

Computational Methods in Urban Studies

Week 10 : Systems – Sustainability transitions

Plan

réf.: Indigenous protesters blockade the entrance to COP30 in Belem, Brazil
Photograph: Fernando Llano / AP (the Guardian) ↓

1. Sustainability

- History of the concept
- Critical perspectives

2. Transitions

- Modeling transitions
- Critical perspectives

3. The Anthropocene

- The “great acceleration”
- Critical perspectives

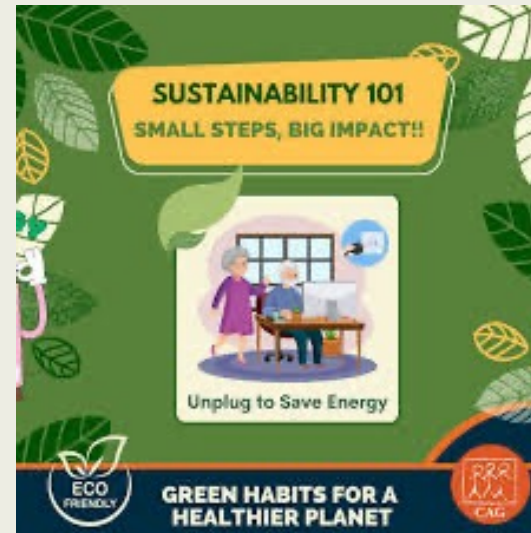
4. Applications to urban systems



The Plot

What do we mean by “sustainability”?

- Each of you defines “sustainability”
- “meeting the needs of the present without compromising the ability of future generations to meet their own needs.” - Brundtland Commission, 1987
- What’s the problem here?



Use a cup of water when brushing your teeth instead of running the tap to conserve water



modified from Microsoft Corp.



The Plot

réf.: EU Commission ↓

- **Enter “transitions”**
 - Each of you shares a prefix to ____ transition
e.g. “*green transition*”
 - What do we *actually mean* by “transition”
 - Who is pushing this narrative? To what ends?
- **The *energy transition***
 - Moving from wood to coal to oil to nuclear?
 - Why *scale* matters here

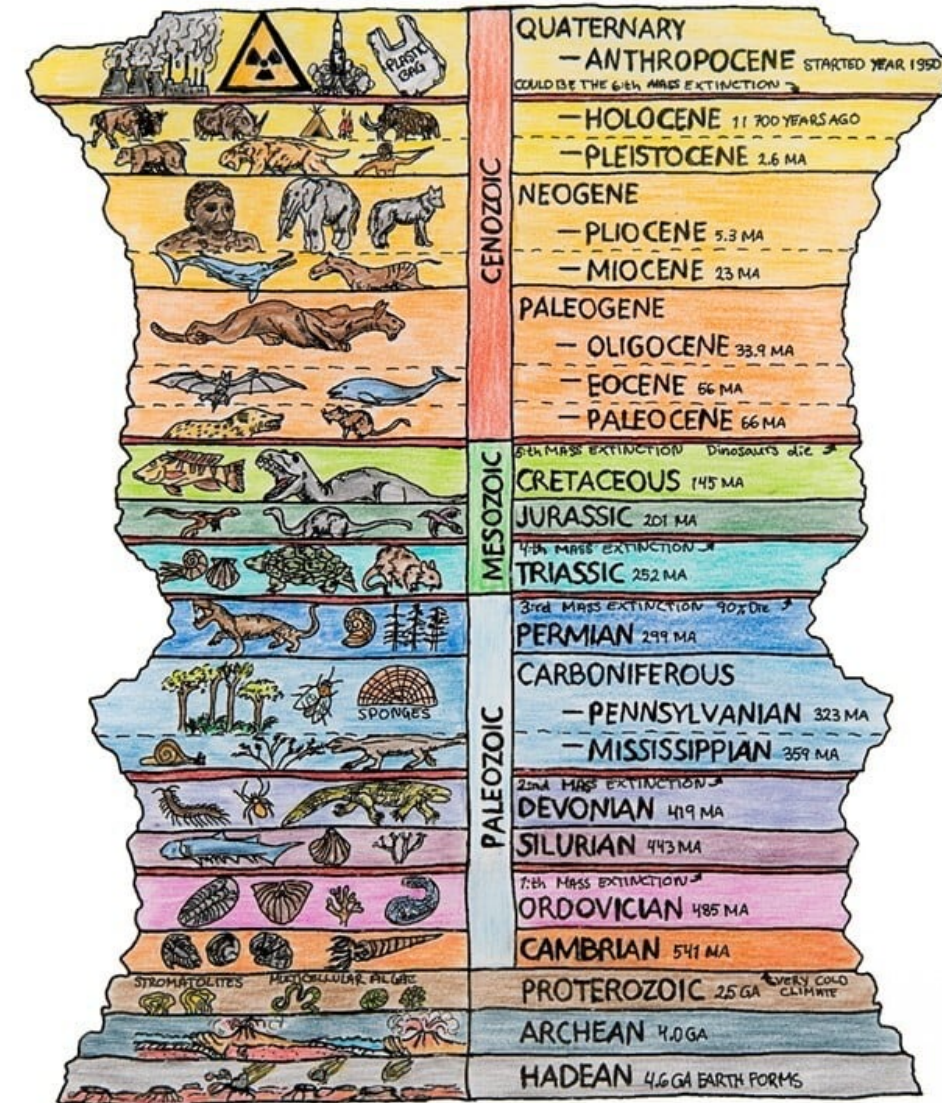


The Plot

réf.: futurelearn.com ↓

- **The Anthropocene as geological epoch**

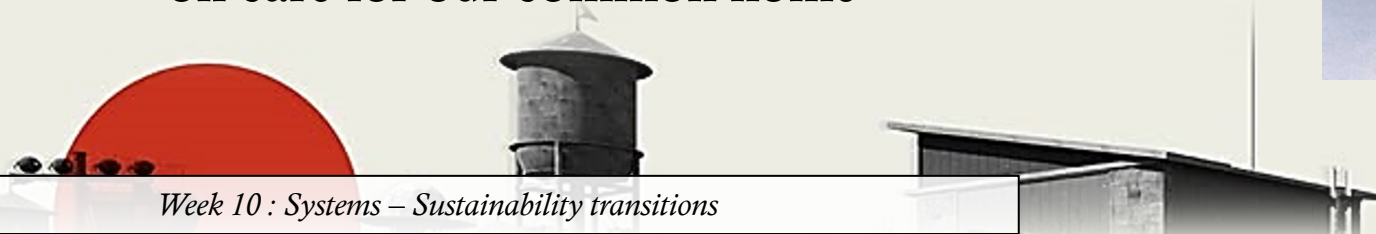
- *Time is divided by geologists according to marked shifts in Earth's state. Recent global environmental changes suggest that Earth may have entered a new human-dominated geological epoch, the Anthropocene.* Lewis & Maslin, 2015
- From Greek *ἄνθρωπος* (man) + *καινός* (new, period/age)
- Does this seem a fair description of our current time?
- How about Capitalocene, Plantationocene, Phallocene, Pyrocene, Necrocene, Urbanocene, Chthulucene?



1. Sustainability

réf.: Pale Blue dot, NASA, 1990↓

- **Emergence of a concept**
 - "Look again at that dot. That's here. That's home. That's us." Carl Sagan about Pale Blue Dot →
 - United Nations Conference on the Human Environment (UNCHE), Stockholm 1972
 - United Nations Conference on Environment and Development (UNCED), Rio 1992
 - Brundtland report (1987) of the World Commission on Environment and Development: "Our Common Future"
 - *Laudato si* (2015) encyclical of Pope Francis "on care for our common home"

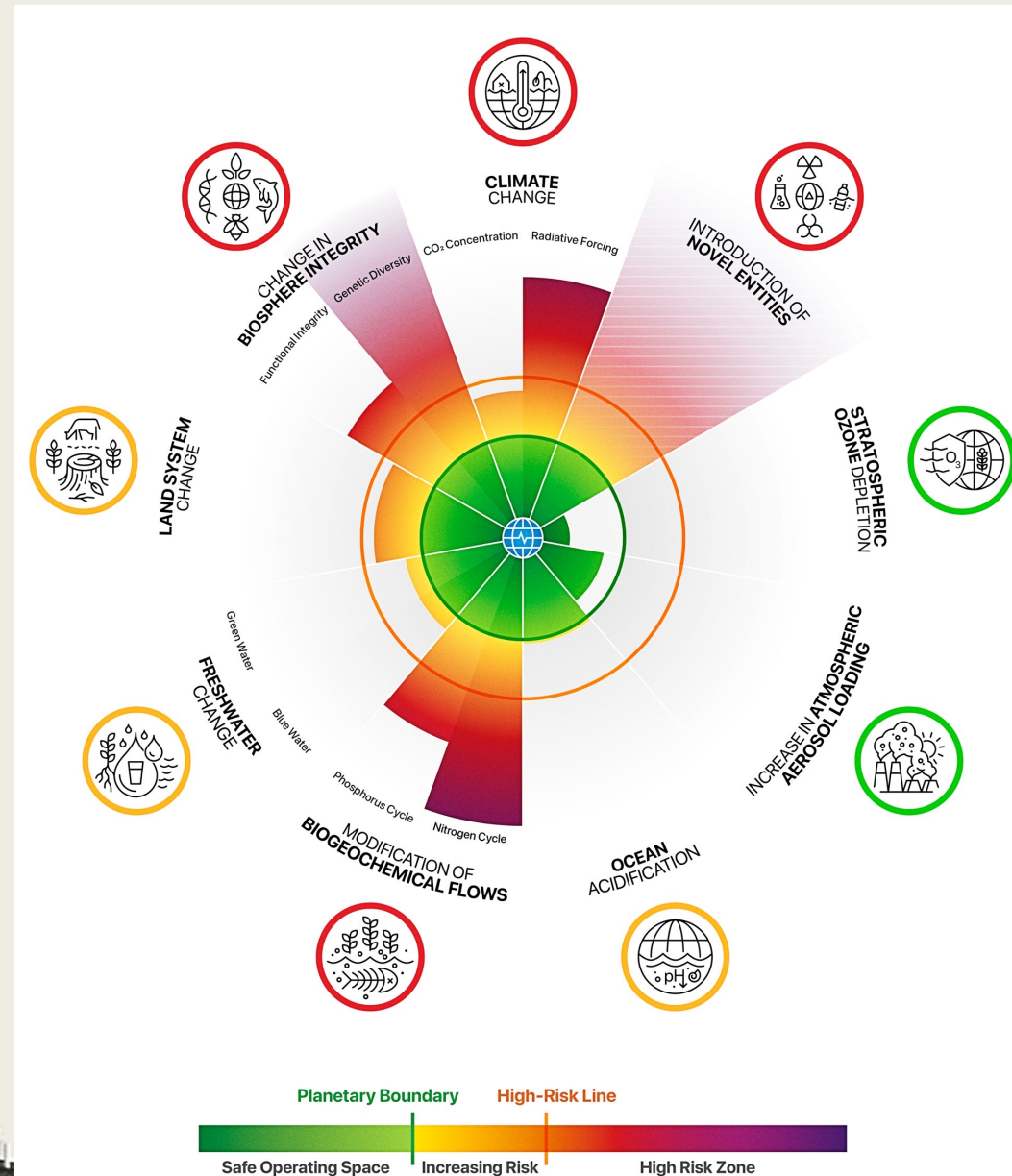


1. Sustainability

réf.: Potsdam Institute for Climate Impact Research ↓

- **Fast forward 40 years... 7 of the 9 planetary boundaries have now been crossed**
 - How have we gotten here – any ideas?
 - 1600 fossil fuel industry delegates at COP30 in Rio
 - 1773 fossil fuel industry delegates at COP29 in Baku
 - 2456 fossil fuel industry delegates at COP28 in Dubai

“We are witnessing widespread decline in the health of our planet. But this is not an inevitable outcome. The drop in aerosol pollution and healing of the ozone layer, shows that it is possible to turn the direction of global development. Even if the diagnosis is dire, the window of cure is still open. Failure is not inevitable; failure is a choice. A choice that must and can be avoided.”

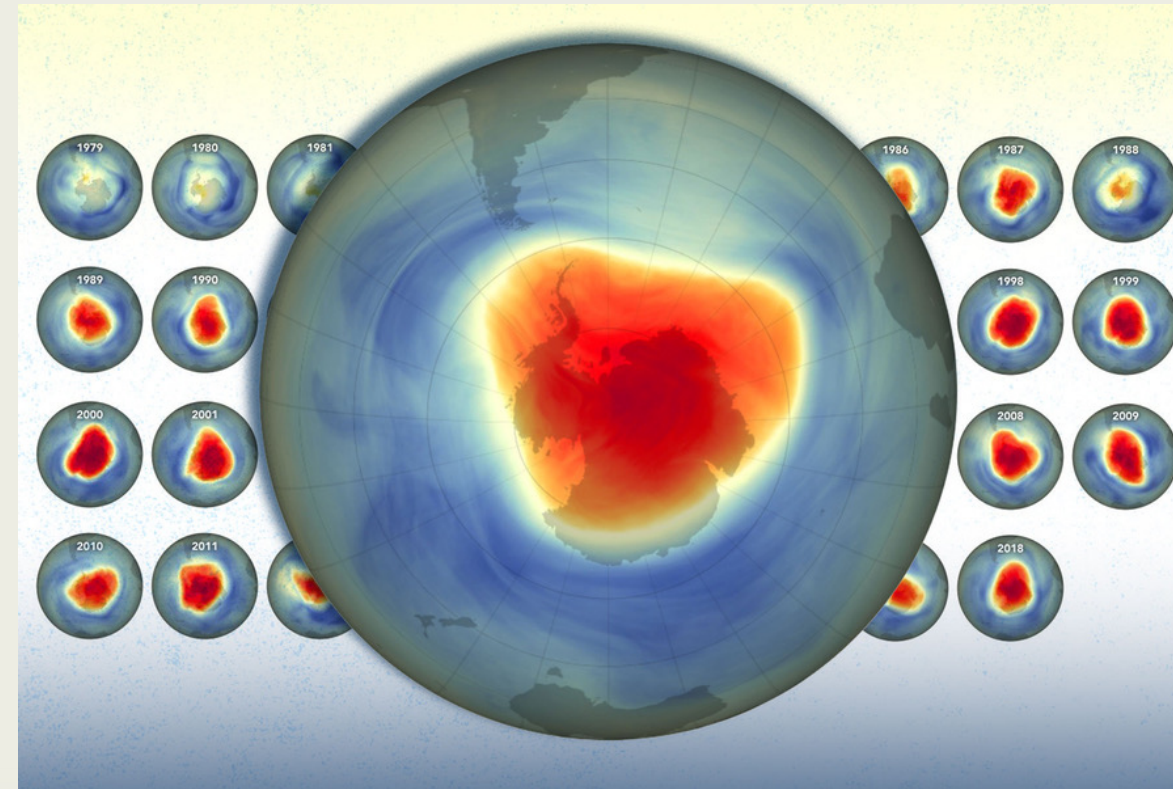


1. Sustainability

- **And yet... when there's a will there's a way!**
 - Remember the hole in the Ozone layer?
 - An MIT-led study confirms the Antarctic ozone layer is healing as a direct result of global efforts to reduce ozone-depleting substances

“Indigenous Peoples have safeguarded forests, water, and bio-diversity by living within nature’s limits, guided by knowledge passed from our ancestors. Today, the Planetary Boundaries science confirms what Indigenous Peoples have always known: when we push beyond these limits, we put all life at risk. To heal our planet, we must unite science and traditional knowledge, respecting the wisdom of those who live closest to the land and waters.”

réf.: MIT news↓

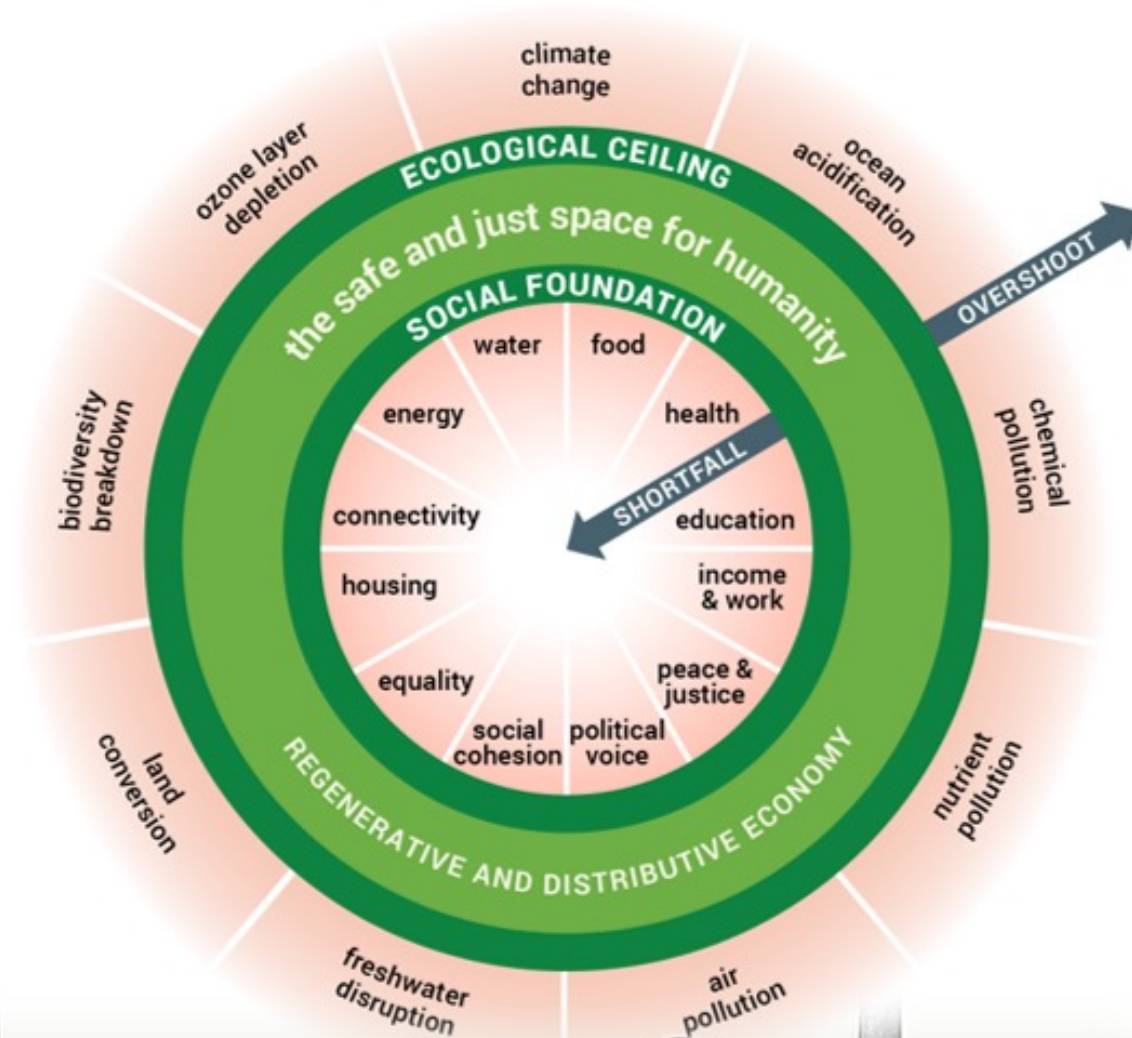


1. Sustainability

réf.: Doughnut Economics Action Lab ↓

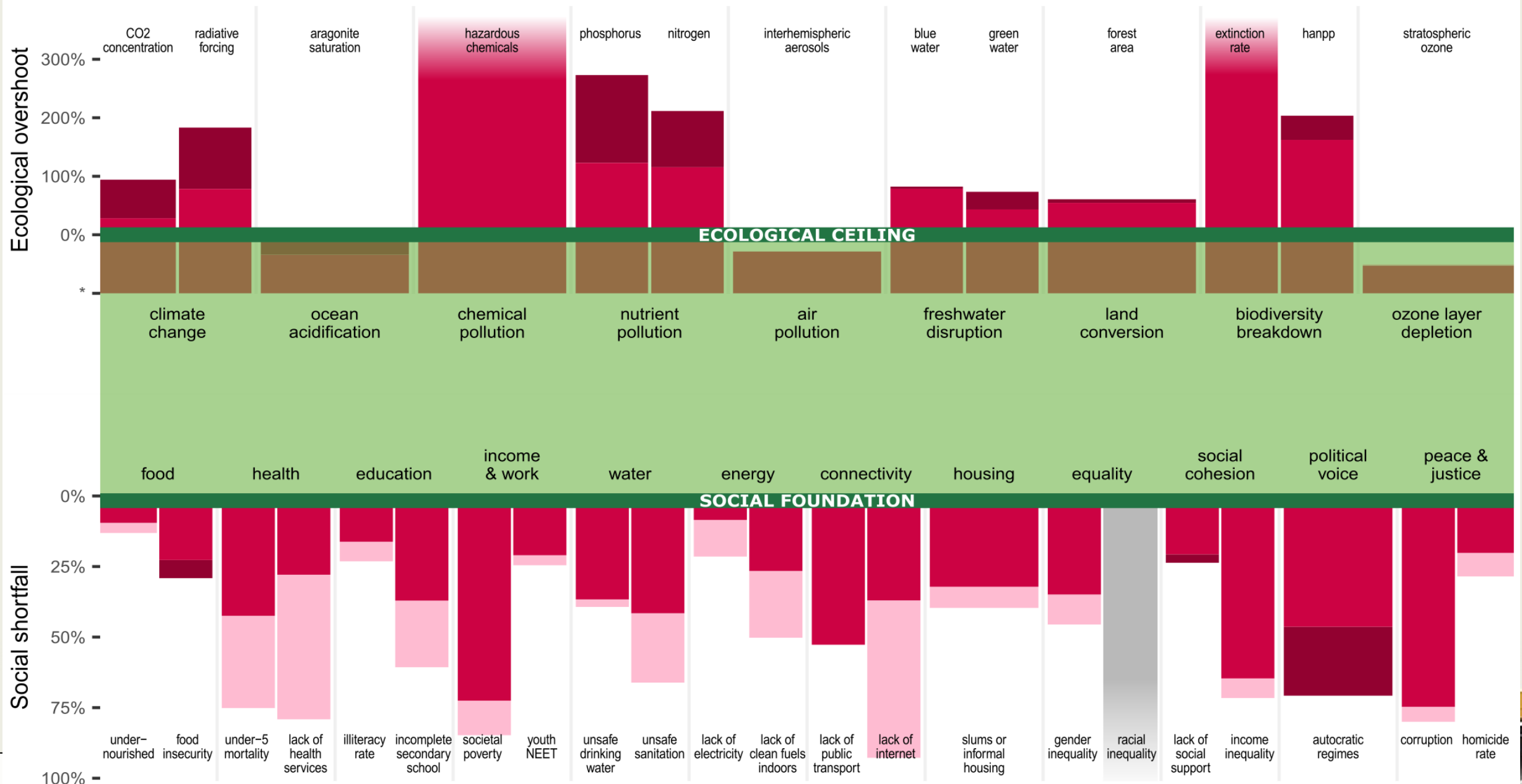
- **Doughnut economics (Kate Raworth)**
 - Social foundation
 - Ecological ceiling

“At its conceptual core, the Doughnut consists of two concentric rings: a social foundation, to ensure that no one is left falling short on life’s essentials, and an ecological ceiling, to ensure that humanity does not destabilise the life-supporting systems that sustain all life on Earth. Between these two sets of boundaries lies a doughnut-shaped space that is both ecologically safe and socially just: a space in which humanity can thrive” Kate Raworth



1. Sustainability

réf.: Doughnut Economics Action Lab ↓



2. Transitions

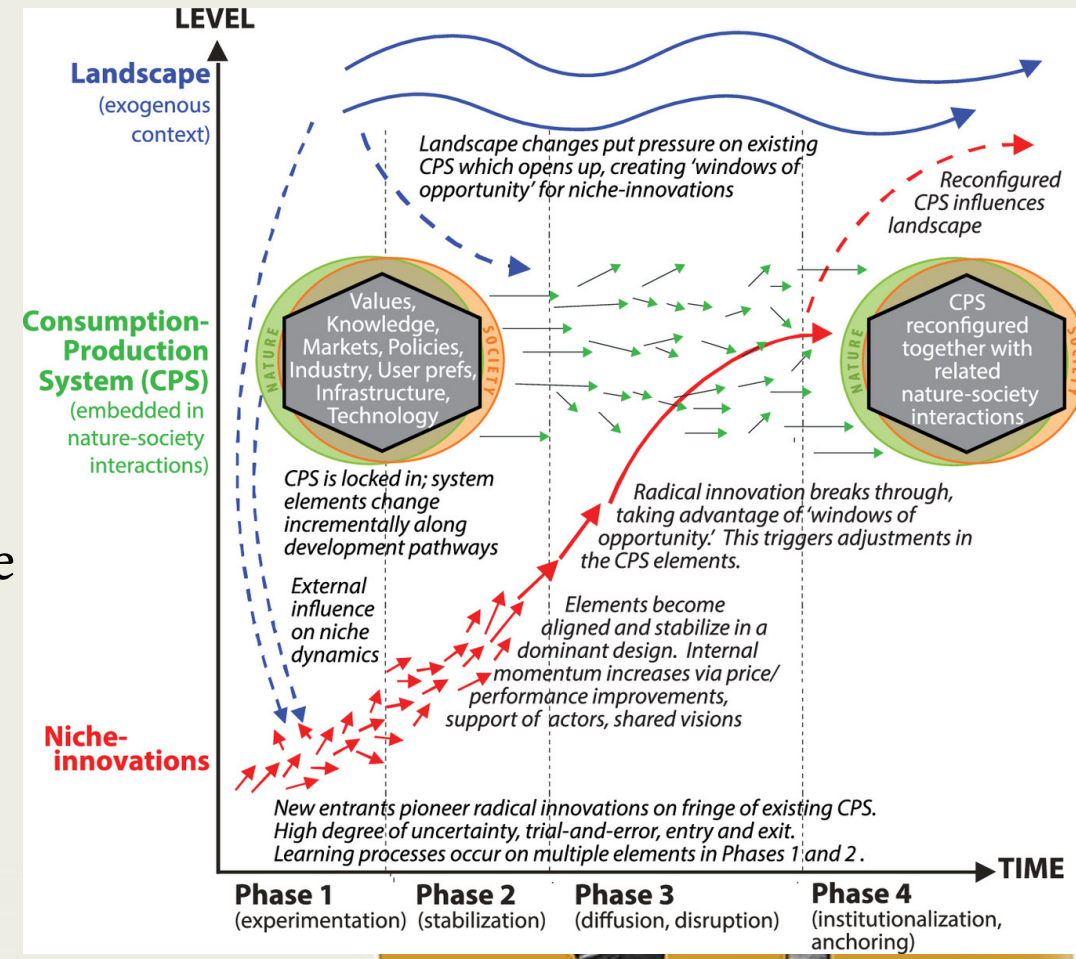


2. Transitions

• Sustainability transitions: a growing research field

- Sustainability transitions is fast growing, interdisciplinary field of research concerned with purposive, far-reaching transformation of existing sectors to achieve more sustainable modes of production and consumption (Markard et al., 2012)
- The ongoing energy transition is characterized by a high degree of uncertainty and complexity, a key role for public policy, strong vested interests and lock-in, and a variety of context-dependent transition pathways (Kern and Markard, 2016)

réf.: Geels et al., 2023 ↓

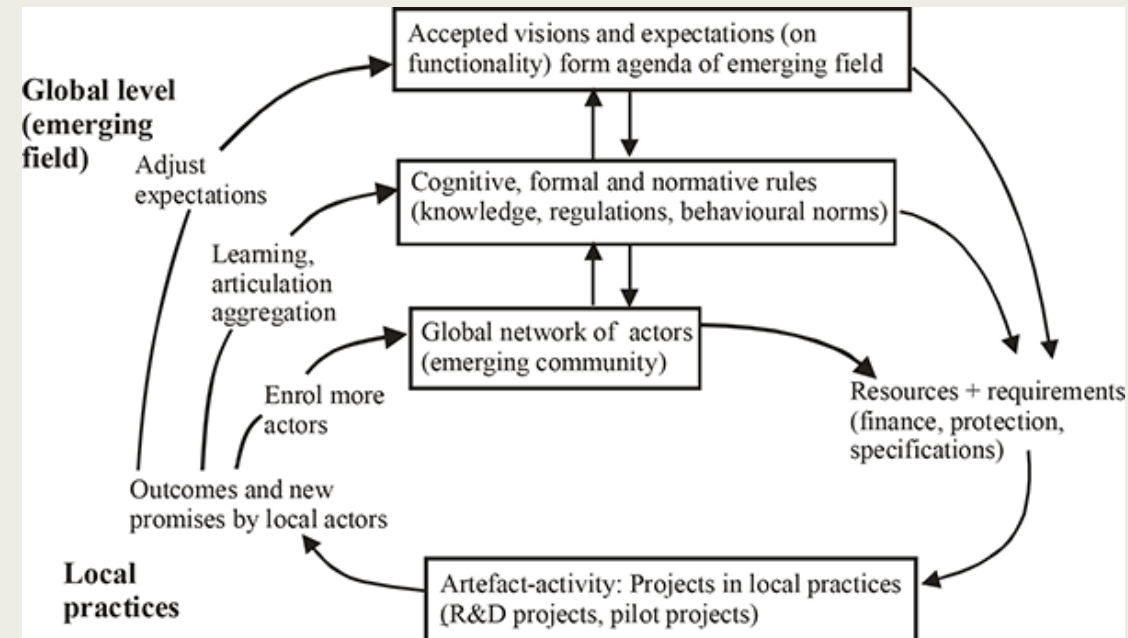


2. Transitions

• Sustainable transitions & sociotechnical systems

- Policy systems and socio-technical systems mutually influence each other. Technological change is an important factor in explaining major policy changes in the energy transition (Markard et al. 2016)
- Infrastructure sectors exhibit specific characteristics such as capital intensity, durability of assets, regulation intensity or systemness, which make them a 'special beast' for transition studies (Markard, 2011)
- <https://www.sciencedirect.com/science/article/pii/S2210422411000050>

réf.: Geels, 2018↓



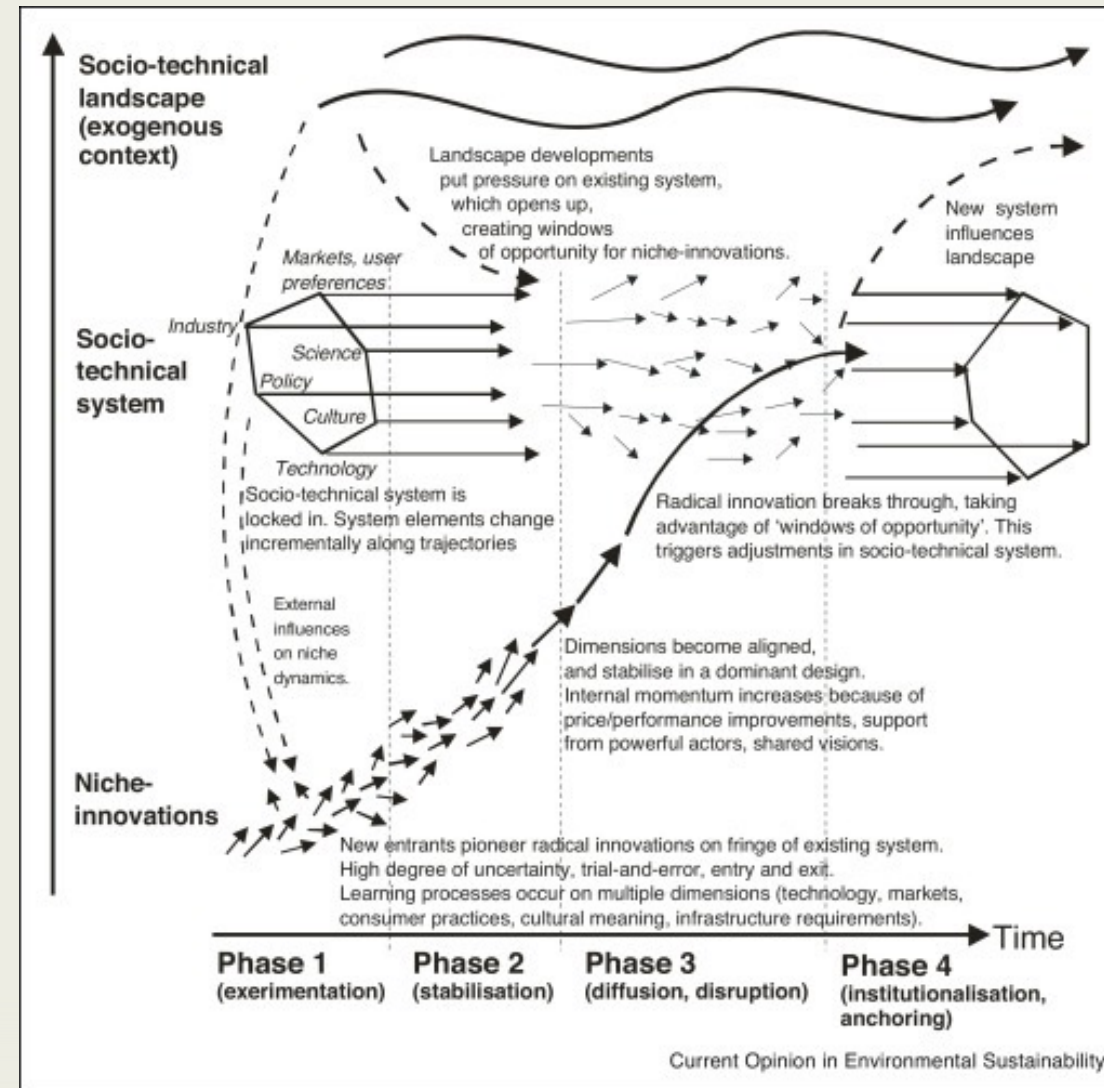
2. Transitions

réf.: Geels, 2011 ↓

The Multi-Level Perspective

- transitions as non-linear processes that result from the interplay of developments at three analytical levels:
 - niches (the locus for radical innovations)
 - socio-technical regimes (the locus of established practices and rules that stabilize existing systems)
 - an exogenous socio-technical landscape

“Since transitions are a complex and multi-faceted research topic, researchers are likely to disagree about how best to investigate them. Recognizing that scholars still debate the origins and causes of the Industrial Revolution and the French revolution, it seems unlikely that differences in the sustainability transitions community will be resolved any time soon” Frank Geels



2. Transitions

- **Transitions can happen (or not) at diff. scales, in diff. contexts**
 - At the global scale, since the last x centuries, there hasn't been an “energy transition” but rather an accumulation of energy sources
 - Actually, there are symbiotic relationships between successive energy sources: coal requires more wood for mines & railroads, oil requires more coal to make steel for wells, pipelines & cars, etc. etc.
 - The “energy transition narrative was created by proponents of nuclear fusion 50 years ago – and it's still “30 years away”...

réf.: Fressoz, 2024 ↓



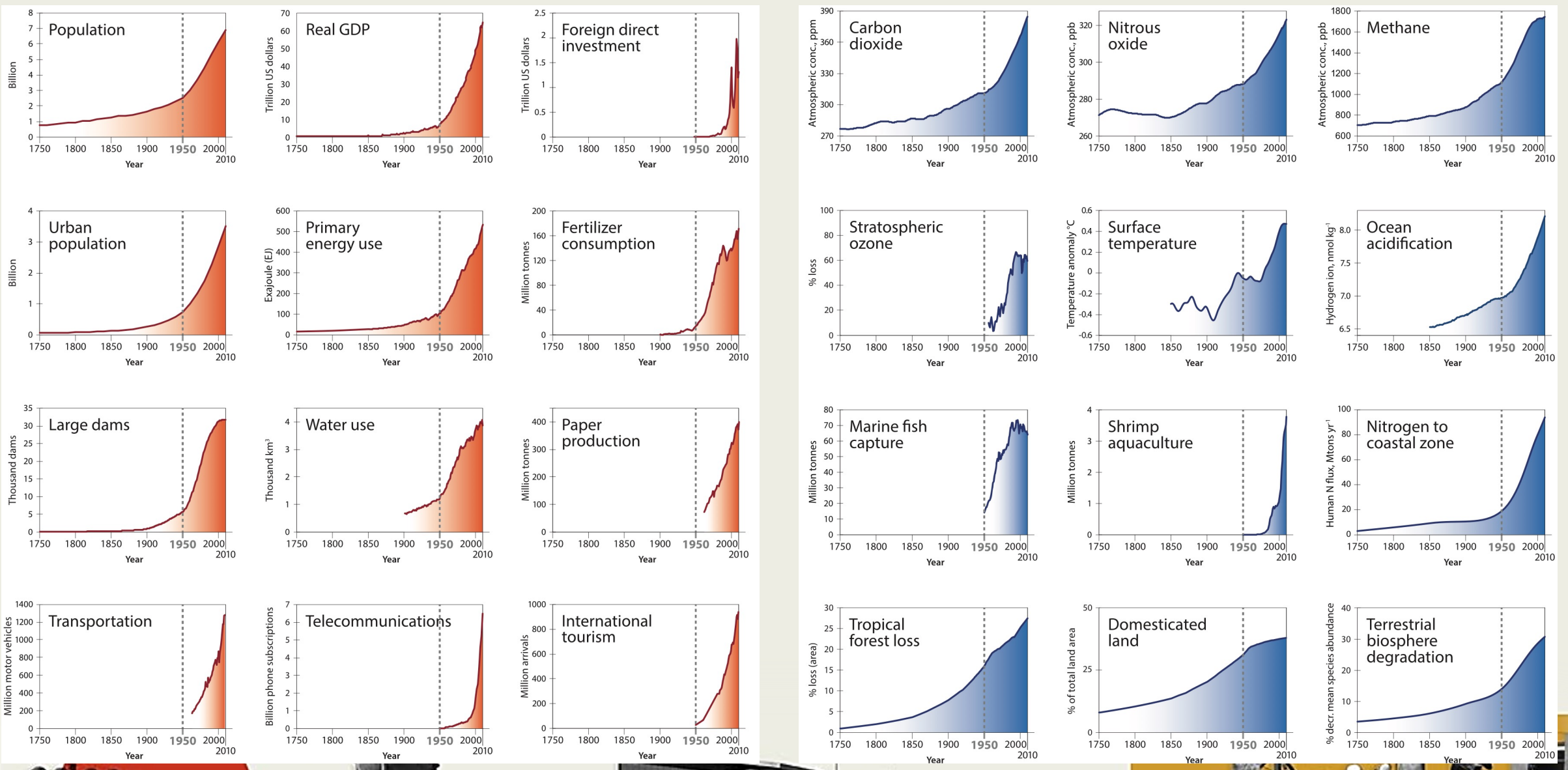
3. The Anthropocene

réf.: New York Times ↓



3. The Anthropocene

réf.: Stephens et al., 2015 ↓



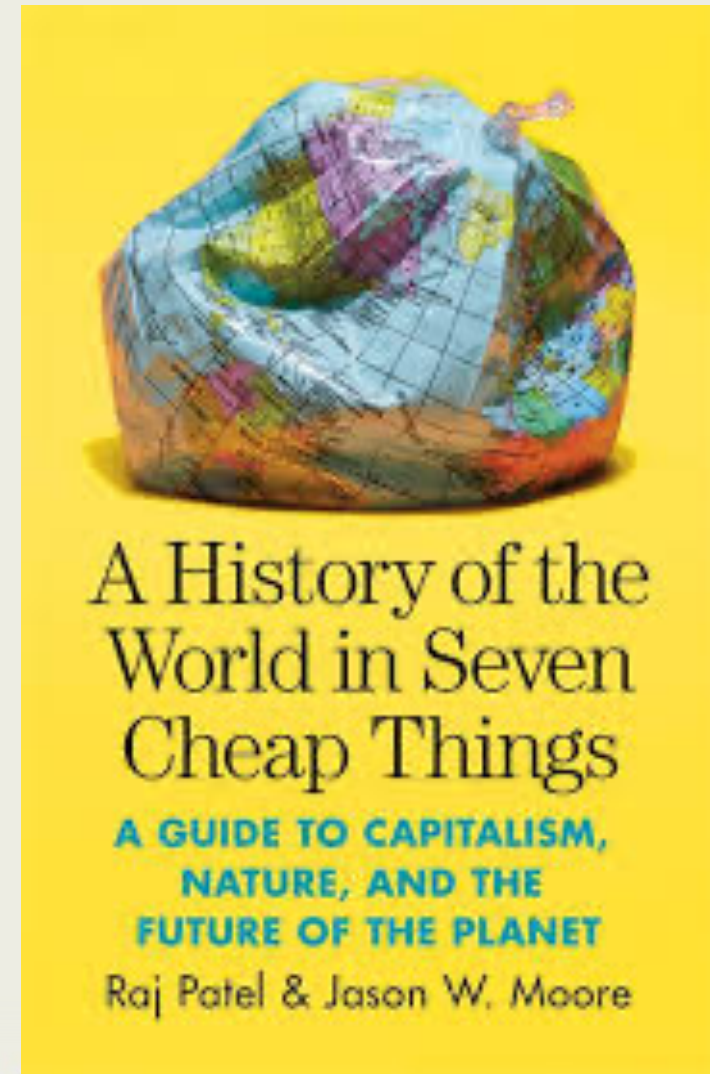
3. The Anthropocene

réf.: Verso Books↓

- **A history of the world in 7 cheap things (Patel & Moore)**

- Cheap Nature
- Cheap Money
- Cheap Work
- Cheap Care
- Cheap Food
- Cheap Energy
- Cheap Lives

“In this book, we show how the modern world has been made through seven cheap things: nature, money, work, care, food, energy, and lives. Every word in that sentence is difficult. Cheap is the opposite of a bargain—cheapening is a set of strategies to control a wider web of life. [...] We’ll explain precisely what we mean by cheap below. First we need to make the case that it’s not just some natural human behavior but rather a specific interaction between humans and the biological and physical world that has brought us to this point.”



3. The Anthropocene

- **Let's take a concrete example: *gallus gallus domesticus***
 - Any guess how many are slaughtered annually?
 - Cheap Nature
 - Cheap Work
 - Cheap Care
 - Cheap Food
 - Cheap Energy
 - Cheap Money
 - Cheap Lives

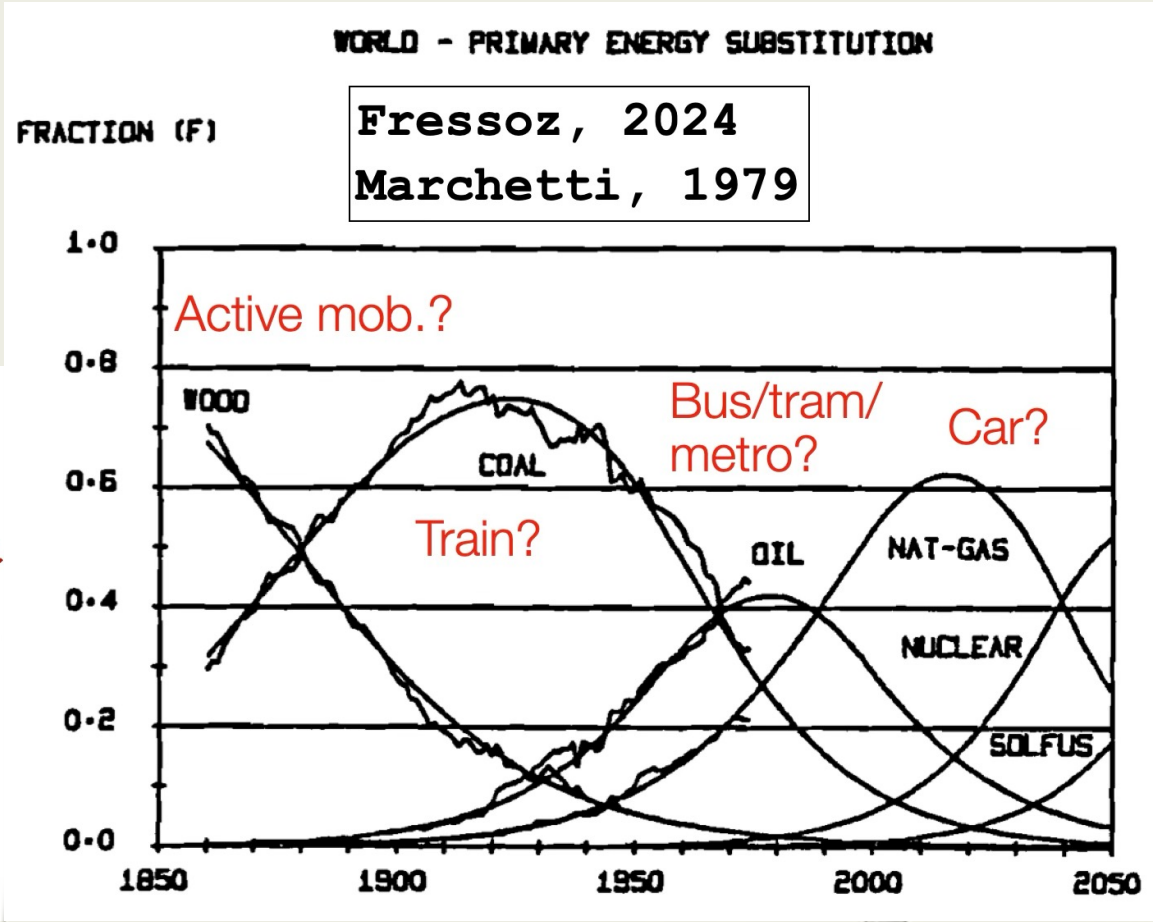
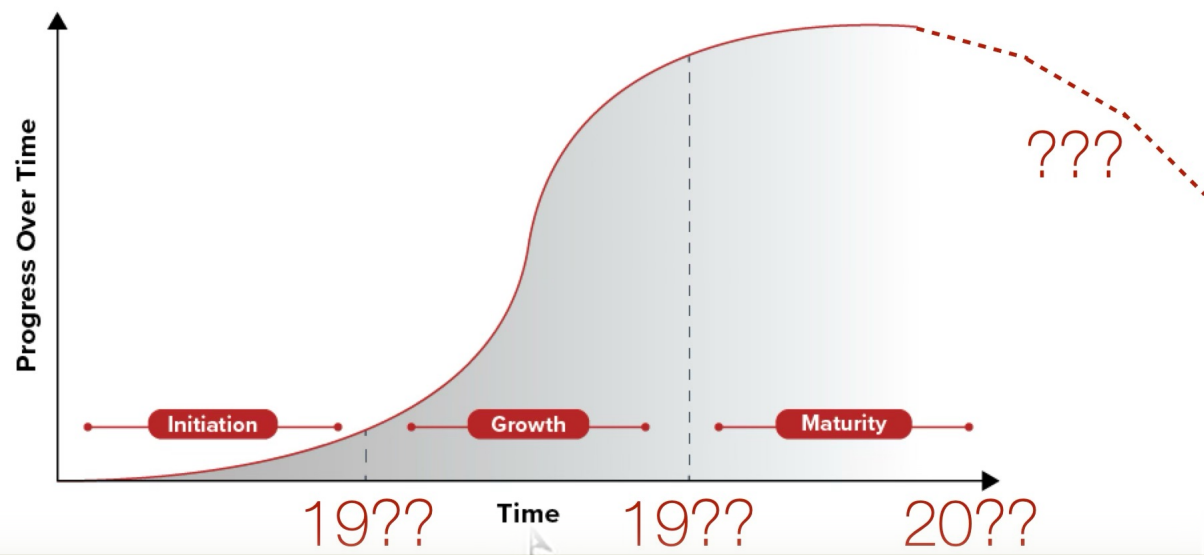
réf.: KFC↓



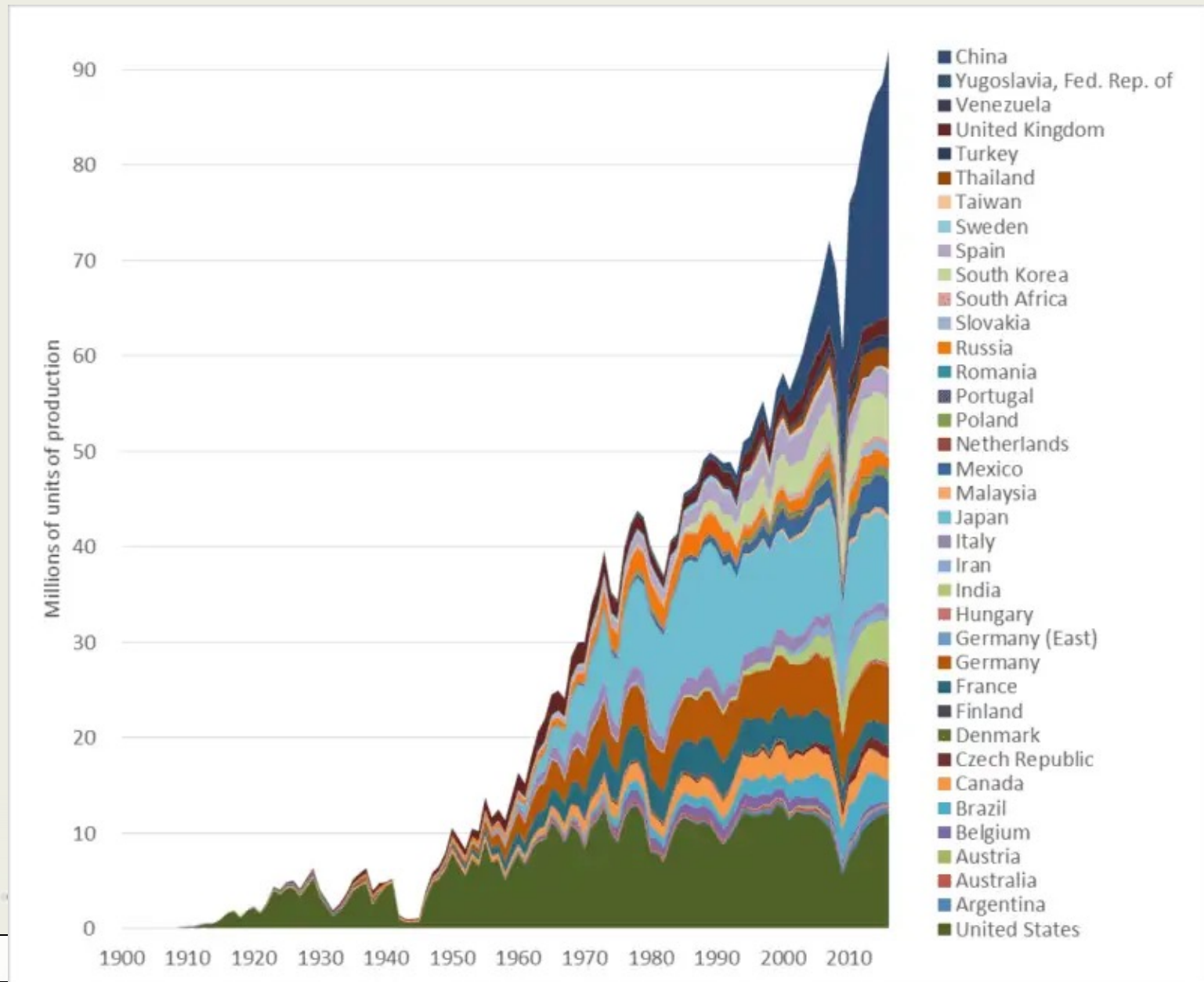
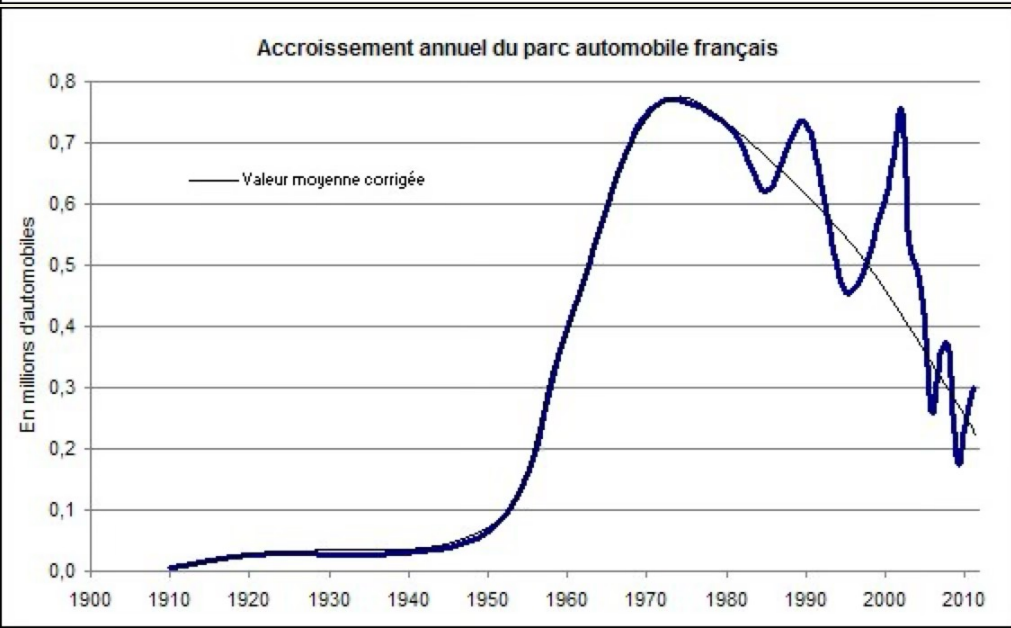
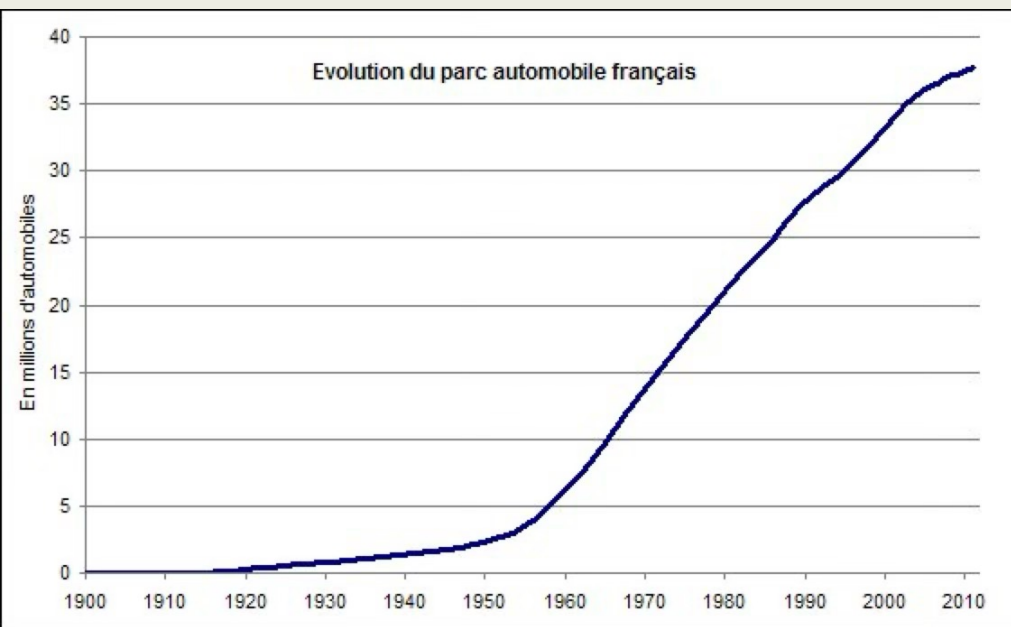
4. Applications to urban systems

The Anthropocene hits the Road

- The automobile as actor of the “great acceleration”
- Analyzing 50 years of travel surveys in Switzerland



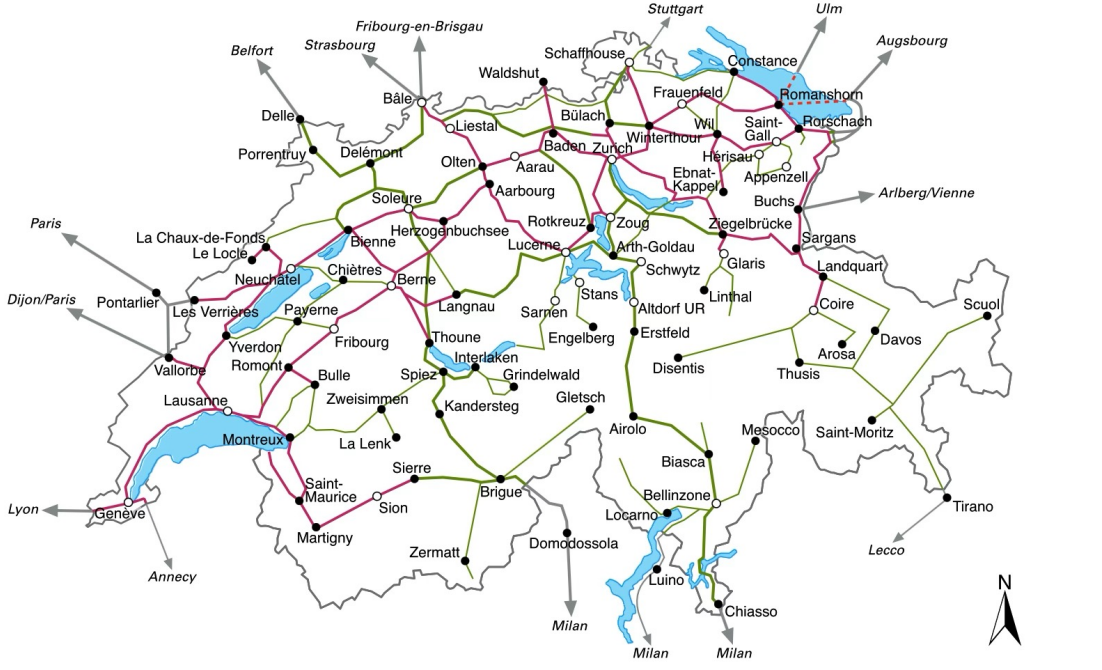
4. Applications to urban systems



4. Applications to urban systems

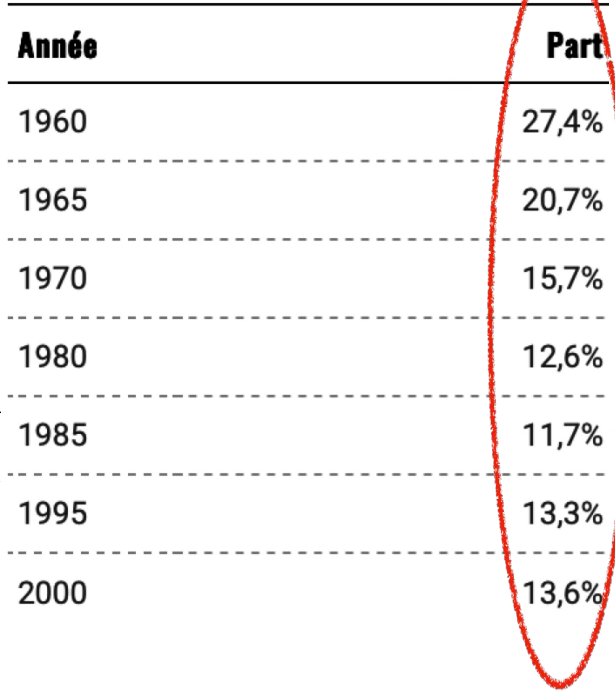
What about infrastructure networks? The case of Switzerland

Développement du réseau des chemins de fer en Suisse jusqu'en 1914

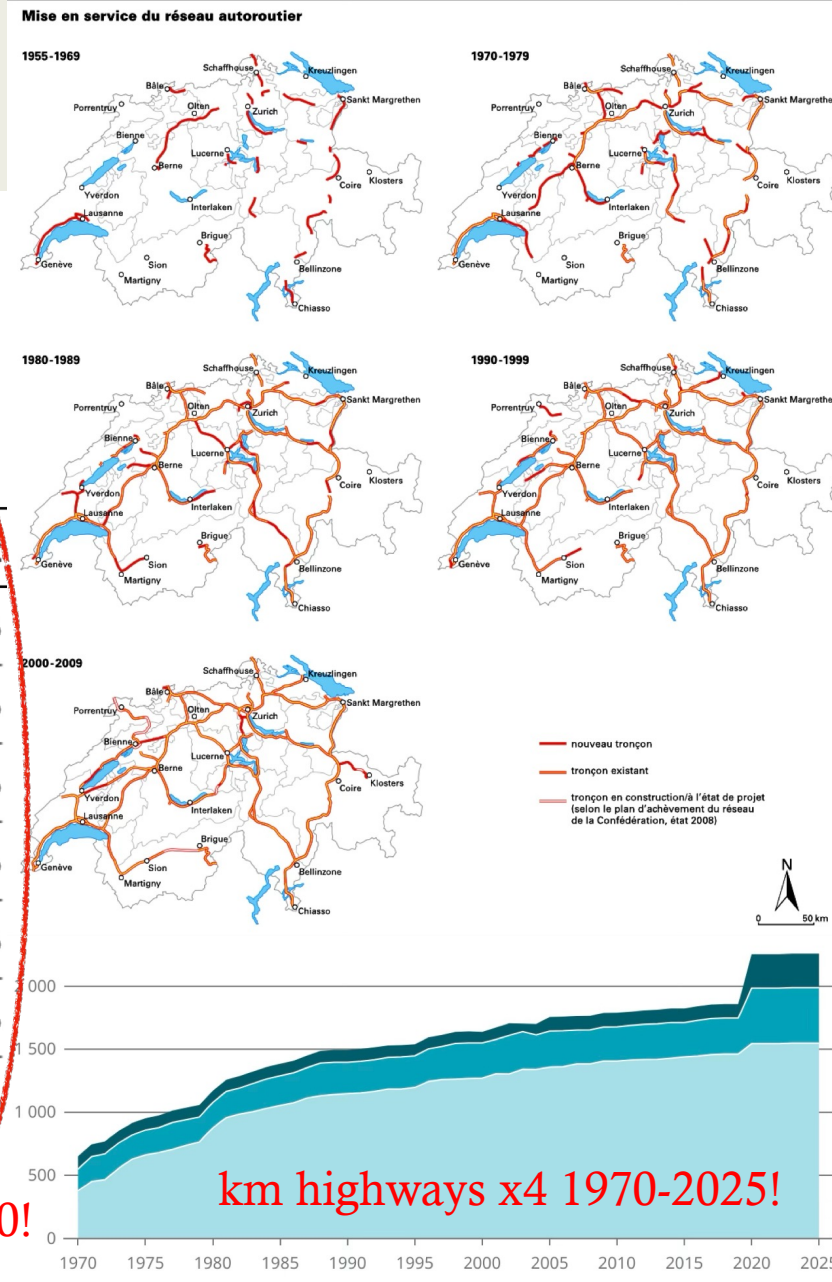


km de chemins de fer	1900	1942/47	1975	1995
CFF	-	ca. 3 503	2 933	3 007
Chemins de fer privés	3 789	2 297	2 043	2 038
<i>dont à voie normale</i>	3 186	777	- ^B	725
<i>dont à voie étroite</i>	603	1 520	- ^B	1 313
total	3 789	ca. 5 800	4 976	5 045

Part des chemins de fer dans les transports de personnes 1960-2000^A



Train mode share/2 1960-2000!
^A En kilomètres-voyageurs



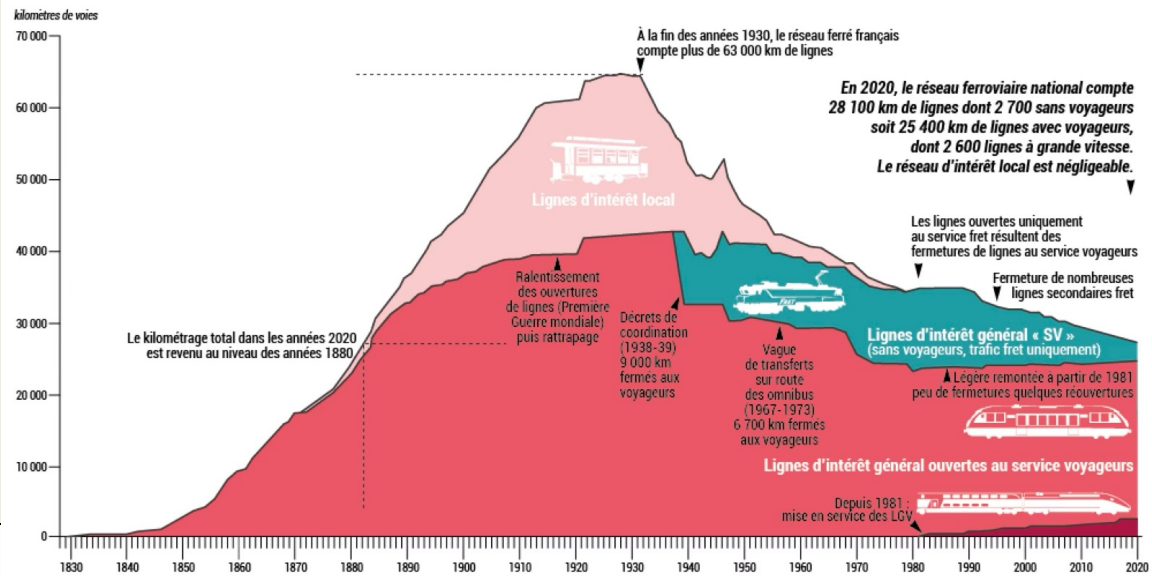
4. Applications to urban systems

Railway network in France

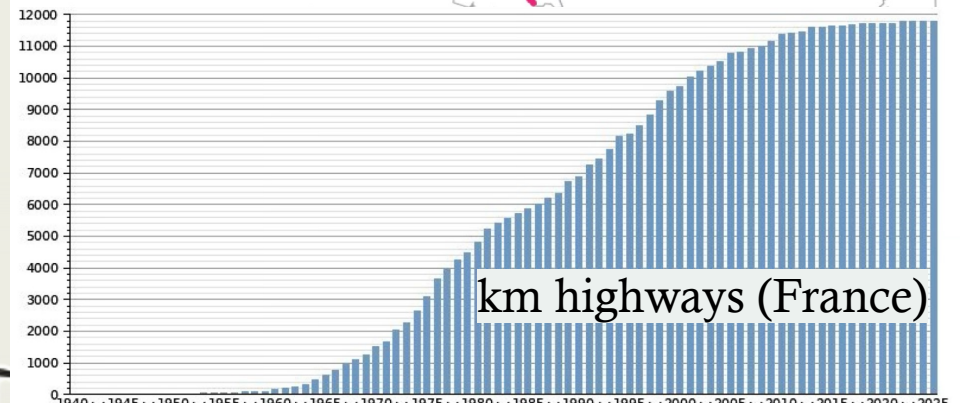
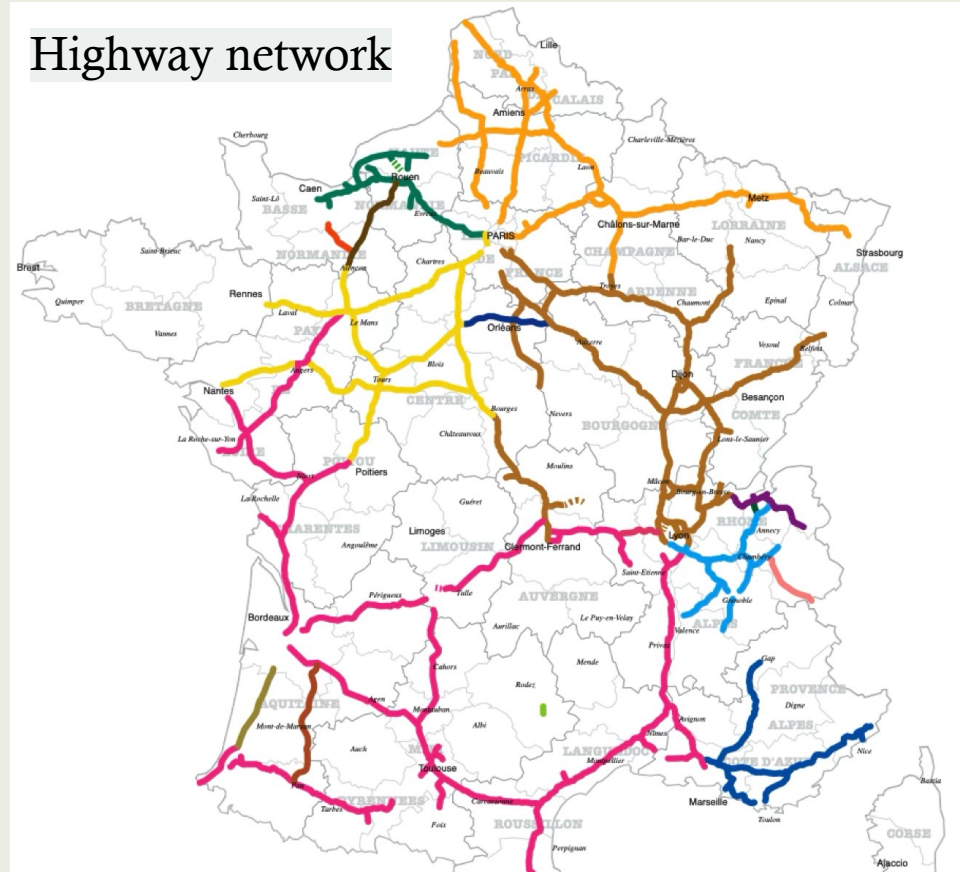
1930



2014



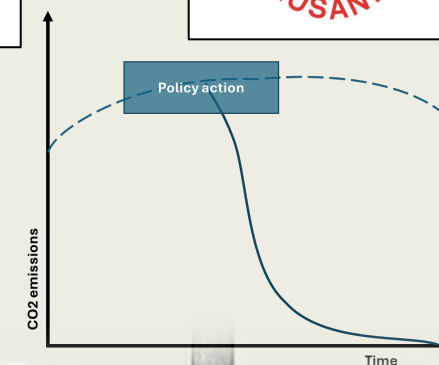
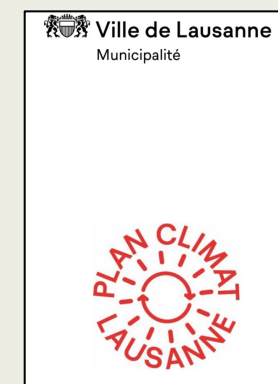
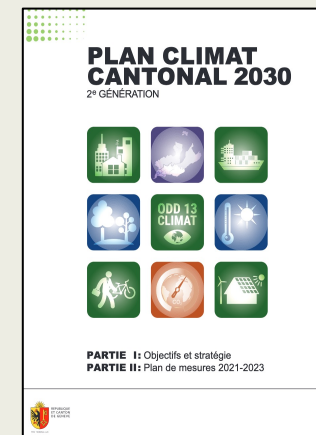
Highway network



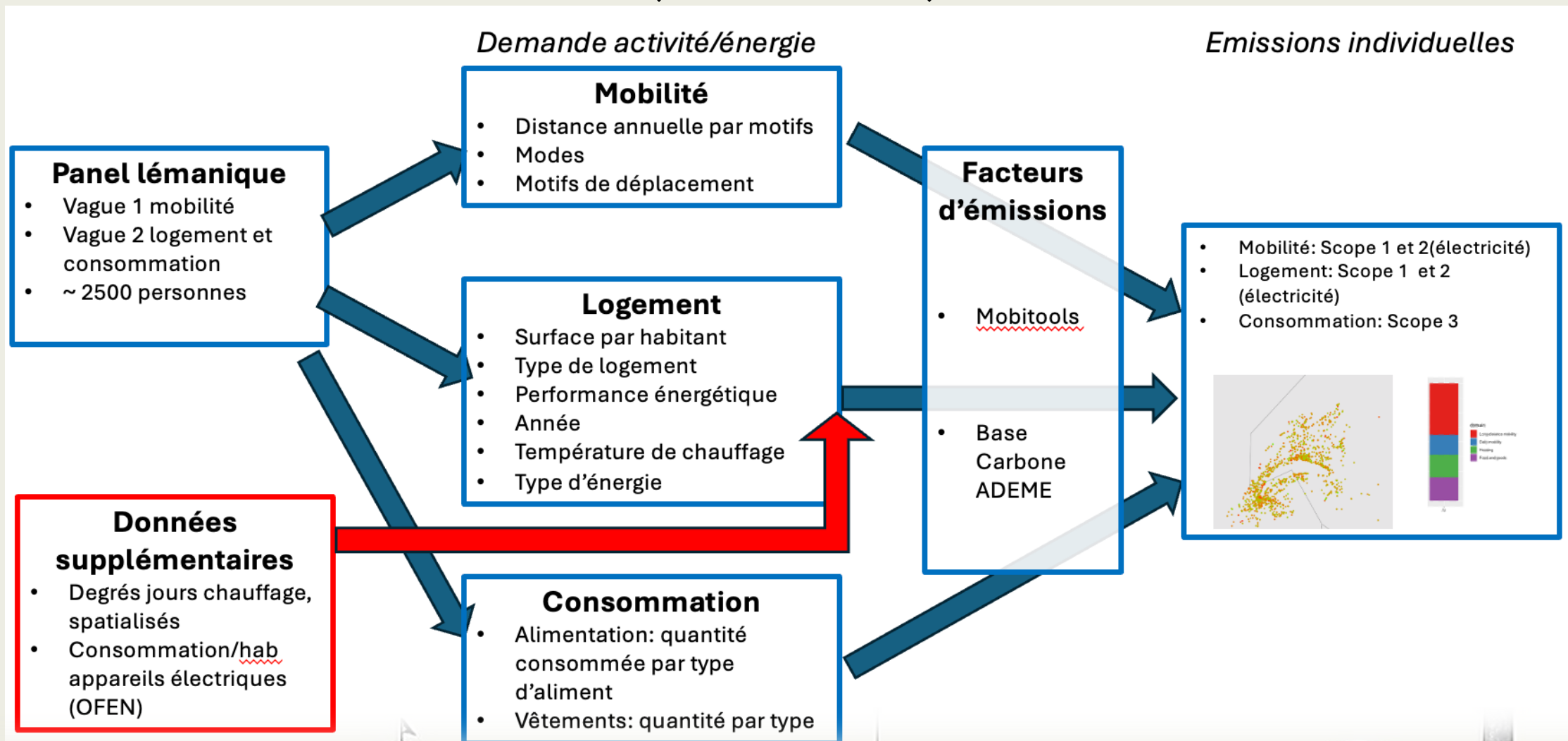
4. Applications to urban systems

- **CROSS LOCAL project leveraging Panel Lémanique data**

- 50 % : Emission cuts envisioned for 2050
- Local institutions needs to take action
- 25 % : « Critical mass » required to initiate massive change
- Socio-economics systems are non linear and require targeted actions
- 67 % : Emissions associated to households' decisions
- Households and buildings as a relevant target for action
- Q1. How are emissions distributed among the various housing contexts ?
- Q2. What are the « tipping interventions » and « optimal » targets that would allow a rapid change ?

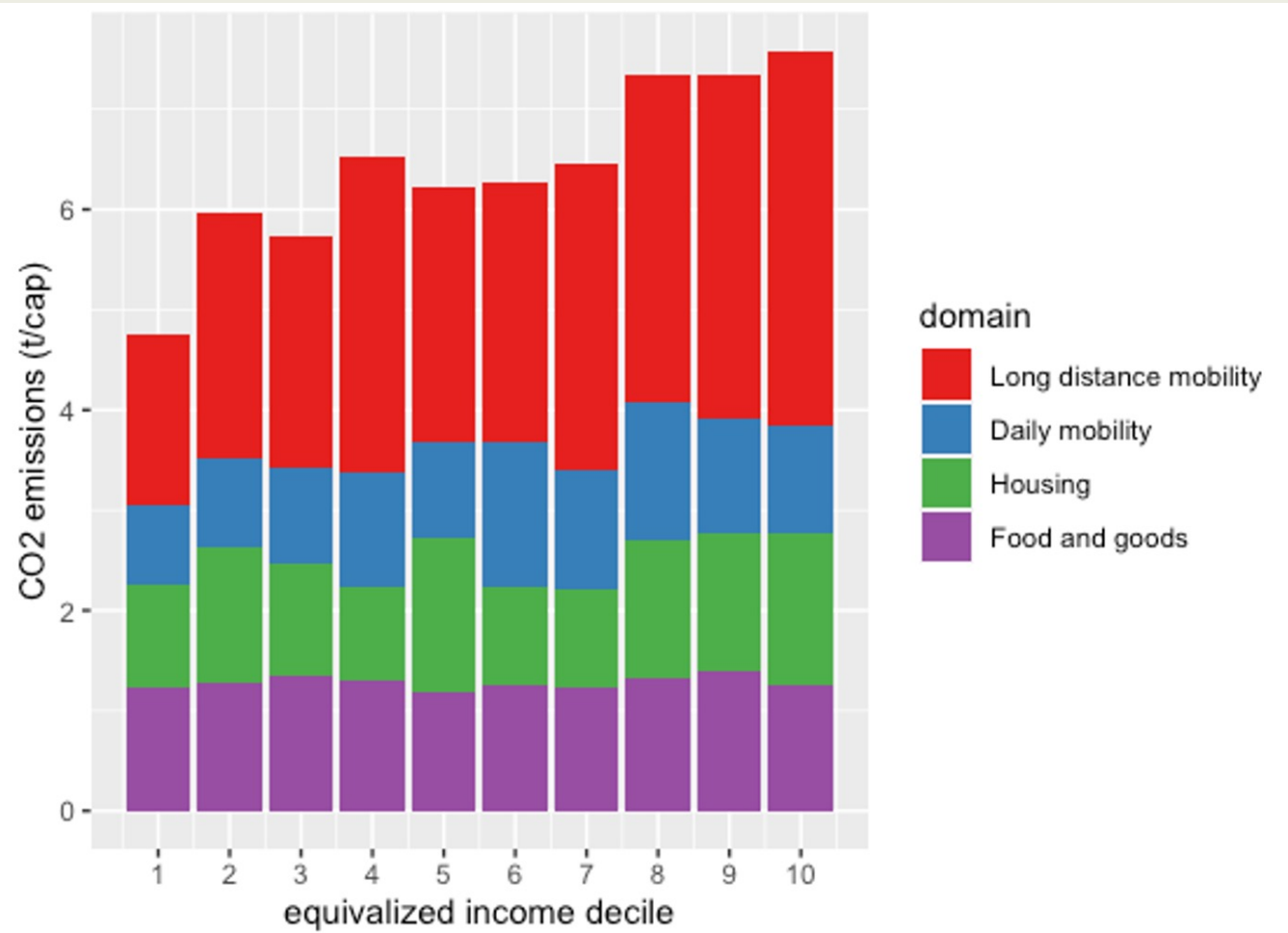
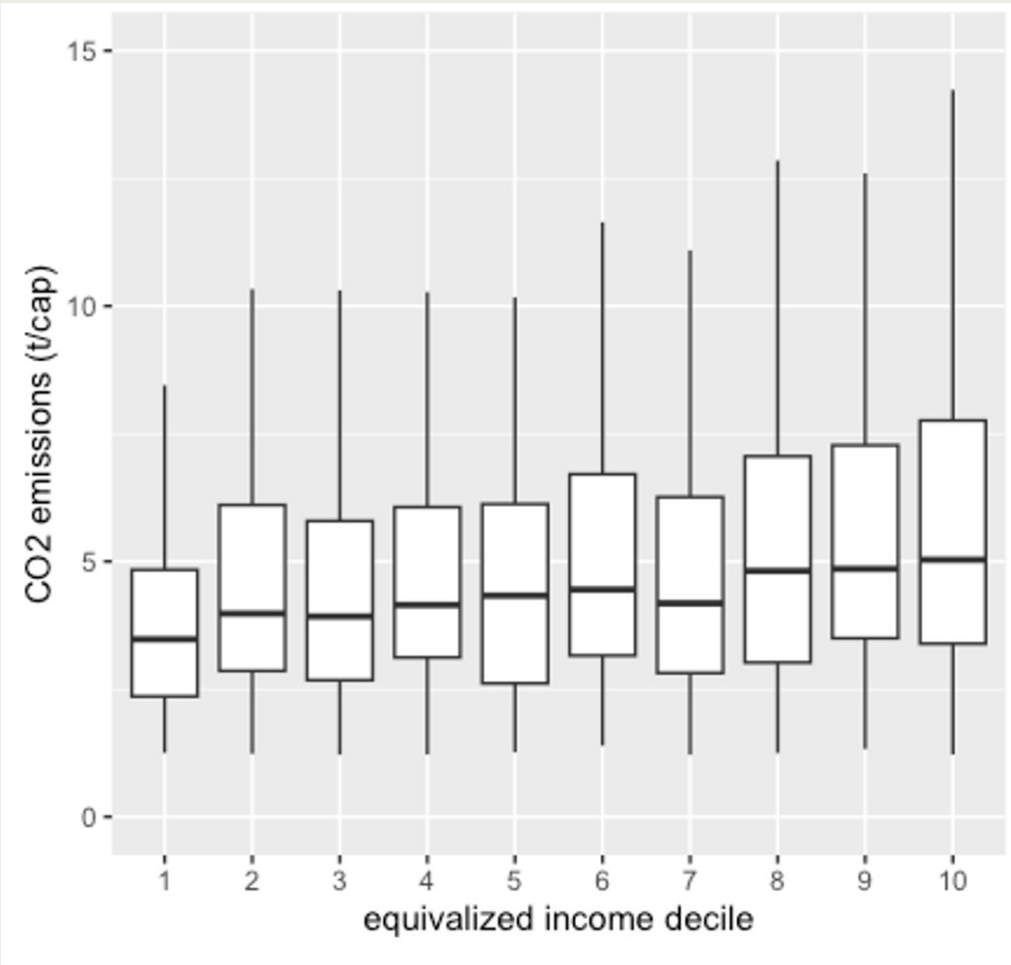


4. Applications to urban systems



réf.: Drevon et al., 2024 ↑

4. Applications to urban systems

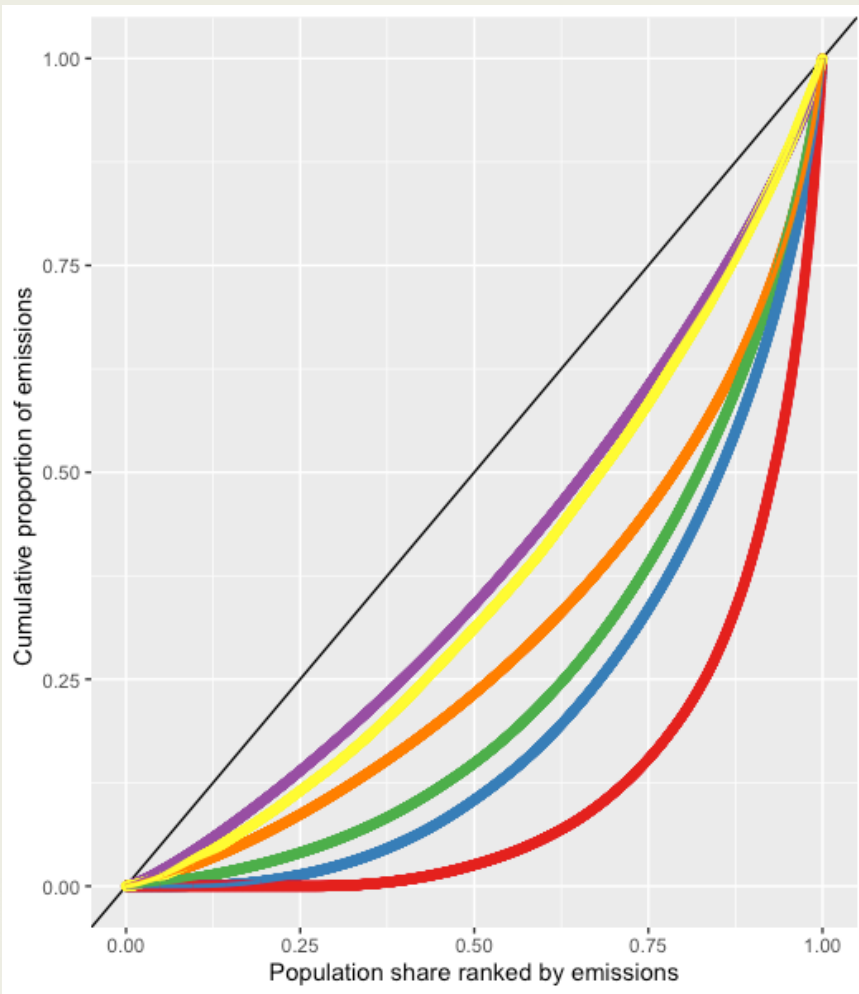


réf.: Drevon et al., 2024 ↑

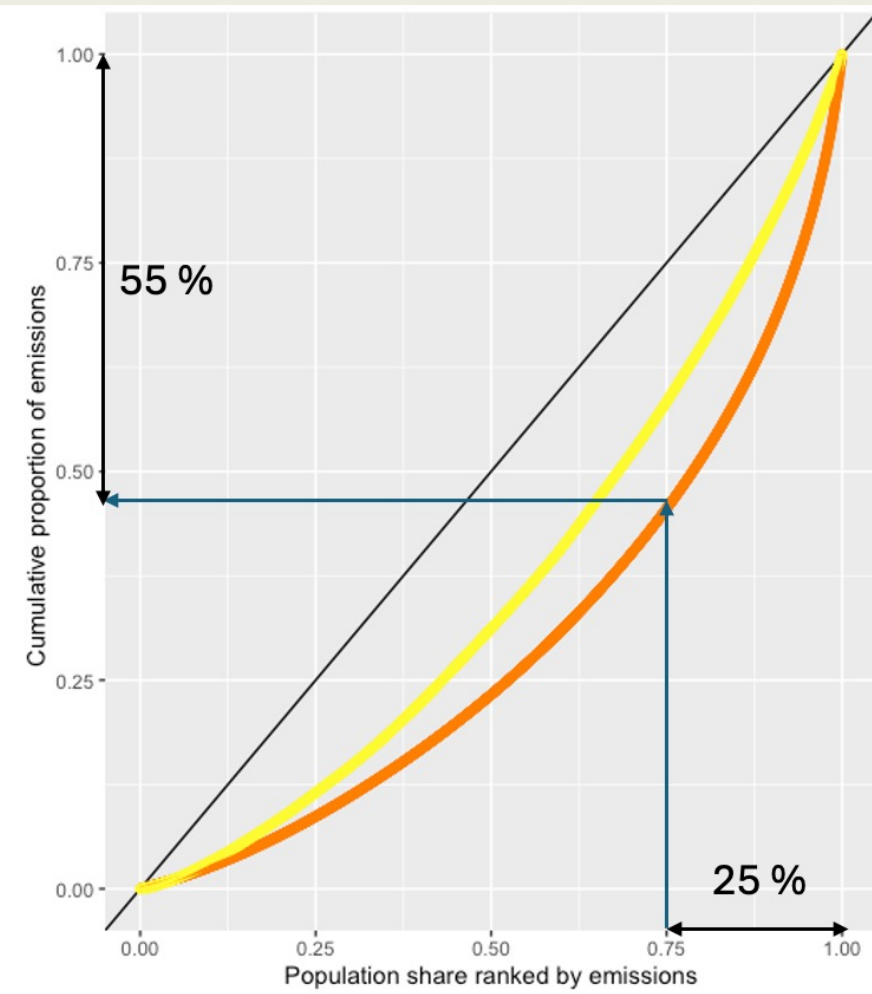


4. Applications to urban systems

- **CO2 emissions increase non-linearly with income!**



- Long distance mobility
 - Daily mobility
 - Housing
 - Food and goods
 - All
 - Equalized income



Domain/Cluster	GINI
Long distance mobility	0.76
Daily mobility	0.58
Housing	0.51
Food and goods	0.23
All	0.41

- All
 - Equalized income

réf.: Drevon et al., 2024 ↑

Conclusion

réf.: Activists perform the death of fossil fuels on the sidelines of the Cop30 in Belém, Brazil. Photograph: Pablo Porciúncula / AFP / Getty Image ↓

- **Sustainability transitions**
 - Doughnut economics
 - Transitions? What transitions?
 - Living in the Anthropocene
- **Where do we go from here?**



Schedule & assessment

- **Do we keep the schedule as is (class next week 1.12, atelier following week 8.12), or do we flip those two sessions (atelier 1.12, class 8.12) ahead of final presentations on 15/12?**
 - How much support from our side do you need for your respective projects?
 - Do you feel like your group is on track and that you can deliver by 15/12?
- **Reminder on assessment formats → deadlines TBD: 10.01.26 & 31.01.26**
 - Research note (collective, 1 per group, 4-6 pages): 40% of final grade
 - Mid-term and final presentations: 10% and 30% of final grade respectively
 - Personal critical reflection (max. 2 pages): 20% of final grade