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THE ECONOMICS OF THE ENVIRONMENT AND NATURAL RESOURCES

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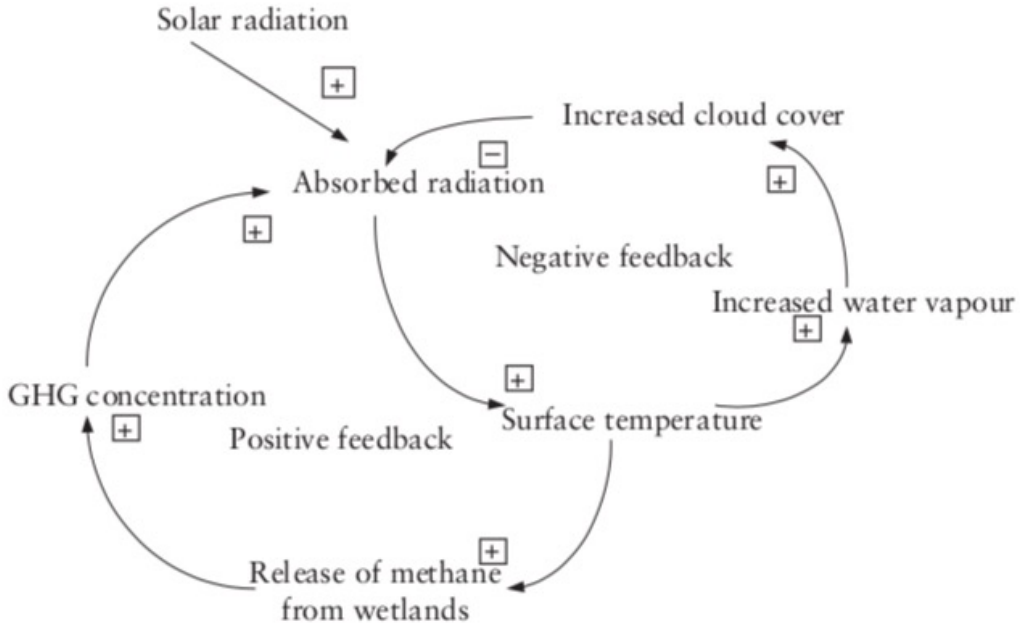


Figure 1.4 Examples of positive and negative feedbacks with climate change

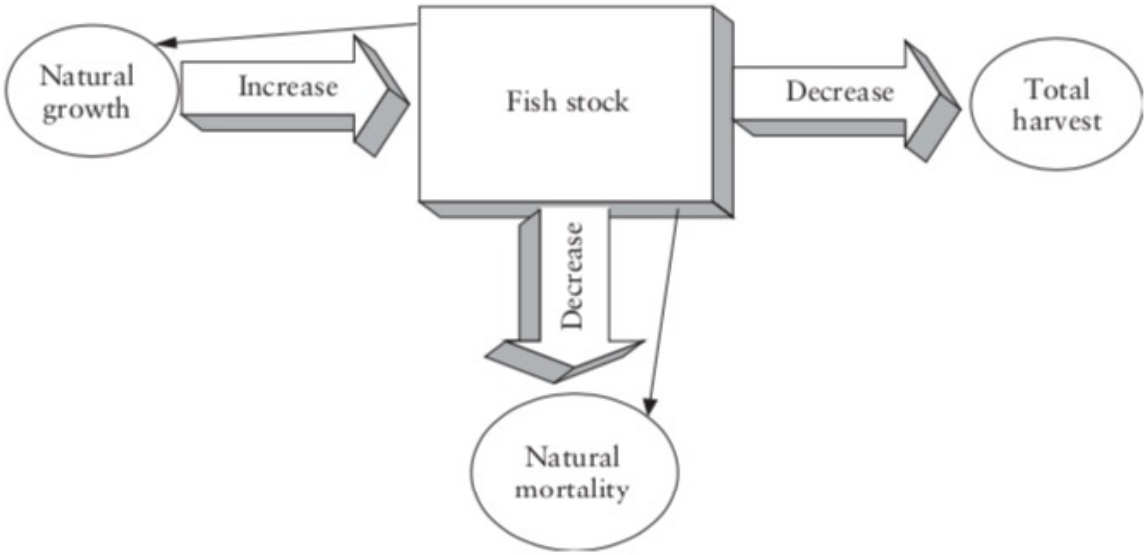
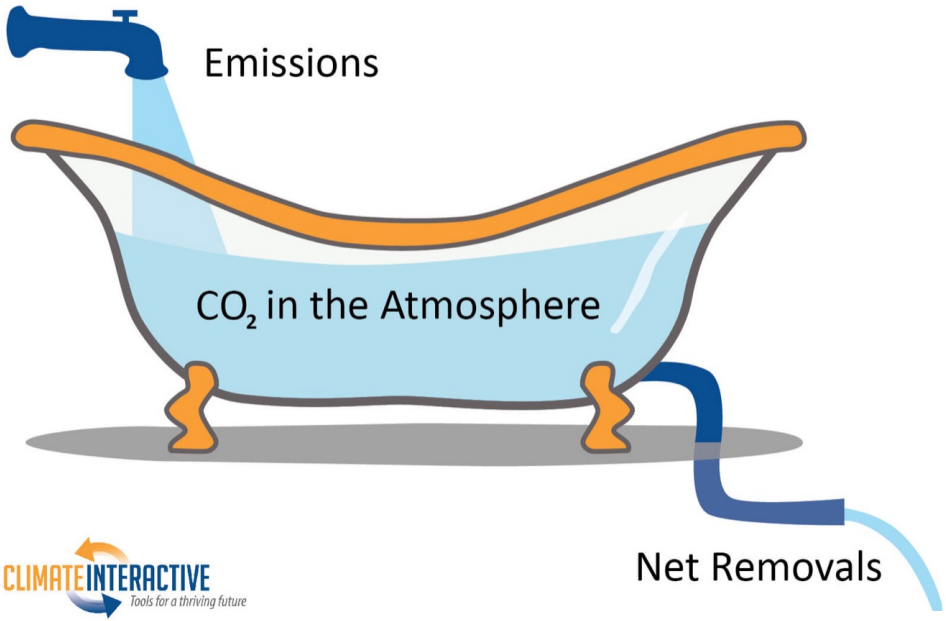
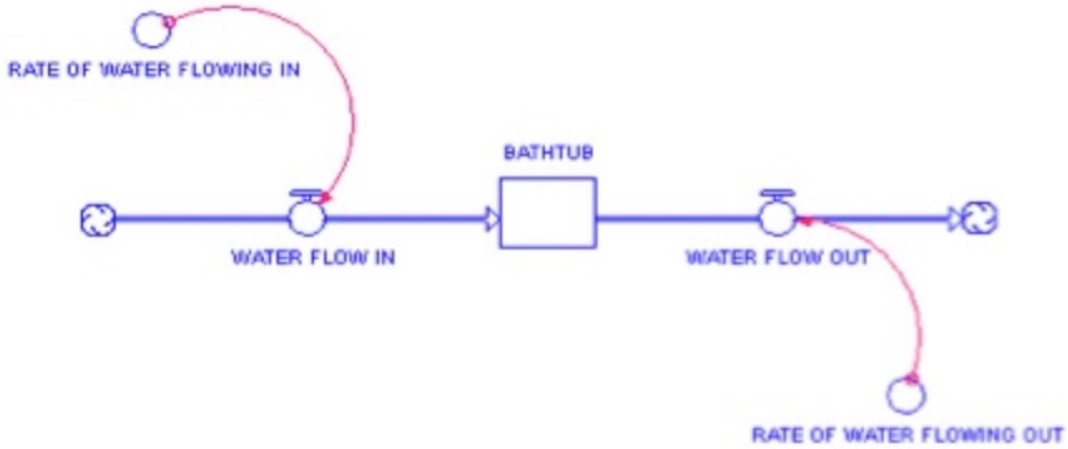


Figure 1.5 Stocks, flows, and feedbacks



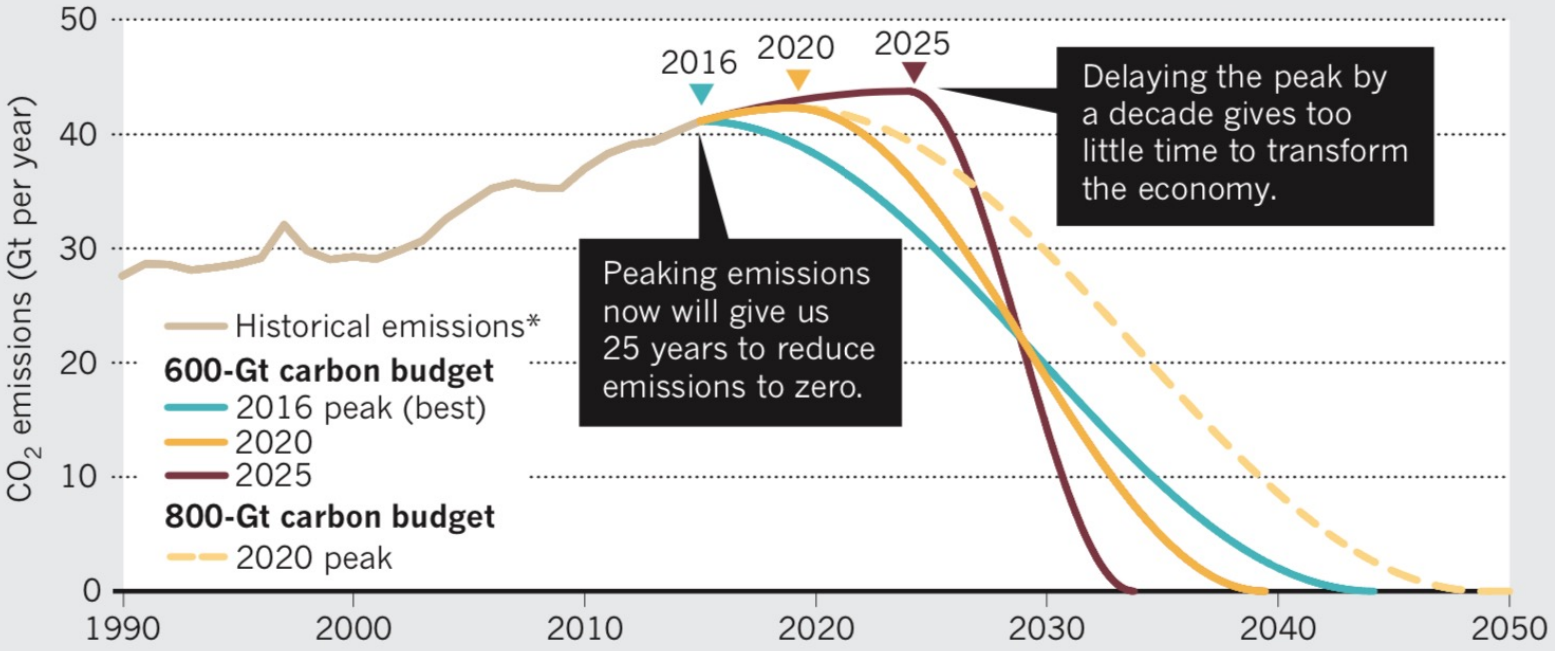
CLIMATE INTERACTIVE
Tools for a thriving future

Overall framing by Dr. John Sterman, MIT Sloan



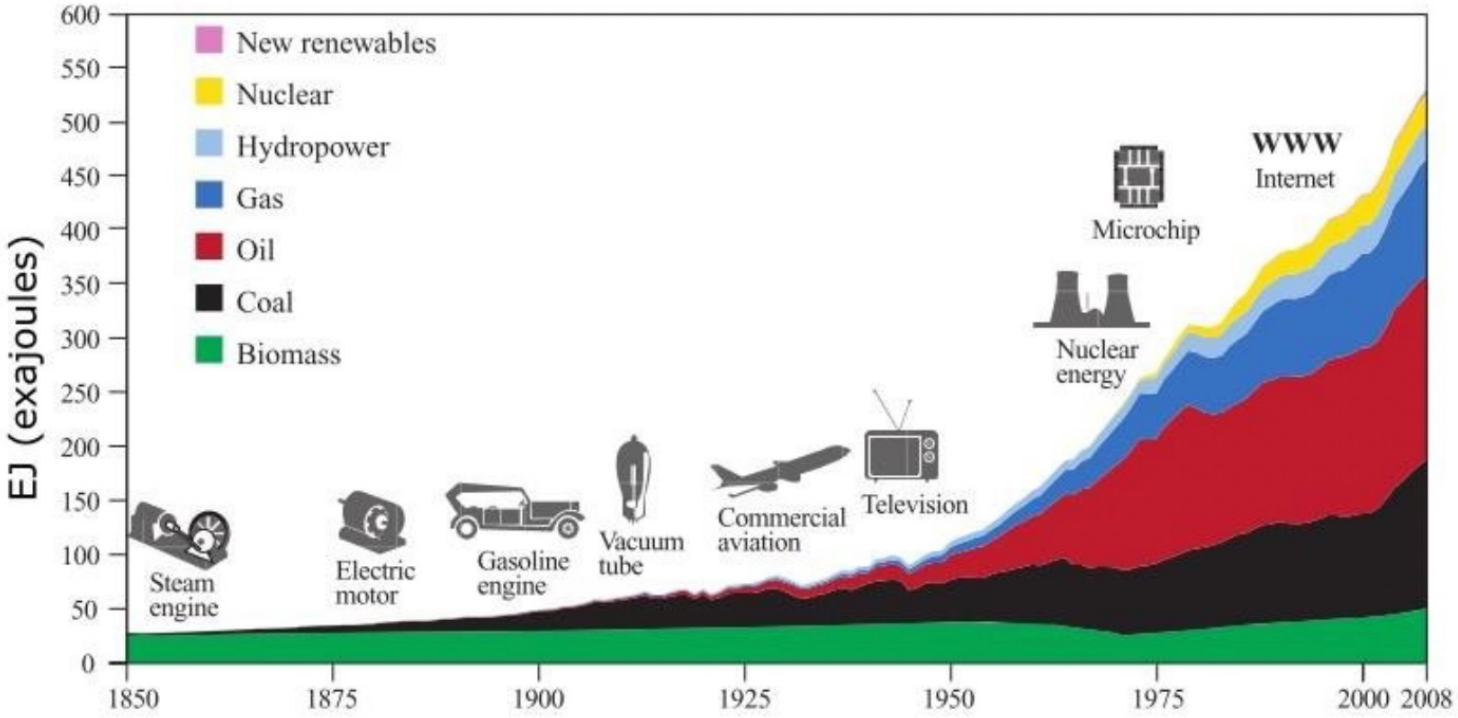
CARBON CRUNCH

There is a mean budget of around 600 gigatonnes (Gt) of carbon dioxide left to emit before the planet warms dangerously, by more than 1.5–2°C. Stretching the budget to 800 Gt buys another 10 years, but at a greater risk of exceeding the temperature limit.



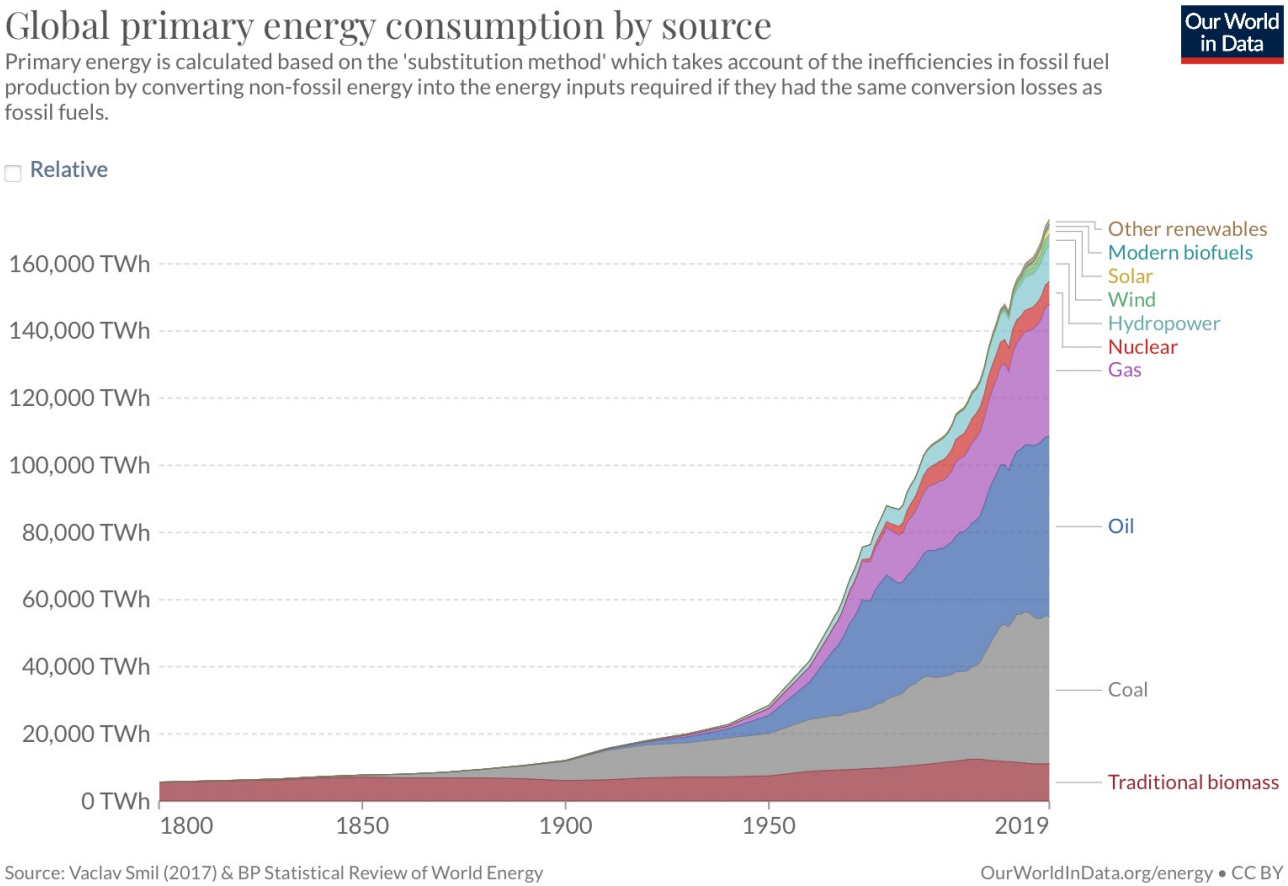
*Data from The Global Carbon Project.

Exponential growth

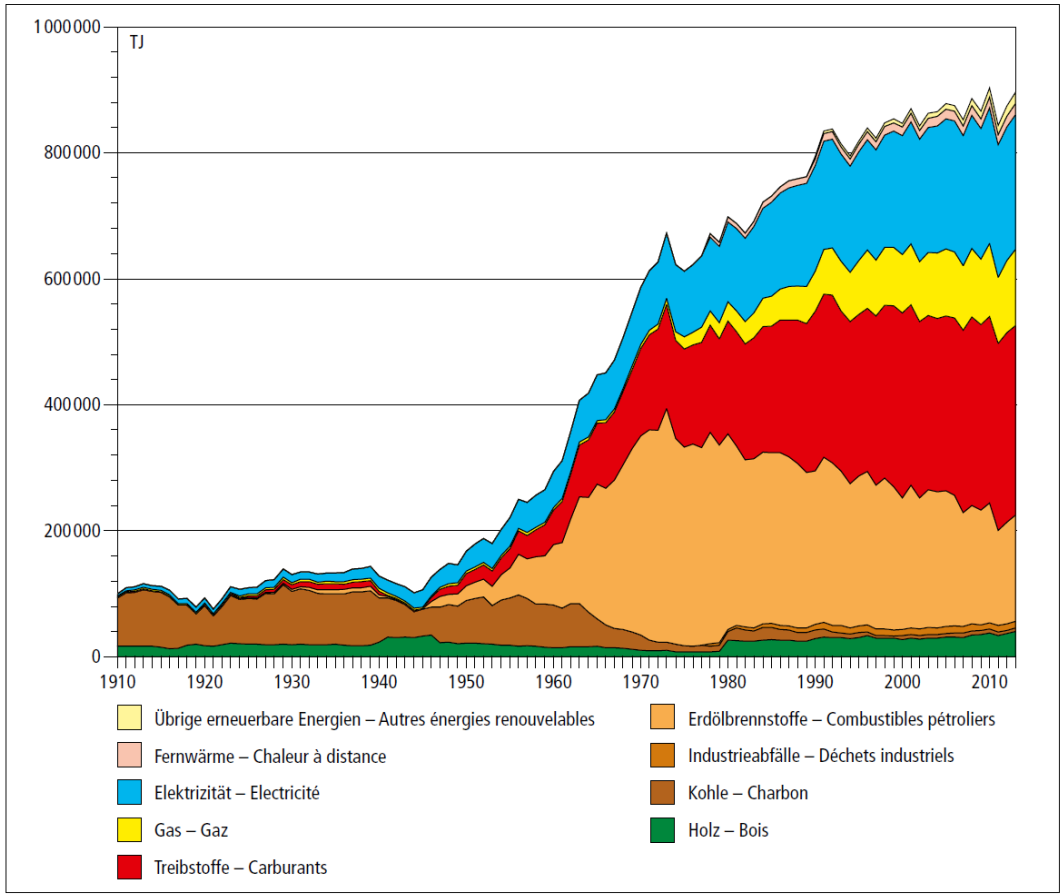


Historical global energy mix Source: Grubler et al. (2012).

Exponential growth?

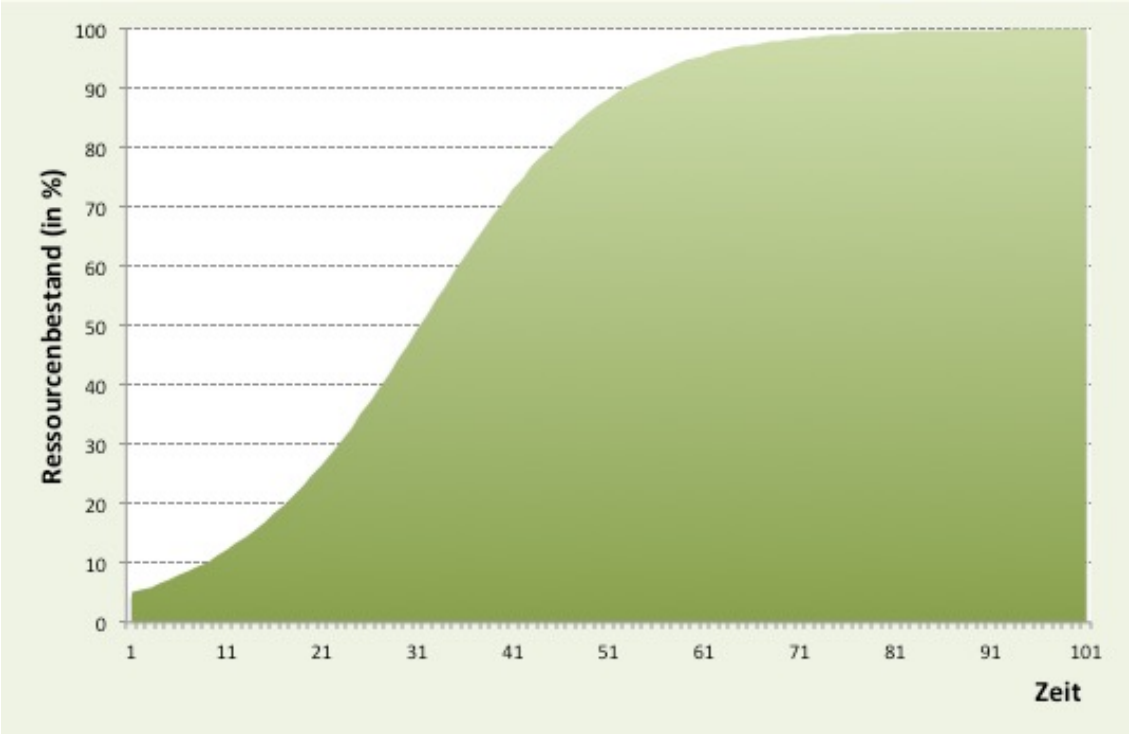


Exponential growth?



A standard model of logistic growth

A standard model of logistic growth



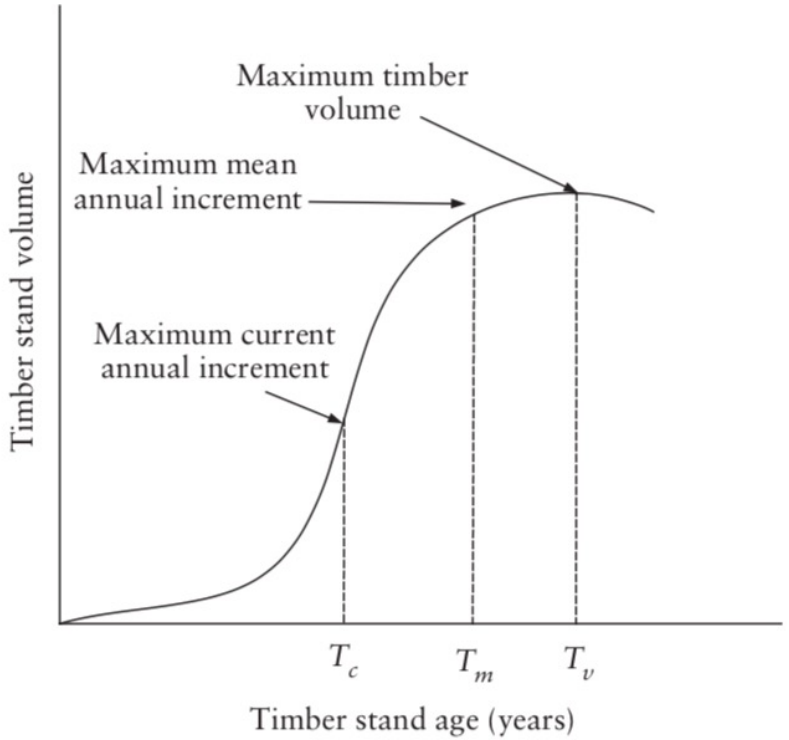


Figure 5.1 Relationship between timber stand volume and age

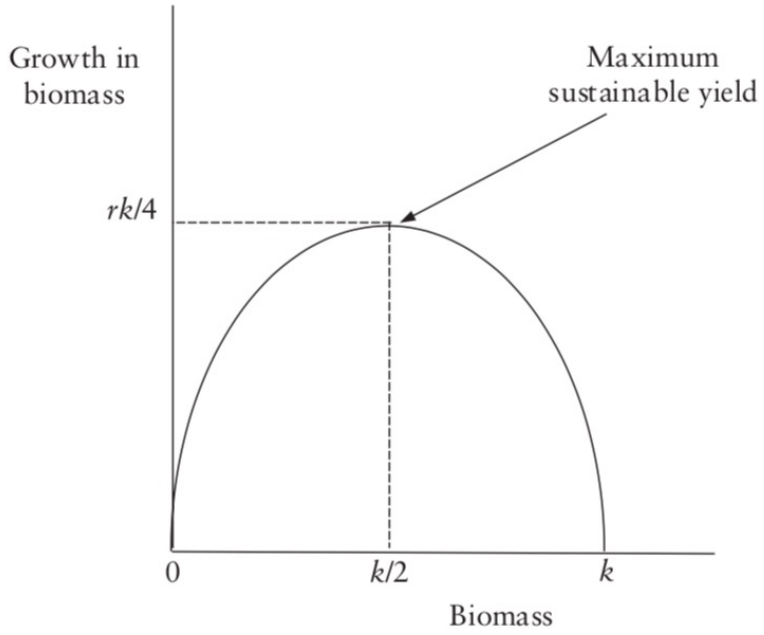


Figure 4.7 Schaefer model of a fishery

If we differentiate the growth in the biomass given by (9) by the biomass, and set the result equal to zero, we can determine the biomass level that maximizes its growth, i.e.,

$$(dx/dt) \;/\; dx = r - 2xr/k = 0 \quad \Rightarrow \quad x^* = k/2 \tag{11}$$

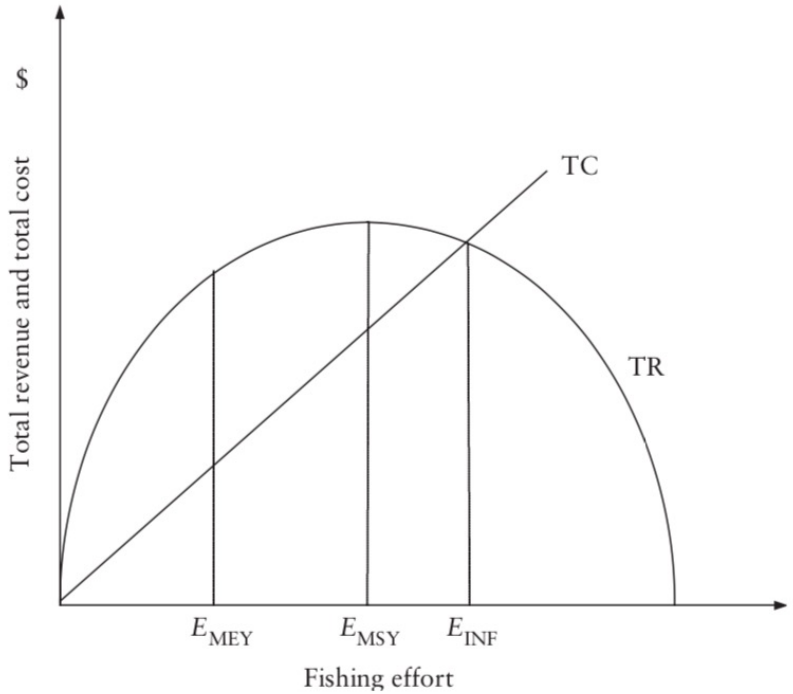


Figure 4.9 The Gordon–Schaefer model (sustained yield-effort)

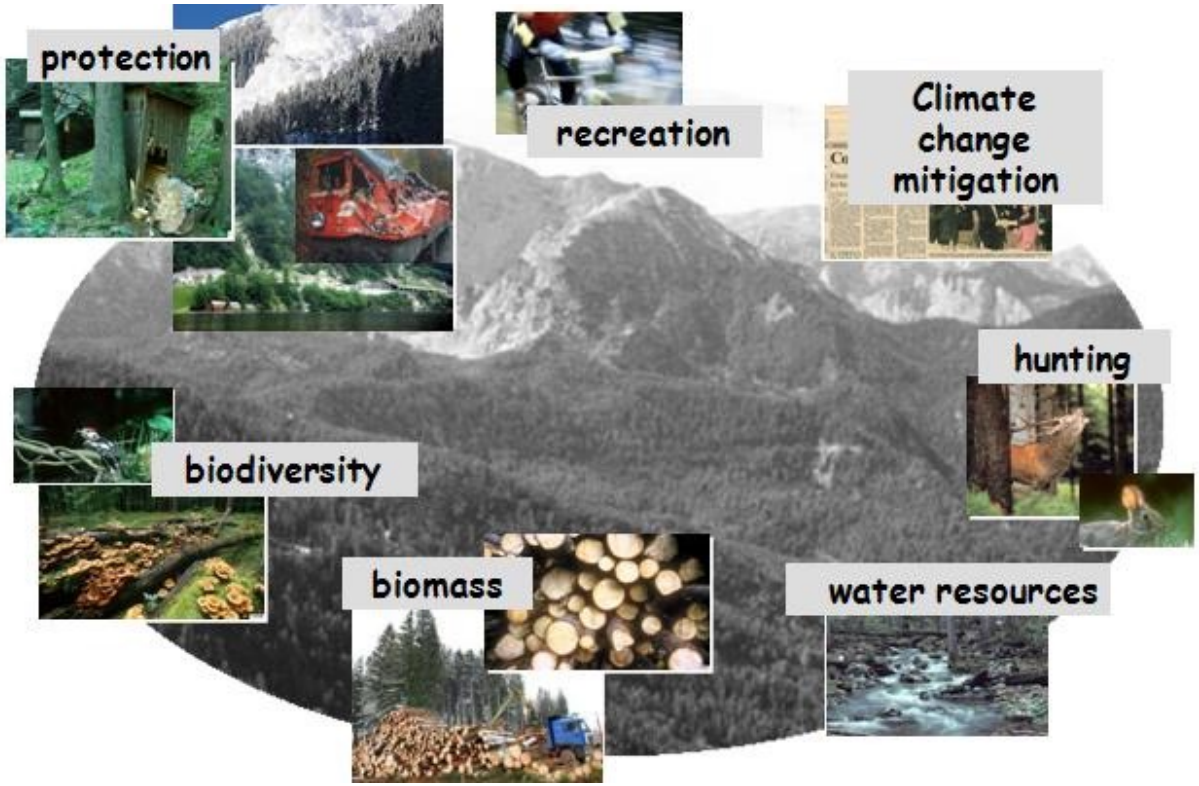
Optimal resource use

- Optimal versus stable / resilient plans
- Is Maximum Sustainable Yield (MSY) the optimal resource use?

Common beech forest

Poplar plantation *Source*: Lignovis GmbH

Multifunctional resource use



Example: Switzerland

Forest policy law from 1876 with orders / prohibitions:

- Planning duty
- Prohibition of privatization
- Prohibition of clear cuts and order to maintain forests

Landschaftsveränderung durch Aufforstung von Schutzwald. Vergleich Tösstal 1903/1961 (Fotos E. Jäckli und E. Krebs).

Forestry and sustainability

German forestry in the 18th century

«Sylvicultura oeconomica oder haußwirthliche Nachricht und Naturmäßige Anweisung zur wilden Baum-Zucht» (1713)

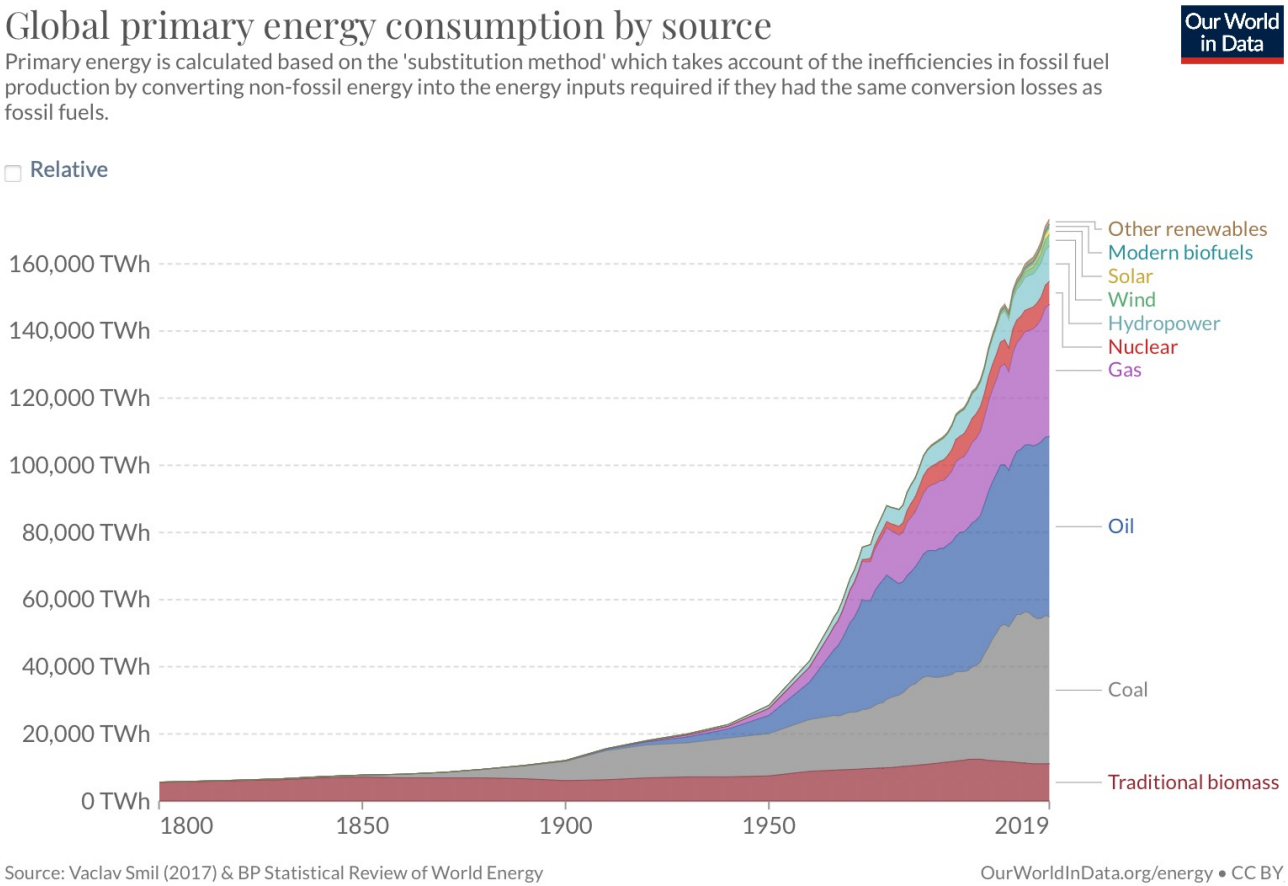
'continuirlich beständige und nachhaltende Nutzung'

Hans Carl von Carlowitz
1645-1714

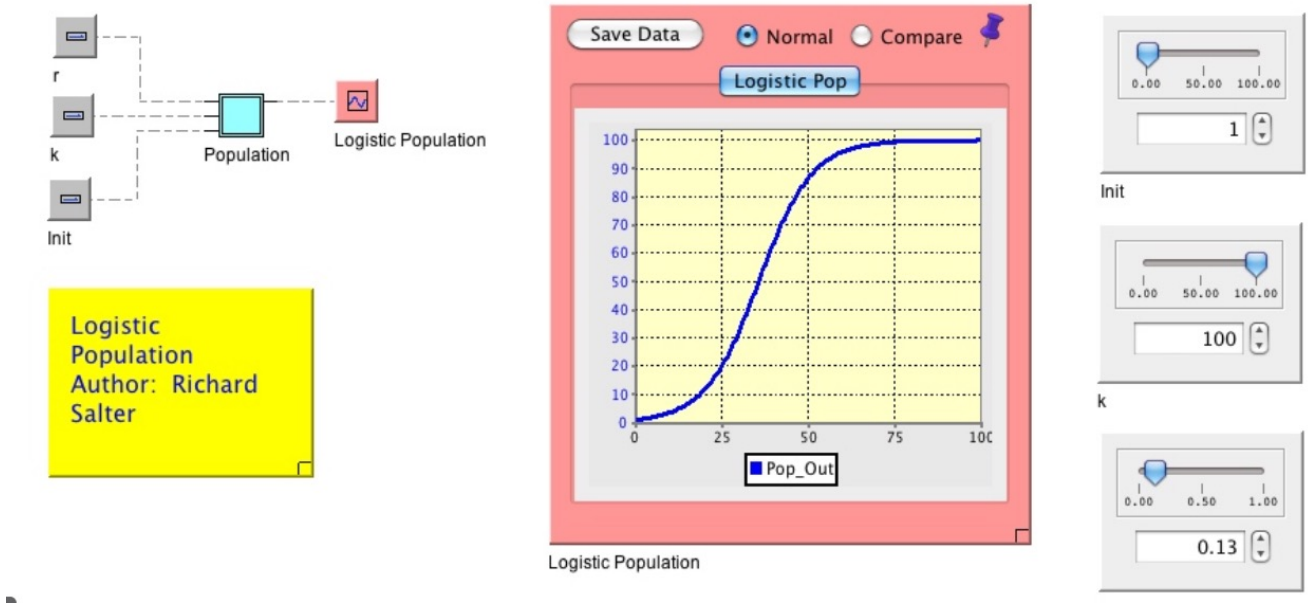
Context: Mining and smelting led to deforestation, timber shortage, increasingly long timber transports, rising prices

=> Economic, not ecological considerations led to the demand for a different use ('suffer great need in the future'). At the same time, Carlowitz invoked the creation mandate of "preservation".

Forest policy and biomass use



Dynamical systems: population growth



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