's founder Bezos is quoted in Clifford (2022). It's an example of how money marketed as

climate funding by the retail conglomerate means focus on reducing operational cost of running their business through automation and material savings.

## Zero Waste Lifestyle and Minimalism

The opposite of overconsumption is the zero waste lifestyle. A movement of people living a simple life. This is always going to be a small percentage of people.

- Tokyo Simple Eco Life (2021)
- Costa (2018): Finnish socialists: minimalism

**For design: These movements are too small and require too much effort to be feasible for the app.**

## Nationally Determined Contributions

Scalable Climate Solutions: What really works on a large scale?

- Climate Analytics & NewClimate Institute (2023) Climate Action Tracker data portal allows to compare countries.

Country or Region	NDC target
China	Highly insufficient
Indonesia	Highly insufficient
Russia	Critically insufficient
EU	Insufficient
USA	Insufficient
United Arab Emirates	Highly insufficient
Japan	Insufficient
South Korea	Highly insufficient
Iran	Critically insufficient
Saudi Arabia	Highly insufficient

- “triple turn”
- lack of transparency
- Call for GOP contributors’ transparency
- UNFCCC. Secretariat (2022)
- The State of Nationally Determined Contributions: 2022 Fransen et al. (2022) notes that the majority of Nationally Determined Contributions (NDCs) are dependent on financial assistance from the international community.

## Carbon Markets

- Siphthorpe et al. (2022) compares traditional and blockchain-based solutions to carbon trading.
- Liu (2021) and Ivy Yin (2023) China's national emissions trading scheme (ETS) started in 2021 priced at 48 yuan per tonne of CO<sub>2</sub>, averaged at 58 yuan in 2022.
- United Nations Environment Programme (UNEP) (2021) report. "The Emissions Gap Report (EGR) 2021: The Heat Is On shows that new national climate pledges combined with other mitigation measures put the world on track for a global temperature rise of 2.7°C by the end of the century. That is well above the goals of the Paris climate agreement and would lead to catastrophic changes in the Earth's climate. To keep global warming below 1.5°C this century, the aspirational goal of the Paris Agreement, the world needs to halve annual greenhouse gas emissions in the next eight years.
- United Nations Environment Programme (UNEP) (2021) report "If implemented effectively, net-zero emissions pledges could limit warming to 2.2°C, closer to the well-below 2°C goal of the Paris Agreement. However, many national climate plans delay action until after 2030. The reduction of methane emissions from the fossil fuel, waste and agriculture sectors could help close the emissions gap and reduce warming in the short term, the report finds. Carbon markets could also help slash emissions. But that would only happen if rules are clearly defined and target actual reductions in emissions, while being supported by arrangements to track progress and provide transparency."
- United Nations Environment Programme (2022) 2022 Emissions Gap report.

## Fossil Fuels and Energy

There's evidence from several countries suggesting moving to renewal energy brings benefits:

- Amin et al. (2022) suggests "removing fossil fuel subsidies and intra-sectoral electricity price distortions coupled with carbon taxes provides the highest benefits" for both the economy and the environment in Bangladesh.
- S. Low et al. (2022) finds considerable uncertainty exists among experts which CO<sub>2</sub> reduction methods among nature-based and technology-based are the most effective.
- Luo et al. (2022) suggests using reinforcement learning to reduce energy use in cooling systems.
- The true cost of products is hidden. The work is hidden.
- Tilsted et al. (2023) expects the fossil fuel industry to grow even faster.

## Emission Scopes

- National Public Utilities Council (2022): The U.S. National Public Utilities Council (NPUC) decarbonization report provides a useful categorization of company emission scopes:

Scope	Source
Scope 1	Direct emissions
Scope 2	Indirect electricity emissions
Scope 3	Value chain emissions

## Cap and Trade

- adsas

## Carbon Inequality

- Chancel (2022) suggests “while one-tenth of the global population is responsible for nearly half of all emissions, half of the population emits less than 12% of it”.

## Carbon Credit Retirement

- ads

## Carbon Capture

- Vitillo et al. (2022) argues
- Gaure & Golombek (2022): “98% of total electricity production is generated by wind power and solar; the remainder is covered by a backup technology.”
- Make commerce more transparent
- **Important: “creating sustainability trust in companies in realtime”**

## Social Cost of Carbon

- Rennert et al. (2022): Carbon price should be 3,6x higher.
- Stanford University (2021): “the cost of the damages created by one extra ton of carbon dioxide emissions”
- Kornek et al. (2021) and Zhen et al. (2018) suggest “The (Social Cost of Carbon) SCC measures the additional damage caused by an extra unit of emissions” with variations between countries (Tol (2019)) and regions (Y. Wang et al. (2022)).
- Stern (2022) reports carbon-neutral economy needs higher CO2 prices.
- Howard et al. (2017) argues Oceans play crucial role in carbon capture.
- Ritz (2022) says Carbon prices are highly asymmetric.
- Lin et al. (2022) says, apart from CO2, reduction of other atmospheric pollutants, such as non-CO2 greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs) is required for climate stability.
- As shown in the Phillipines by Cheng & Han (2022), with increasing extreme weather events, “businesses are more likely to emerge in areas where infrastructure is resilient to climate hazards”.
- Jerrett et al. (2022) says, In California, “Wildfires are the second most important source of emissions in 2020” and “Wildfires in 2020 negate reductions in greenhouse gas emissions from other sectors.”
- T.-P. Wang & Teng (2022): Quantifying climate damage proposes scenarios of climate damage.

## Provenance and Traceability

- 200 million PCs sold every year personalized AI, meta glasses understand your context. sense and reconstruct the world around you and to understand the context in which you’re using your device. sense and reconstruct the world around you and to understand the context in which you’re using your device. Make suggestions and take action proactively to help you get things done — ideally, so seamlessly that you may not even notice. neuroscience co-adaptation of the interface. your future devices will learn and adapt to you as you use them.
- “Reality Labs Research at Meta Connect 2022” (2022)
- App shows traceability!!
- Katie Gustafson (2022) “**Uniform traceability system for the entire supply chain.**”
- Muñoz et al. (2023) Is there such a thing as sustainable fishing? Bottom trawling is the worst and should be banned.

- Help consumers to demand more
- Tim Nicolle (2017)
- Tim Nicolle (2021) and PrimaDollar Media (2021) PrimaDollar Realtime ESG Give supply chain a voice by connecting workers directly to the consumer
- “Worker Voice” (2022) Worker Voice apps
- *Real Time ESG Tracking From StockSnips* (2021) “Real Time ESG Tracking From Stock-Snips”
- Inc (n.d.)
- Ethereum blockchain and animal rights. “Blockchain can provide a transparent, immutable record of the provenance of products. This can be especially useful for verifying claims made about animal welfare. For example, products claiming to be “free-range,” “organic,” or “sustainably sourced” could have their entire lifecycle recorded on the blockchain, from birth to shelf, allowing consumers to verify these claims.”
- Animal rights vs animal welfare
- Traceability and animal rights
- Mamede et al. (2022) proposes *Seafood tracing: Fingerprinting of Sea Urchin*.
- Waters (2015) (**Need access!**)
- Cawthorn & Hoffman (2016) (**Need access!**)
- Gamborg & Jensen (2017) (**Need access!**)
- Bailey & Eggereide (2020) shows how the Norwegian government plans to increase salmon production 5x by 2050. How can this be sustainable?
- Van Wassenaeer et al. (2023) Compares use cases for blockchains in enhancing traceability, transparency and cleaning up the supply chain. There are several technologies for tracking goods from shipping chain with OriginTrail, including OriginTrail, Bext360, Everledger, Provenance.
- Miller (2019) Suku makes supply chains more transparent
- Dutta et al. (2020) hundreds of paper researching blockchain use in supply chain operations since 2017.
- Neethirajan & Kemp (2021) using biometric sensors to track livestock sustainability.
- Ray (2023) comprehensive overview of Web3.
- Ashraf & Heavey (2023) Solana blockchain and Sigfox internet of things (IoT) Integration for supply chain traceability.
- Patel et al. (2023) livestock products are 15% of agri-foods valued at €152 billion in 2018.

## Oracles for Sustainability Data

Intersection with finance.

A data oracle is the concept of a source of real-world data which can be ingested through an application programming interface (API) by, for example, a blockchain system. There are many databases of sustainability information which could serve as an oracle for “green filter”, including carbon labeling, packaging, transportation, consumption, and waste.

- Ethereum (2023)
- Caldarelli et al. (2020) notes it’s a challenge to ensure the accuracy and trustworthiness of real-world data from Oracles.
- Brady Dale (2021) and Chainlink (2022): The largest Oracle provider ChainLink founder Sergey Nazarov believes the collaboration of oracles and blockchains can make carbon credits more trustworthy.
- IPCI OpenLitterMap G.I.D Coin Regen Network

## Real World Data

- O bank carbon calculator (Brasil)
- “Consumer Spending Carbon Calculator” and “Low-Carbon Lifestyle Debit Card”
- *Taiwan’s O-Bank Launches ‘Consumer Spending Carbon Calculator,’ Rewards Carbon Reduction* (2022)
- “access Mastercard’s big data database and calculates the amount of carbon emission of each transaction based on the type and amount of products or services purchased.”

## Ethics and Cruelty

- Cruelty free brands
- Rank companies based on sustainability
- BCorp
- ESG
- Trash found in ocean / nature etc
- Help you to decide: what to buy, how to save, where to invest
- Increase your investment point by matching with your contribution /.
- Point of Sales integration (know the SKU you buy). Integrate to the financial eco footprint (no need to scan the product). What’s the name of the startup that does this?
- Precision Fermentation and Cultivated Meat: Meat products without farm animals

## **Biomarkers vs Ecomarkers (Ecological Indicators)**

- **Blood testing and biomarkers allow people to track their health. I'm introducing the concept of 'eco-markers' to follow the sustainability of human activities.**
- There is a parallel in health to sustainability and indeed both are inextricably linked.
- Apple (2022a): In a 2022 report Apple outlines its plans to : “Empowering people to live a healthier day”
- Apple (2022b) What's new in HealthKit
- What would that look like for sustainability?
- Empowering people to live a sustainable day

## **Agroforestry and Permaculture**

- Food forests for regenerative food systems.
- Ruba & Talucder (2023)
- Irwin et al. (2023)
- Yadav et al. (2023)
- G. Low et al. (2023)
- Ollinaho & Kröger (2023) “bioeconomy is not inherently sustainable and may pose considerable risks to biodiversity.”
- De Queiroz-Stein & Siegel (2023)
- Gamage et al. (2023) “Organic food and drink sales in 2019 totaled more than 106 billion euros worldwide.”
- Curve Labs founder Pat Rawson quotes @shillerNarrativeEconomicsHow2019 in ReFi podcast about Kolektivo: “Would you rather buy a DogeCoin or a regenerative food forest token?” ReFi DAO (2022) (Use as a question for the survey?)



## Environmental Degradation

### Growing Population

- According to The Economic Times (2022), in November 2022, Planet Earth’s population reached 8 Billion people.
- The future population projections in United Nations Department of Economic and Social Affairs, Population Division (2022) predict 8.5B people by 2030 and 9.7B by 2050.
- While population growth puts higher pressure on Earth’s resources, some research shows the effect is more from wasteful lifestyles than the raw number of people (**FIND CITATION**).

### Overconsumption

- In Anthony Leiserowitz et al. (2022), a large scale study on Meta’s Facebook (n=108946), “Respondents in Spain (65%), Sweden (61%), and Taiwan (60%) are the most likely to say that climate change is mostly caused by human activities”.
- Overconsumption is one of the root causes of climate change and marine plastic pollution.
- Ford et al. (2022) and Lavers et al. (2022) suggest strong linkage of climate change and marine plastic pollution “along with other stressors that threaten the resilience of species and habitats sensitive to both climate change and plastic pollution”.
- Eesti Vabariigi Valitsus (2022) Estonian Green Deal Action Plan (Eesti Rohepöörde Tegevusplan).
- WWF (2022) **case study highlights how 4 biodiverse regions Cerrado in Brazil, Chaco in Argentina, Sumatra in Indonesia, and the Cuvette Centrale in Democratic Republic of Congo are experiencing rapid destruction due to consumer demand in the European Union.**
- McGinty (Thu, 08/06/2020 - 11:25): How to Build a Circular Economy
- Ivanova et al. (2020): “Around two-thirds of global GHG emissions are directly and indirectly linked to household consumption, with a global average of about 6 tCO<sub>2</sub>eq/cap.”
- Armstrong McKay et al. (2022) discusses tipping points
- Moberg et al. (2019) reports daily human activities emission contribution on average in France, Germany, Norway and Sweden:

Emission Share	Category
21%	Housing
30%	Food
34%	Mobility
15%	Other

- According to Debnath et al. (2022) 39% of global CO2 emissions comes from the building sector.

## **Biodiversity Loss**

- UEBT (2022) reports “Biodiversity awareness is now at 72% or higher in all countries sampled, compared to only 29% or higher across countries sampled in 2009.”
- Unit (2023): The history of the United Nations Convention on Biodiversity goes back to 1988, when the working group was founded
- Almond, R.E.A. et al. (n.d.) reports, the number of species killed, mass destruction of nature. “69% decline in the relative abundance of monitored wildlife populations around the world between 1970 and 2018. Latin America shows the greatest regional decline in average population abundance (94%), while freshwater species populations have seen the greatest overall global decline (83%).”
- UNEP (Tue, 12/20/2022 - 07:44): **The Convention on Biodiversity 2022 (COP15) adopted the first global biodiversity framework to accompany climate goals.**

## **Ecosystem Services**

- Bousfield et al. (2022) reports there’s evidence paying landowners for the ecosystem services their forests provide may reduce deforestation.
- In Estonia, startups Arbonic and Single.Earth are trialing this approach in several forests.
- Han & Chen (2022) identifies nature-based solutions “land re-naturalization (such as afforestation and wetland restoration)”
- Noriega et al. (2018) attempts to quantify the ecosystem services (ES) provided by insects. While it can be assumed much of the flora and fauna are crucial for Earth’s systems, science is still in the process of understanding and quantifying its contributions. Meanwhile the destruction pressure on ecosystems is rapidly increasing (cite A B C).

## **Deforestation**

- Frédéric Simon (2022) Due to deforestation, Europe rapidly losing its forest carbon sink.
- Burning of biomass undermines carbon capture.

## **Clean Water**

- Koch (2022) (**Need access!**)

## Air Pollution

Clean air is a requirement

- Groundbreaking research by Lim et al. (2022) analyzed over 400,000 individuals in England, South Korea and Taiwan establishes exposure to 2.5 µm PM (PM<sub>2.5</sub>) air pollution as a cause for lung cancer. Bouscasse et al. (2022) finds strong health and economic benefits across the board from air pollution reduction in France.
- In Hannah Devlin (2022), prof Tony Mok, of the Chinese University of Hong Kong: “We have known about the link between pollution and lung cancer for a long time, and we now have a possible explanation for it. As consumption of fossil fuels goes hand in hand with pollution and carbon emissions, we have a strong mandate for tackling these issues – for both environmental and health reasons.”

**Design Implications:** *People live in the polluted areas are so used to it. What app to wake them up? “You live in a highly polluted area. Here’s the TOP 10 companies causing pollution. Here’s what you can do.”*

## Disasters

Large ones that get international news coverage:

- Chernobyl
- Exxon Valdez
- Deepwater Horizon
- the Great Pacific Garbage Patch
- Fukushima
- Volkova et al. (2021) increased risk of wildfires due to climate change.
- Martinez-Alier (2021) and Martinez-Alier et al. (2022) as well as Scheidel et al. (2020) cover how EJAtlas tracks environmental justice cases around the world. Disputes in Eerola (2022).

## Health

- Sarah Ludwig Rausch & Neha Pathak (2021): “Human health is central to all sustainability efforts.” All of these (food, housing, power, and health care), and the stress that the lack of them generate, play a huge role in our health,” Hollis says.”
- *Public Health Linkages with Sustainability* (2013)
- Guidotti (2015)

- “Sustainability is important for many reasons including: Environmental Quality – In order to have healthy communities, we need clean air, natural resources, and a nontoxic environment.”

## Conclusion

- A wide range of legislative proposals, targets, organizations, and goals already exists across Europe. Upcoming laws will harmonize approaches to sustainability and raise standards for all member countries, in turn influencing producers who wish to sell in the EU common market.
- In unison, the reviewed technologies and practices move us closer to enabling *realtime ESG*: up-to-date transparent information about how our products are produced. Realtime ESG is necessary a building block to enable consumers and investors make more accurate, real-world purchase decisions.

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