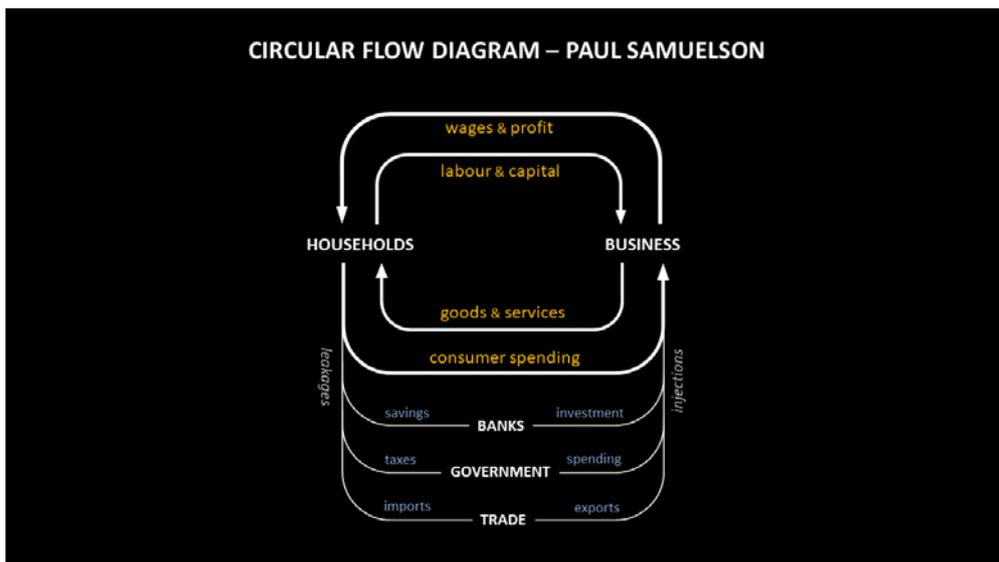


FRAMING THE GLOBAL CRISIS

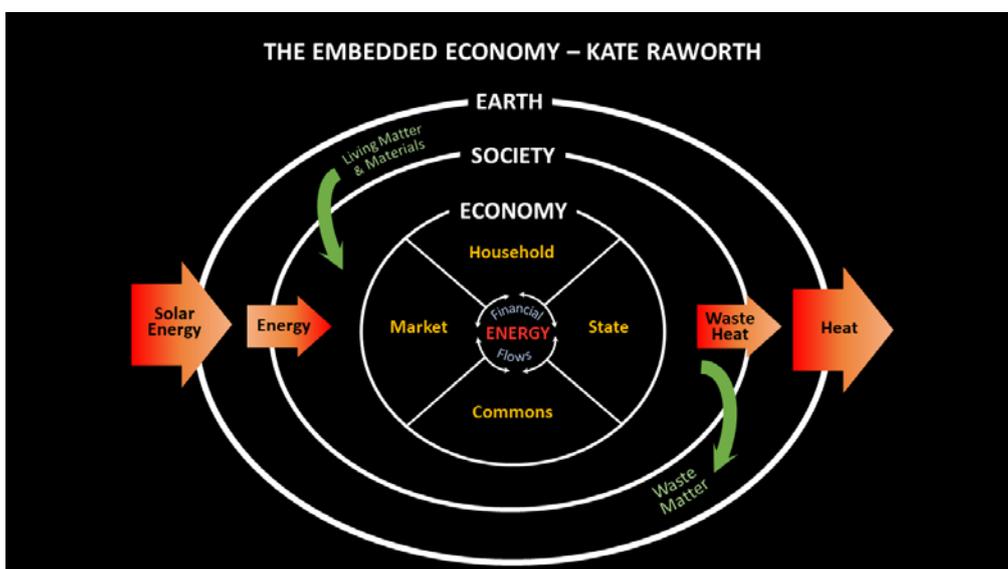
INTEGRATING ECOLOGICAL AND ECONOMIC CHANGE

MARK ROTHERHAM

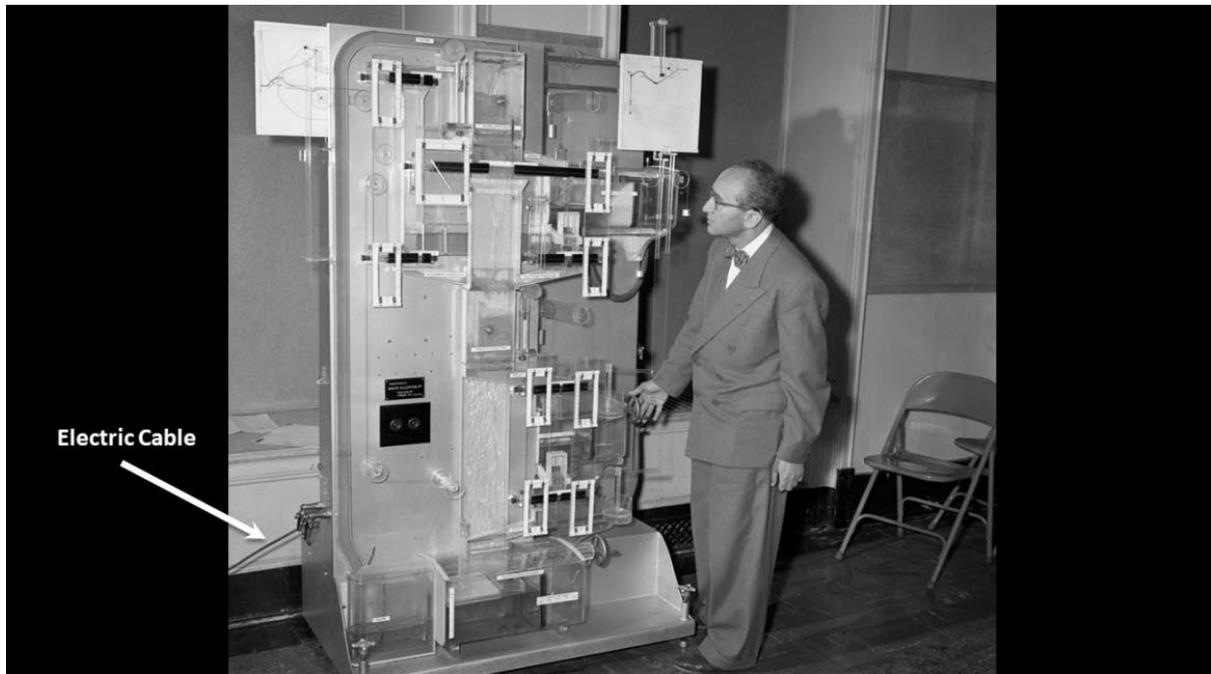
Paul Samuelson is regarded as the founder of modern economics. In 1947 he drew its defining diagram (below). Instead of using mathematics to show financial transactions in relation to various components of the economy his Circular Flow diagram was based on the metaphor of water flowing through plumbed pipes.



The Embedded Economy (below) shows the Earth as source and sink for all the matter and energy we consume. Building on the work of Herman Daly, one of the founders of ecological economics, economist Kate Raworth has redrawn Samuelson's diagram to show the economy embedded within society and that both the economy and society are subsets of the larger Earth system.



In 1948 engineer turned economist Bill Phillips (pictured below) constructed a hydraulic machine of Samuelson's Circular Flow diagram. His MONIAC (Monetary National Income Analogue Computer) consists of a series of transparent tanks that fill and overflow with pink water to simulate financial flows through the economy. Nobody noticed that MONIAC would not work unless you first plugged it into the electric supply. Ultimately, it is energy that makes 'the world go around,' not money.



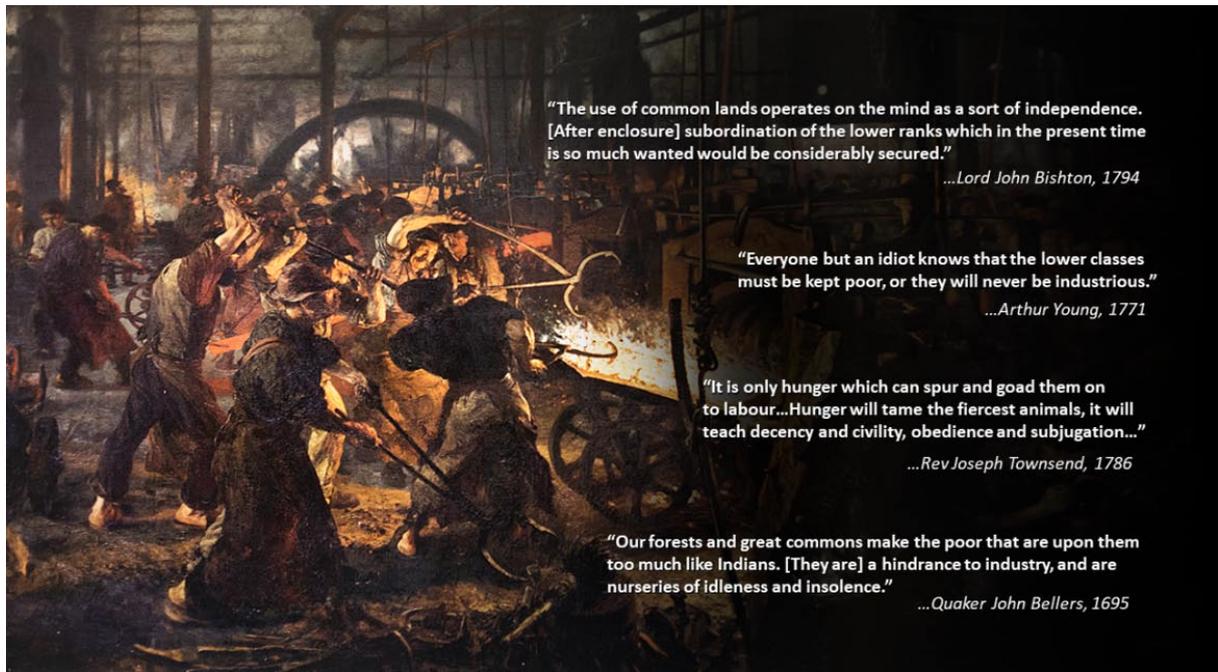
When we talk about power it can have various meanings. The power pyramid is the classic vertical power structure with the ruling class at the top and slaves at the bottom:

FORMS OF POWER

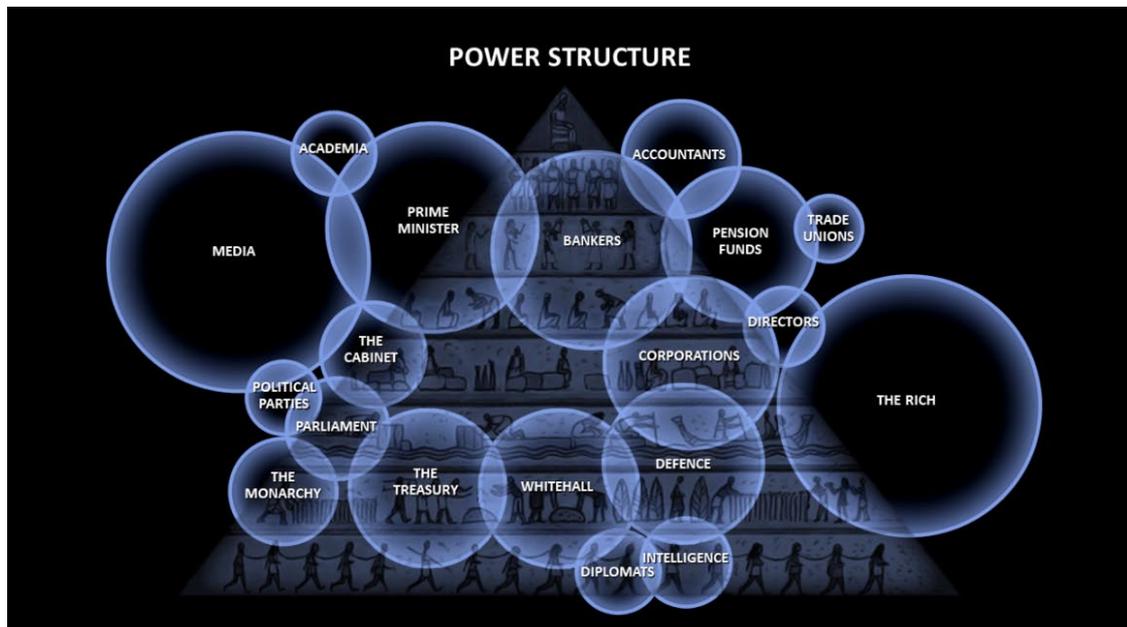
1. **PHYSICS:** The rate of energy transfer (measured in watts)
2. **NATURE:** The ability to do something
3. **SOCIAL POWER:** The ability to get other people to do something:
 - a. *Horizontal Social Power*
 - b. *Vertical Social Power*

A pyramid diagram illustrating social power. The pyramid is divided into horizontal layers, each containing a different group of people. The top layer is the smallest and contains a single figure. The bottom layer is the largest and contains many figures. The layers represent different levels of social hierarchy, from the ruling class at the top to slaves at the bottom.

The ruling class used immense violence to force people living in subsistence communities to become wage dependent industrial workers:

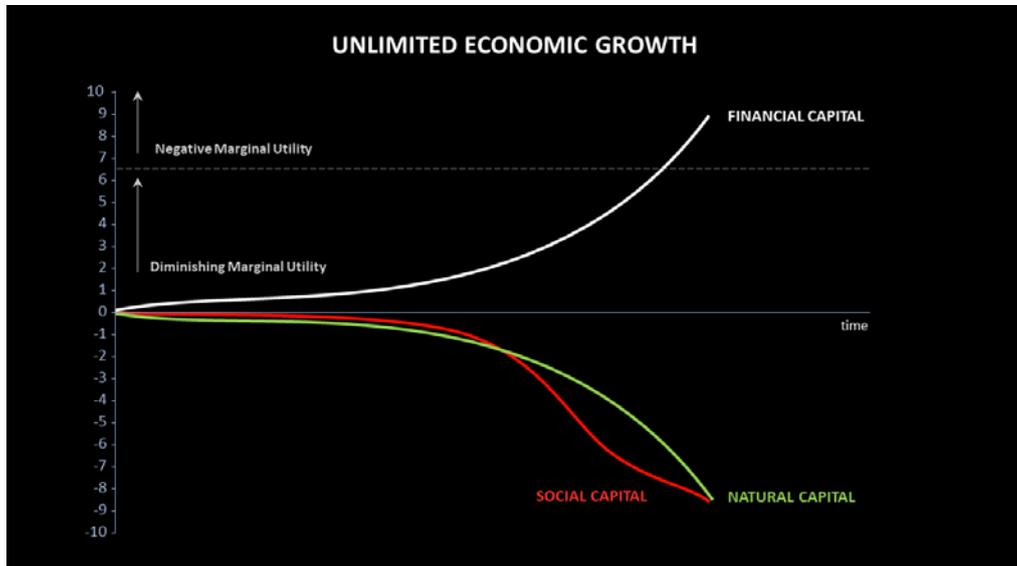


Today's power structure is more complex, consisting of overlapping interests among various actors in the political-economy. It is however still a vertical power structure with the financial interests of a wealth elite at the top of the hierarchy.

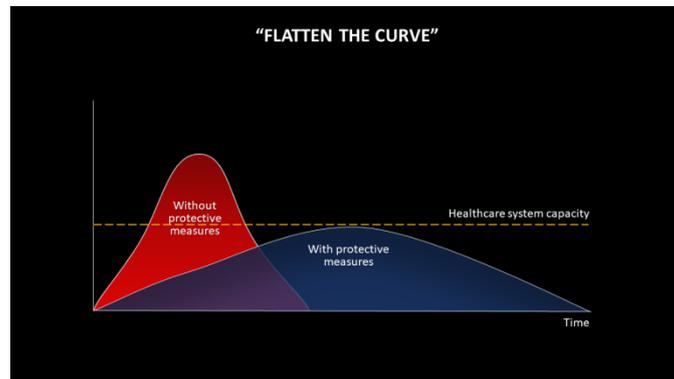


Commercial banks create money from nothing each time they issue a loan. This money enters the economy as an interest bearing debt, forcing the economy to either grow or collapse. Monetary reform is therefore fundamental to ecological economics.

Herman Daly considers GDP just as likely to be a measure of 'illth' as a measure of wealth. Costs to nature and society are considered 'externalities' and therefore not subtracted from GDP, which itself is subject to diminishing returns to the point where economic growth becomes counterproductive.



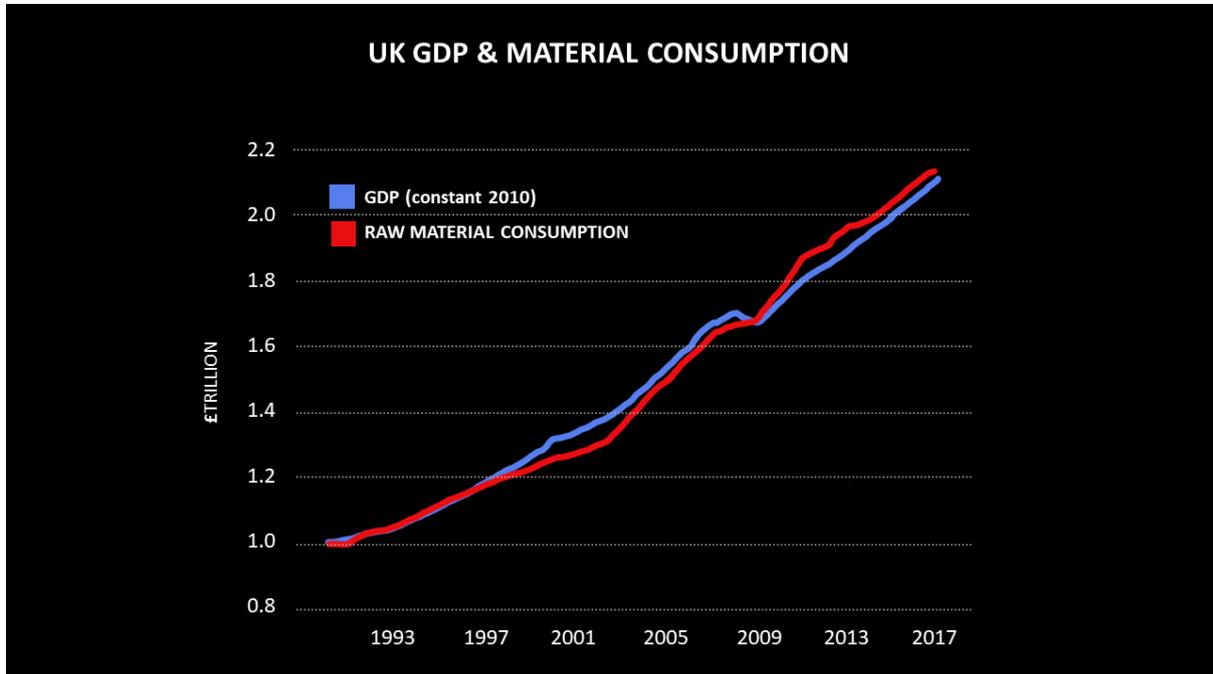
We have all been introduced to systems thinking with the slogan 'Flatten the curve':



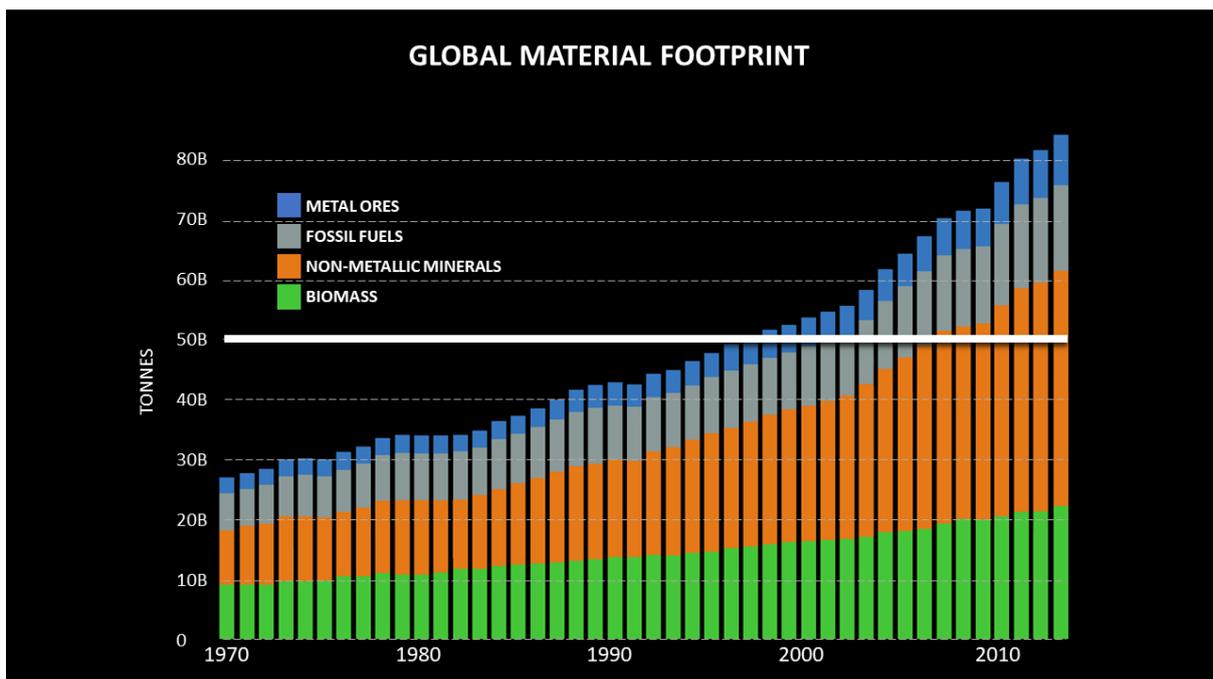
The Great Acceleration took off in the 1950s. There are lots of curves we need to flatten to bring our economy back within planetary boundaries:



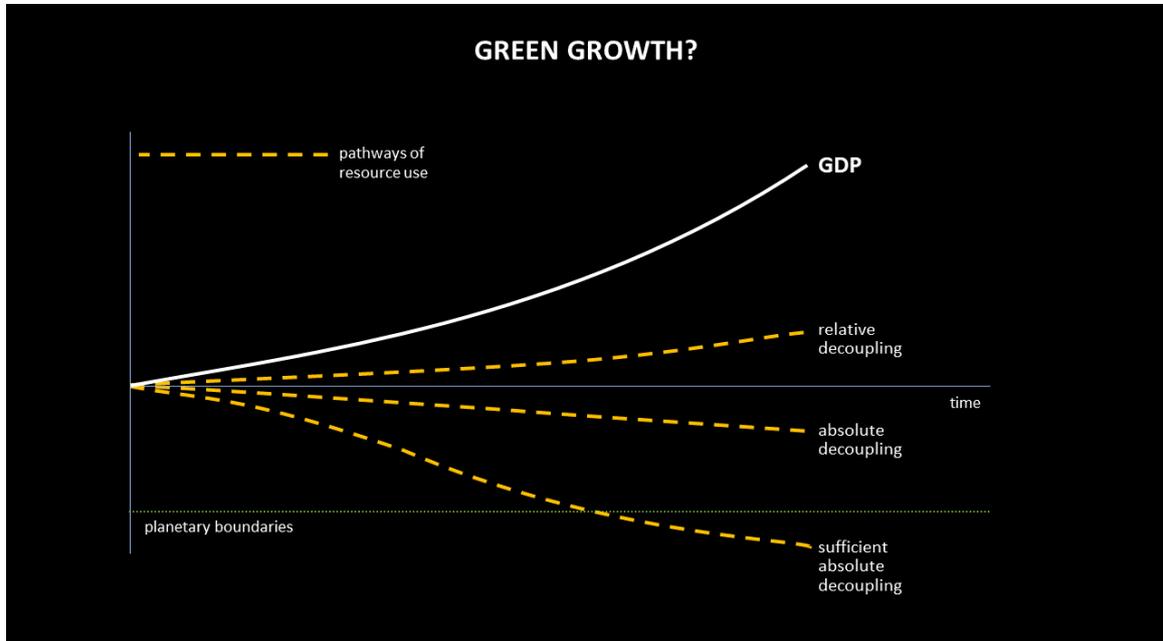
Looking ahead to COP26 UK Prime Minister Boris Johnson will assert that we can "Have cake, eat" meaning that we can grow the economy and reduce carbon emissions. This assertion however does not take account of emissions from embodied energy in material consumption which has remained tightly coupled with, and since 2008 even exceeded, GDP growth (shown below).



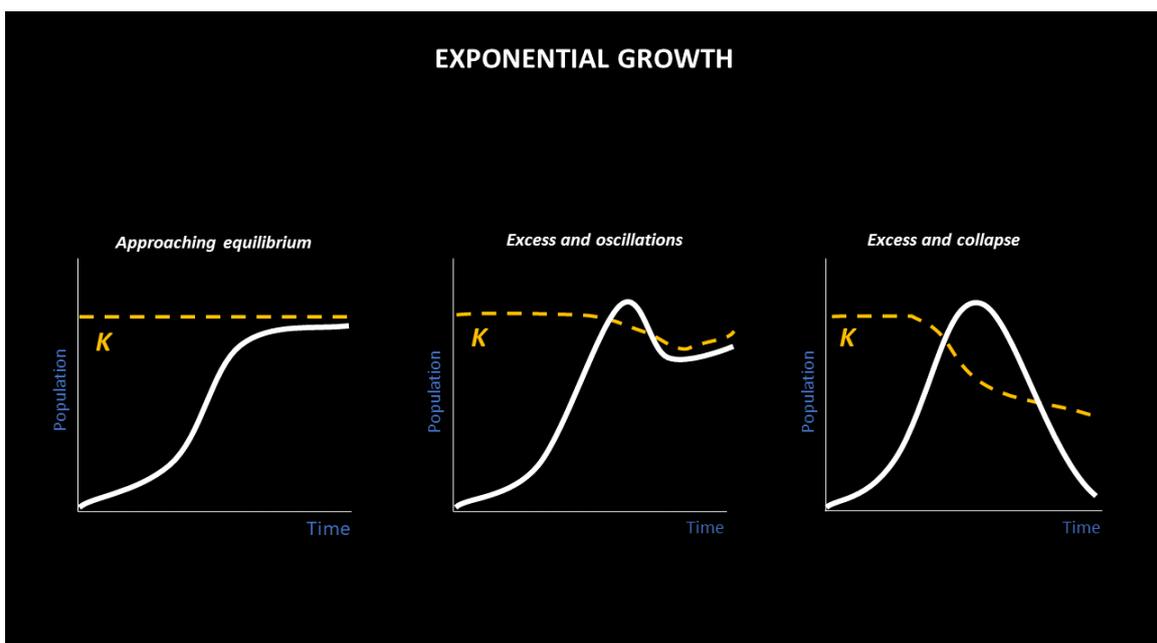
Global material footprint trebled from 1970 - 2015. In 2020 the world economy consumed 100.6 billion tonnes of raw materials - double the sustainable level of 50B tonnes (shown below).



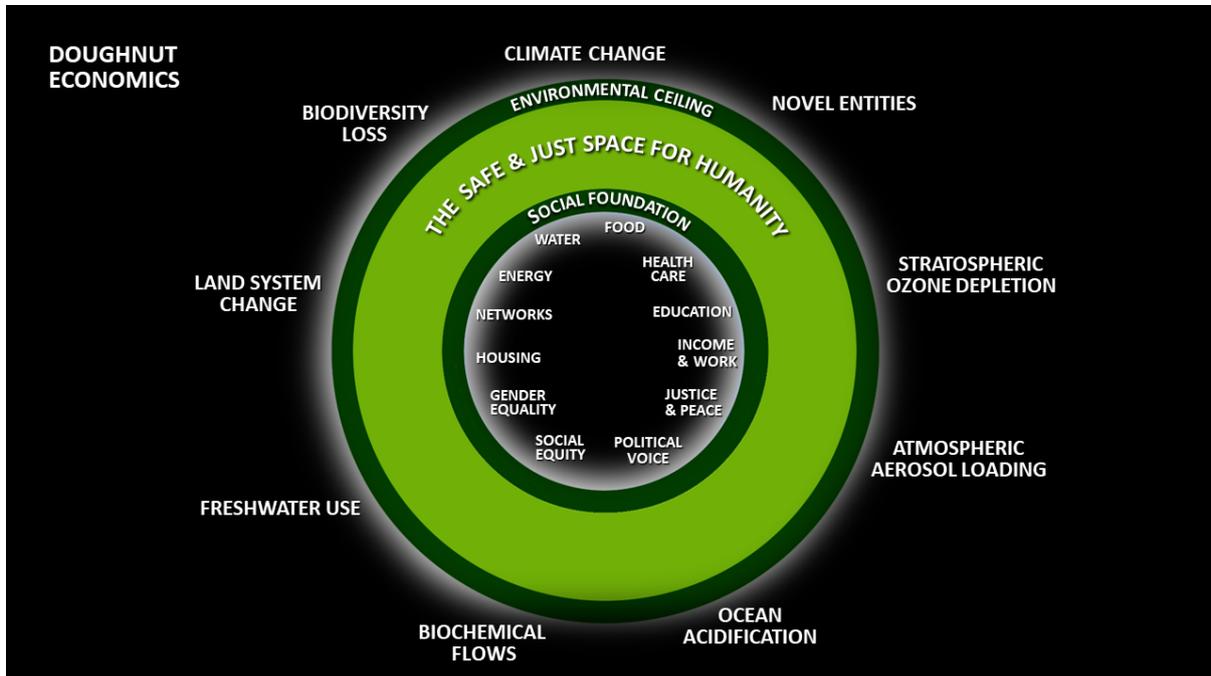
To bring carbon emissions and material consumption back within planetary boundaries and limit global average temperature rise to no more than 1.5C by the end of the century we need to be on the pathway marked "sufficient absolute decoupling" (below). There is no empirical evidence that this can be achieved simultaneously with GDP growth.



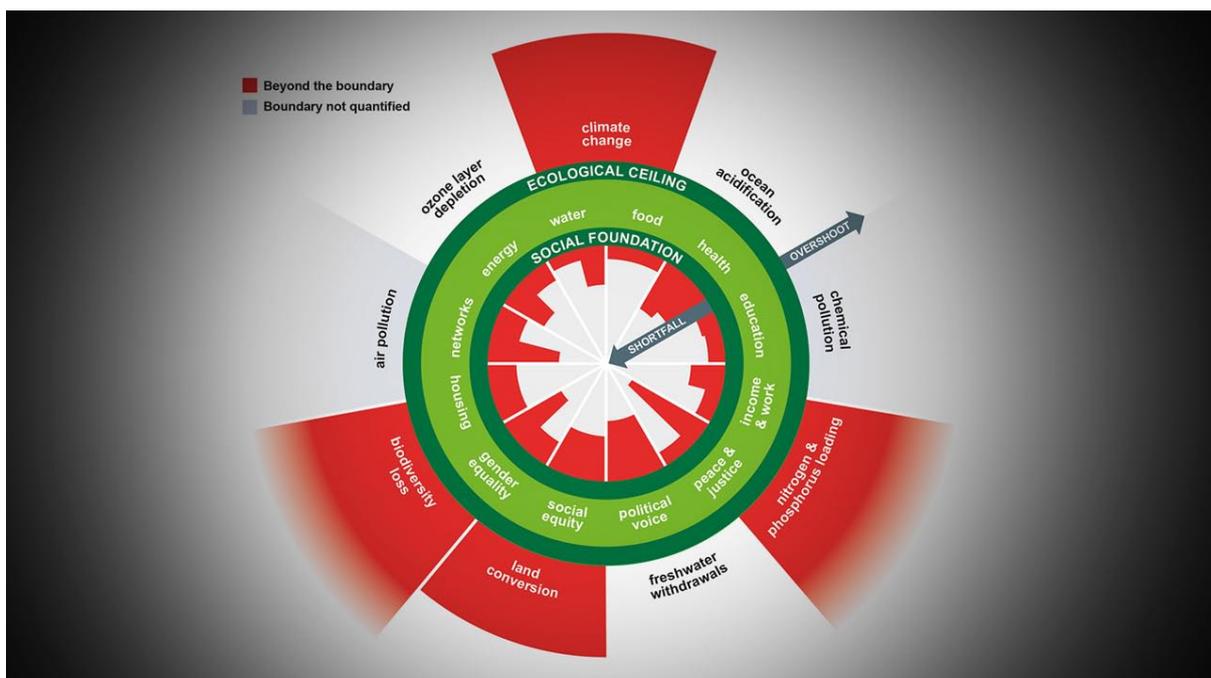
Systems modelling (below) showing 3 exponential growth scenarios within the finite capacity of an ecosystem (K) e.g. the growth of a rabbit population in a meadow. PM Johnson has effectively rejected the 2nd scenario (Excess and oscillations) whereby we purposely reduce GDP growth to allow ecosystems to recover. Systems modelling shows the result of trying to grow without regard to ecosystem capacity (Excess and collapse).



Kate Raworth's Doughnut Economics (below). Between the social foundation and environmental ceiling lies the safe and just space for humanity. Instead of the exponential growth curve this image must become a new icon for 21st Century economics.

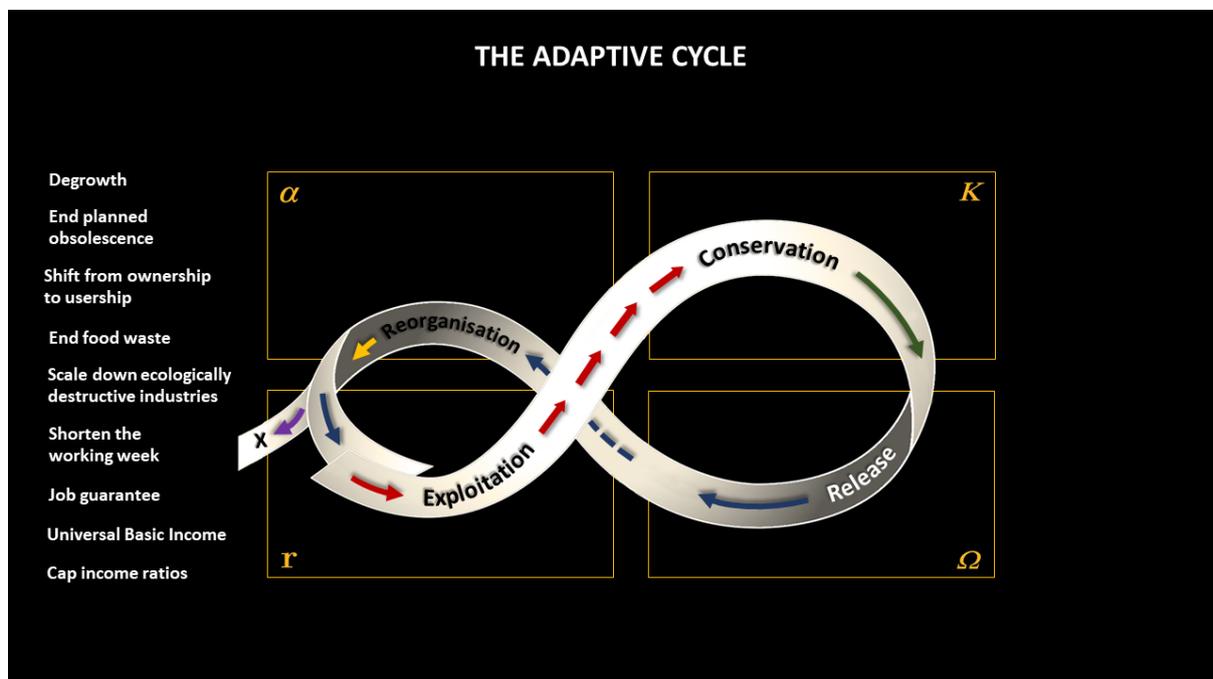


Mother Earth is bleeding out. Areas coloured red (below) show human populations falling into social deprivation even as planetary boundaries are being exceeded. Raworth describes this picture as "our planetary selfie." At COP26 world leaders must agree on emergency measures to heal these social and ecological wounds.



The Adaptive Cycle is a model developed by early founder of ecological economics Crawford Stanley Holling's (1930-2019). It shows 4 boxes representing the stages of a cycle linked together by a mobius loop. The fore-loop starts from the bottom left (r) and increases along the arrows to the top right (K). This represents the longer, slower phase of increase leading eventually to exhaustion e.g. GDP growth. This is followed by collapse (Ω). The back-loop is a more rapid phase resulting in reorganisation (α).

The yellow arrow in the alpha phase (α) marks a critical juncture. At this point there exists a small window of opportunity for transformation (marked X). Failure to choose this exit point leads to repetition of the cycle. Albert Einstein defined 'madness' as doing the same thing over and over again, expecting a different result. In the example below the choice of path is between a new round of capital accumulation - e.g. 'green growth' leading to more severe planetary degradations - or the ecological economic policies listed.



SOME KEY POINTS

- The economic system is a subset of the larger Earth system
- Sources of energy and their method of supply create forms of political power
- The capitalist system was wilfully made and can therefore be wilfully transformed
- GDP growth in wealthy nations is incompatible with planetary boundaries
- Material consumption has a heavy embodied energy footprint
- 'Green growth' is likely to be a euphemism for business-as-usual capital accumulation
- Doughnut Economics is an integral framework for a safe and just space for humanity