Natural resource crisis and the planetary boundaries

Ilaria Perissi

in collaboration with Ugo Bardi and Sara Falsini

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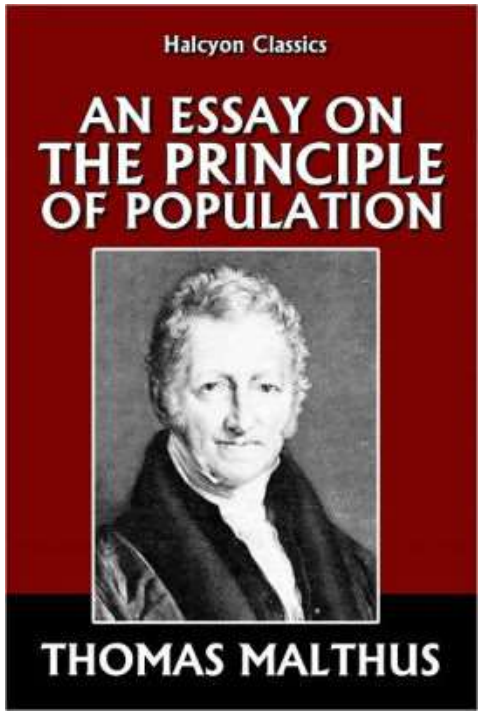
Natural resource crisis and planetary boundaries



Thomas Malthus -1798

Population, when unchecked, increases faster than food production. Whereas population increases in geometric progression, food production increases in arithmetic progression.

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Jay Forrester (1950s)

System Dynamics, a useful tool to

catch complex systems dynamic

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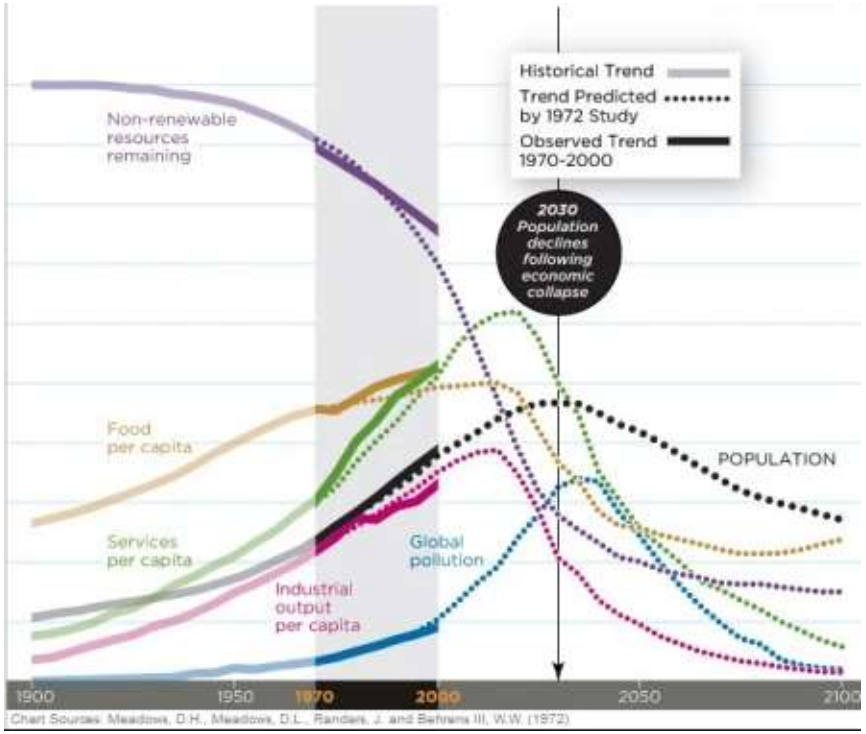
Limits to Growth



Modeling the Renewable Energy transition in Europe

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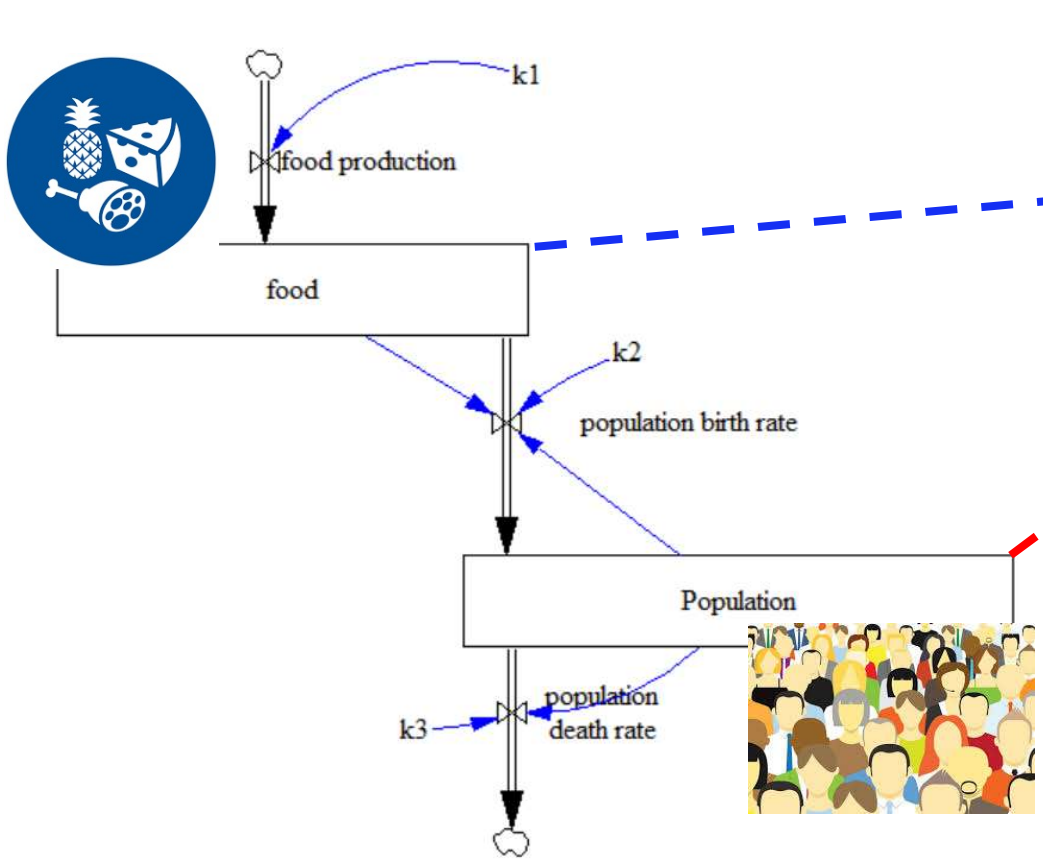
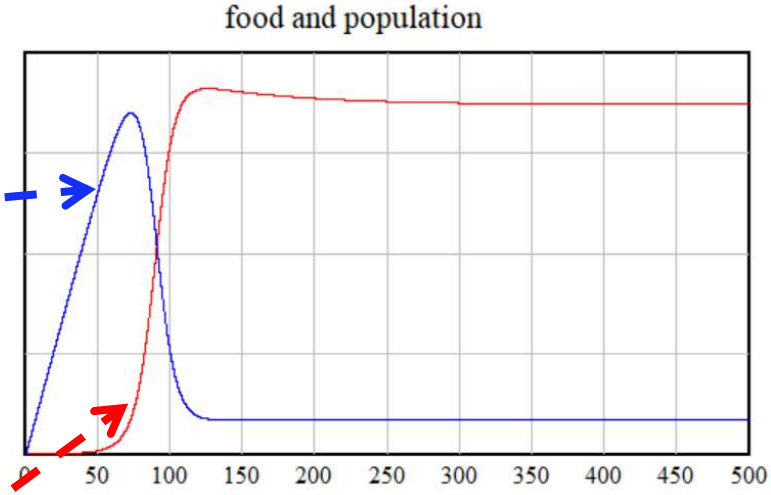
Malthus model





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Vito Volterra – Umberto D'Ancona (1920s)

Vito Volterra helped by

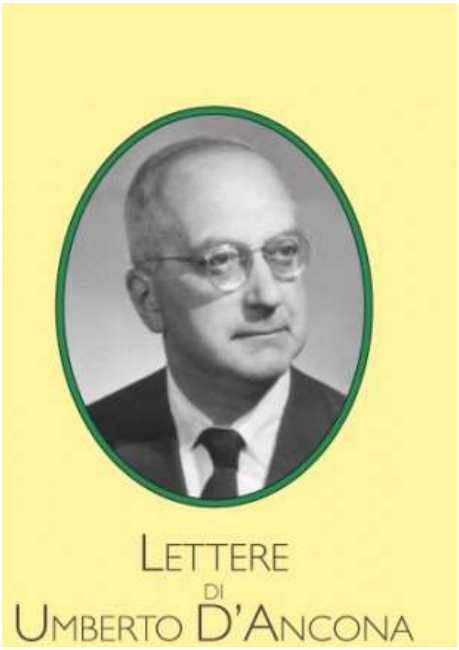
Umberto D'Ancona studied

the fish catches in

the Adriatic sea (Italy),

formulating the Prey-

Predator dynamic



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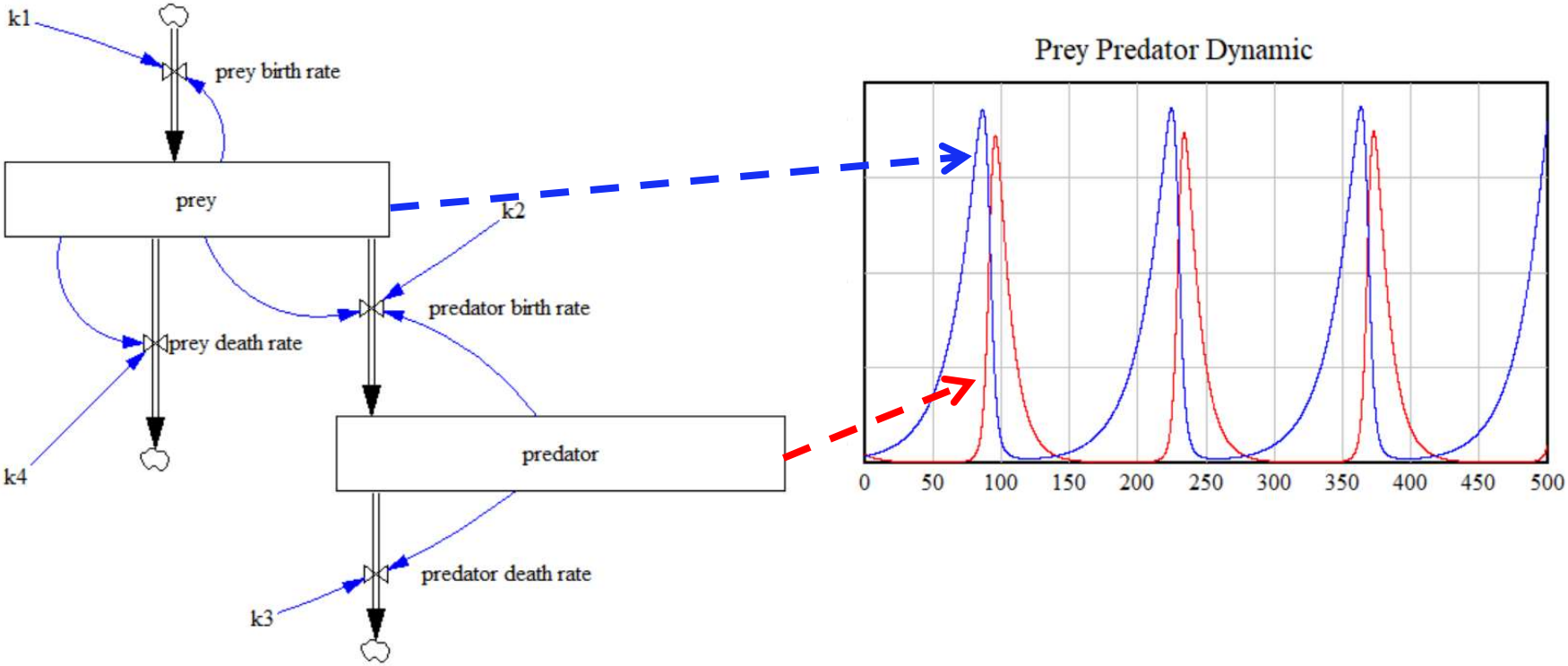
Natural resource crisis and planetary boundaries

Lotka Volterra model: competion among 2 species



Criticized: describes only few real systems

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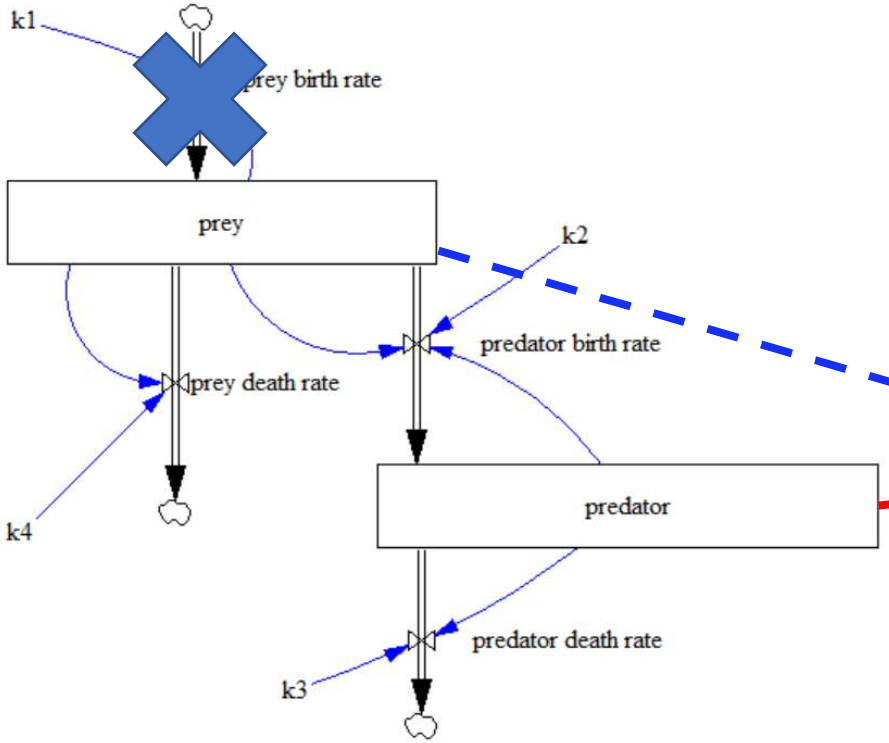
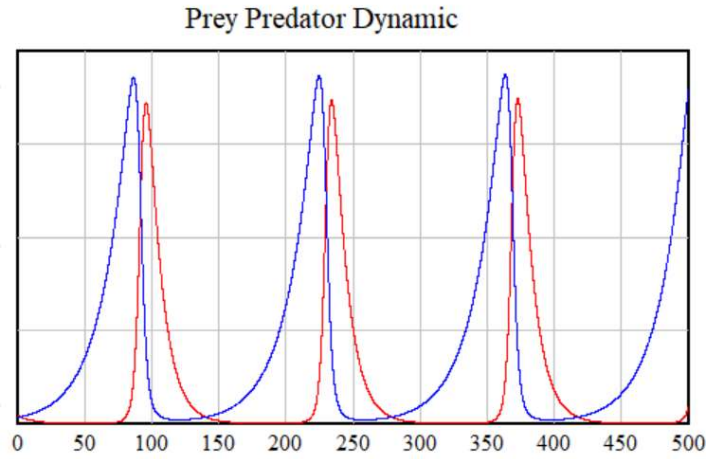
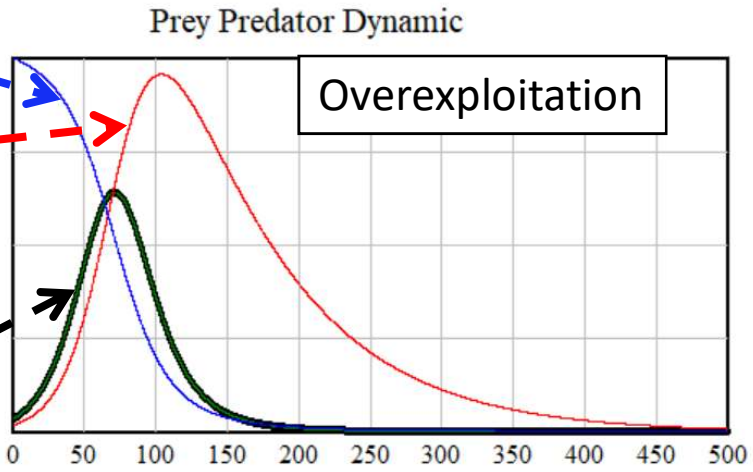
Natural resource crisis and planetary boundaries

Lotka Volterra rivisited: Overfishing







Rate of prey extraction

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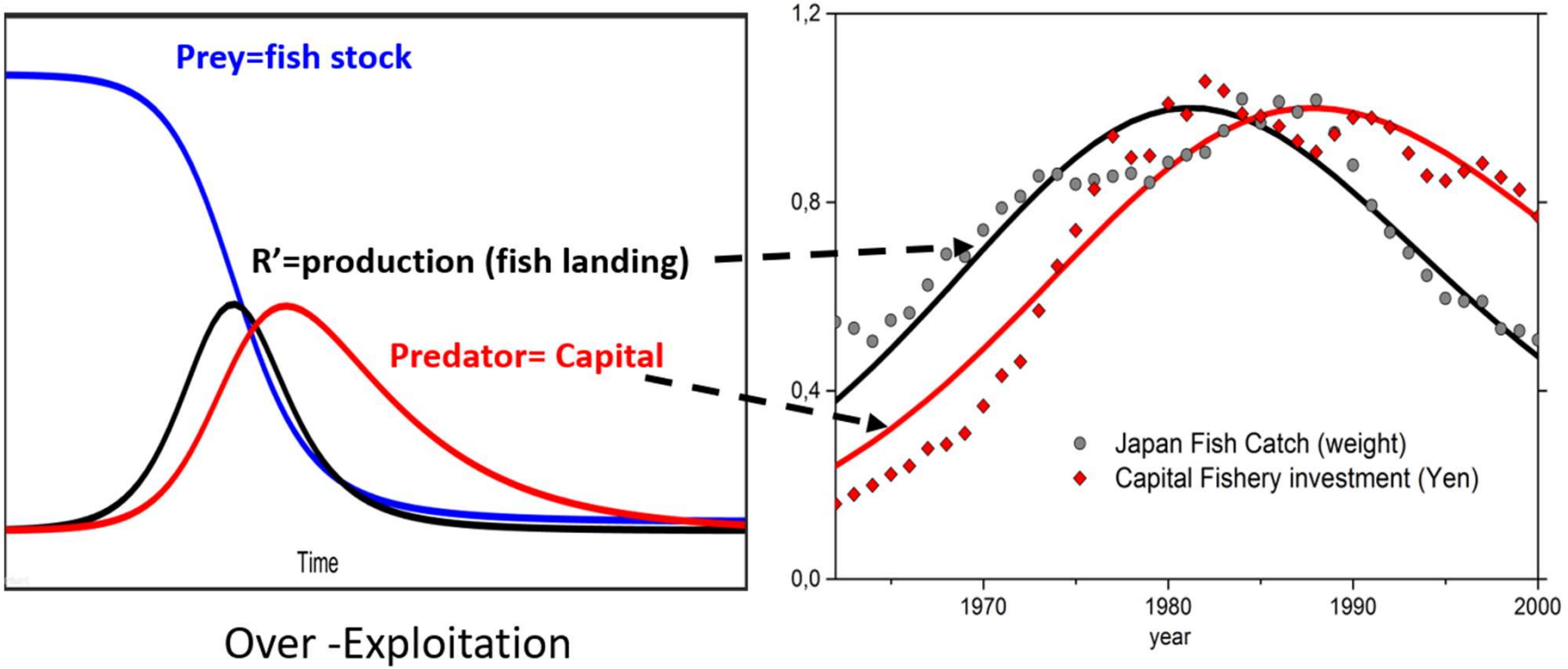
Overfishing: Decline of Japanese Fisheries



Over -Exploitation

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Ecological Modelling

Volume 359, 10 September 2017, Pages 285-292

Dynamic patterns of overexploitation in fisheries

Ilaria Perissi [a] ✉, Ugo Bardi [a, b] ✉, Toufic El Asmar [c] ✉, Alessandro Lavacchi [d] ✉

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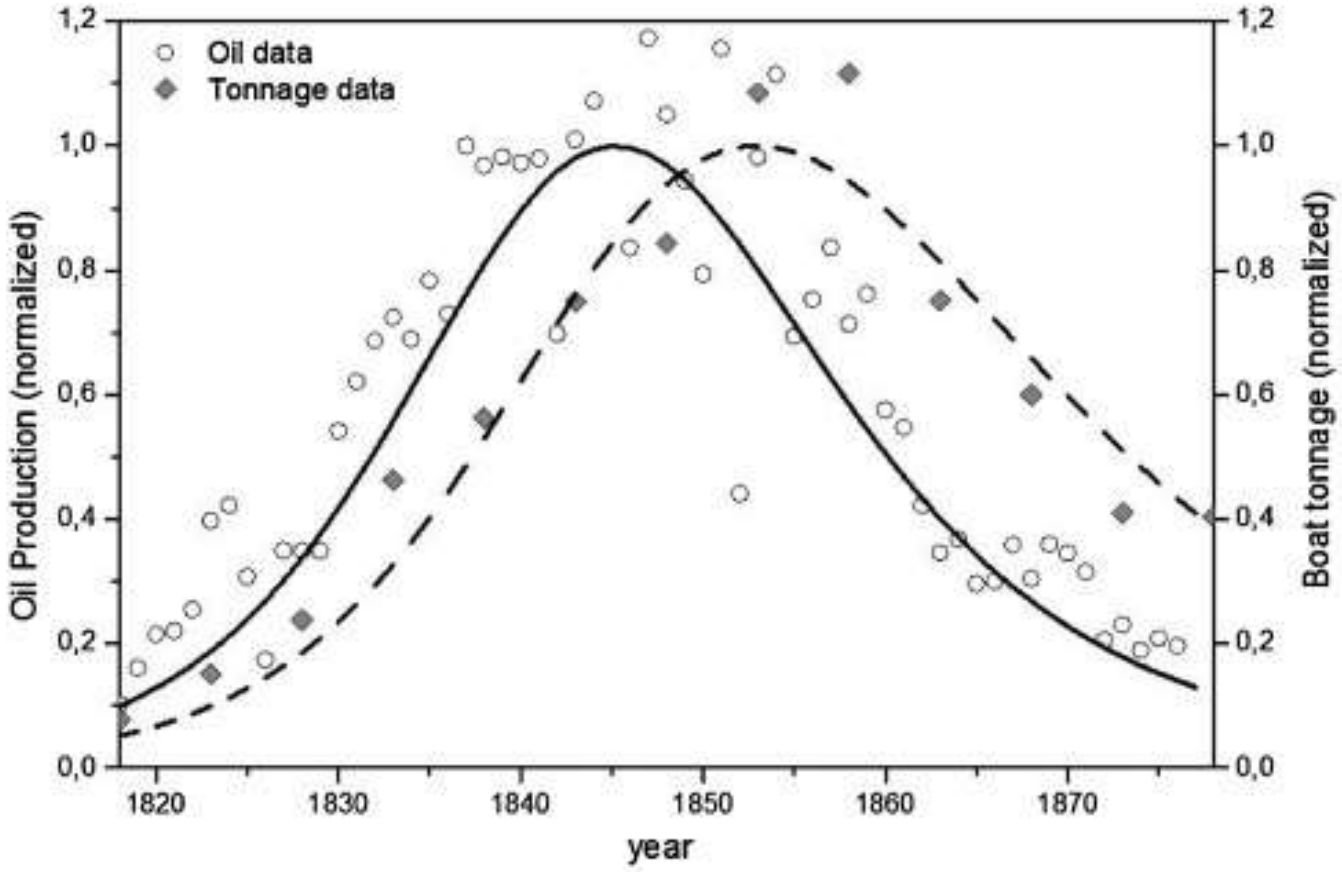
Whales (1800)



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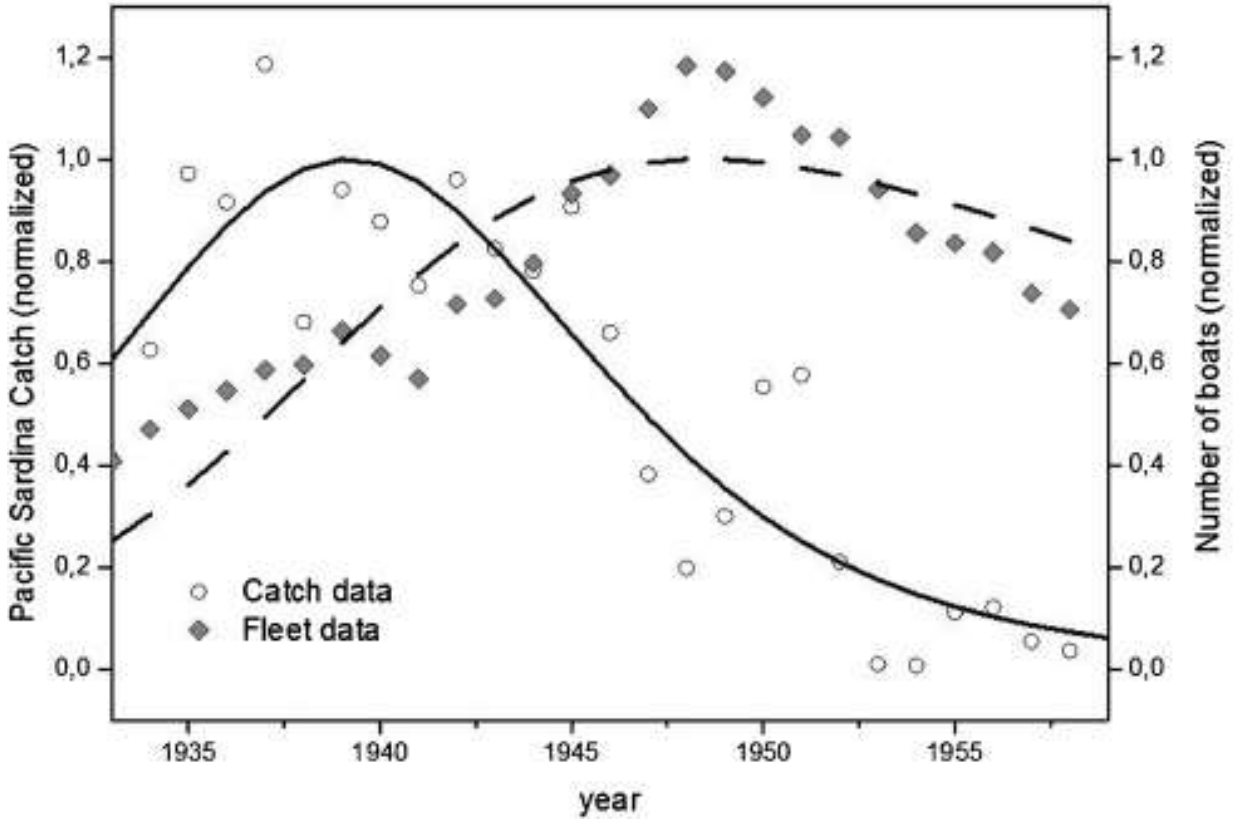
Pacific Sardines (1950)



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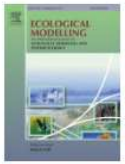

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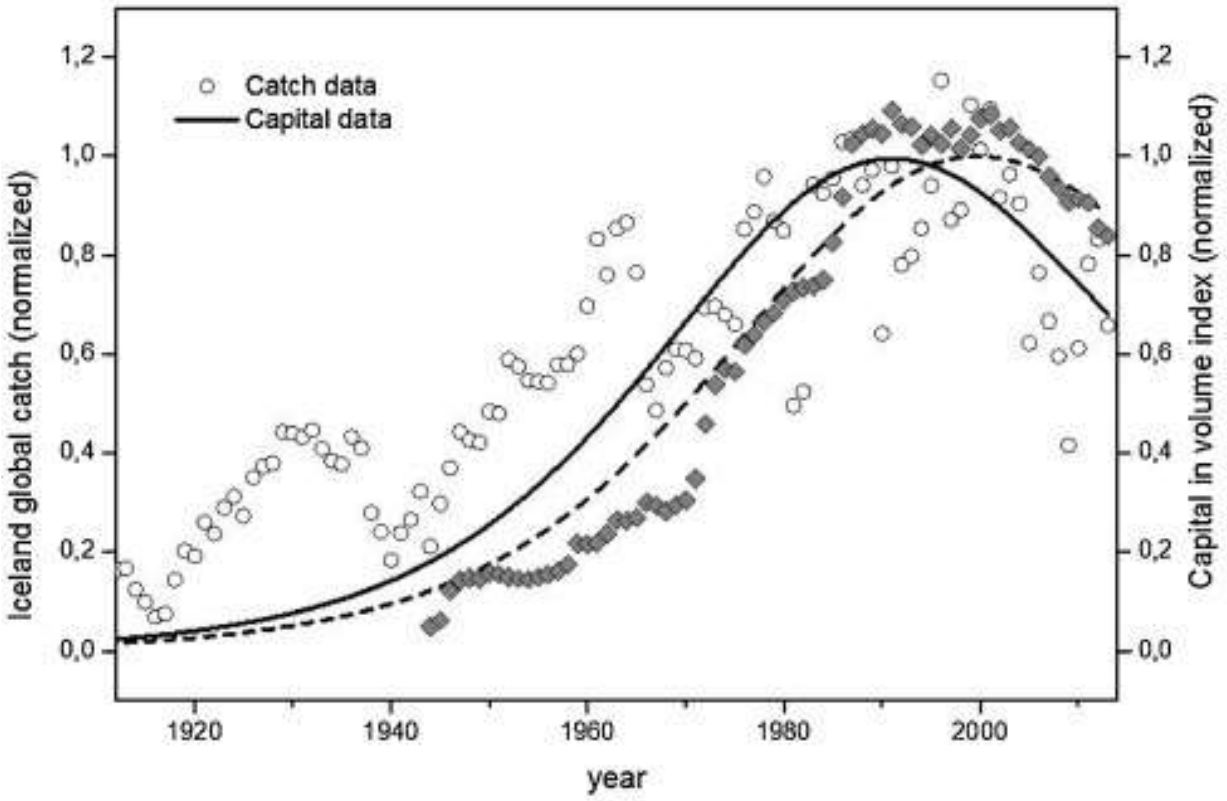
Iceland Fishery (now)



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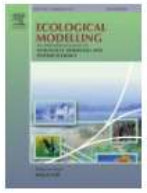

Dynamic patterns of overexploitation in fisheries

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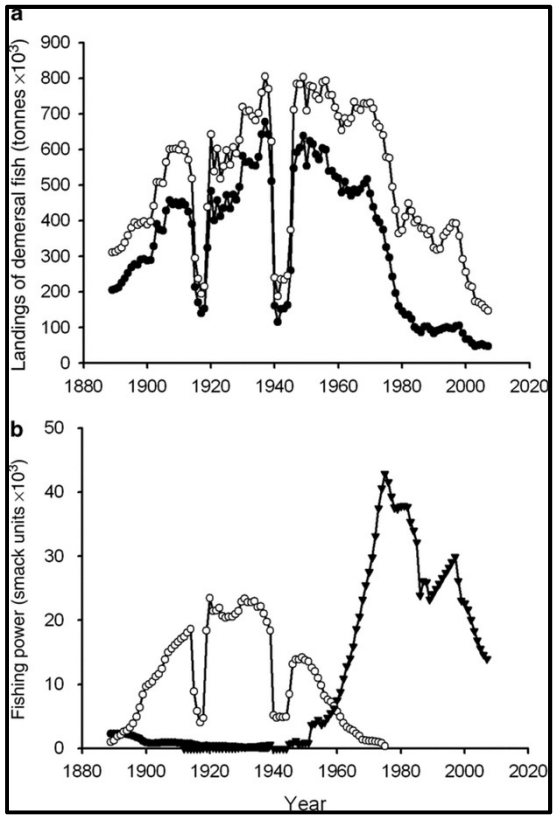
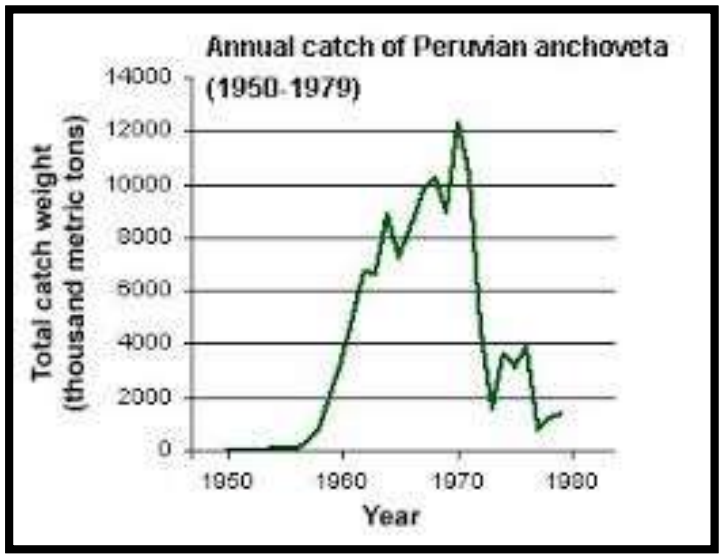
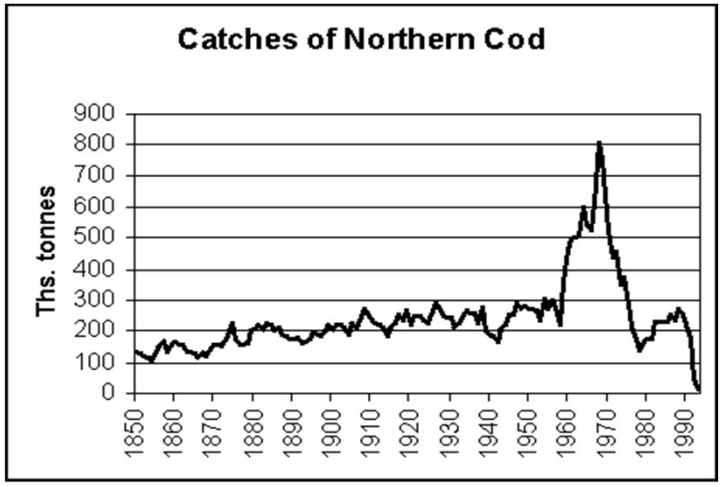
Natural resource crisis and planetary boundaries

UK bottom trawl fisheries







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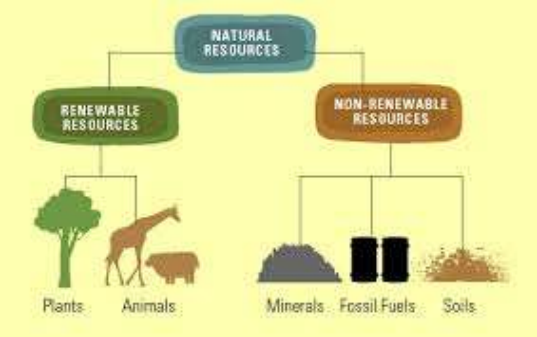
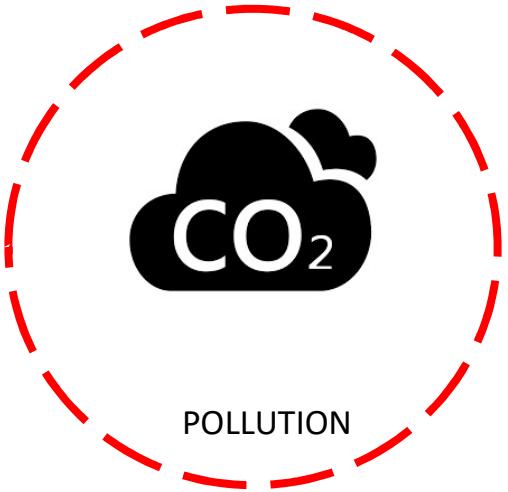
Natural resource crisis and planetary boundaries

What's more? A third stock



RESOURCES

CAPITAL



POLLUTION

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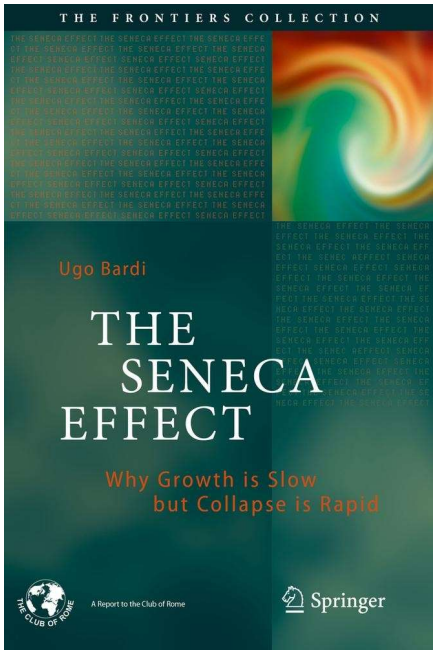
Natural resource crisis and the planetary boundaries

Ugo Bardi (2017)

The Seneca effect.

Why growth is slow but collapse is rapid



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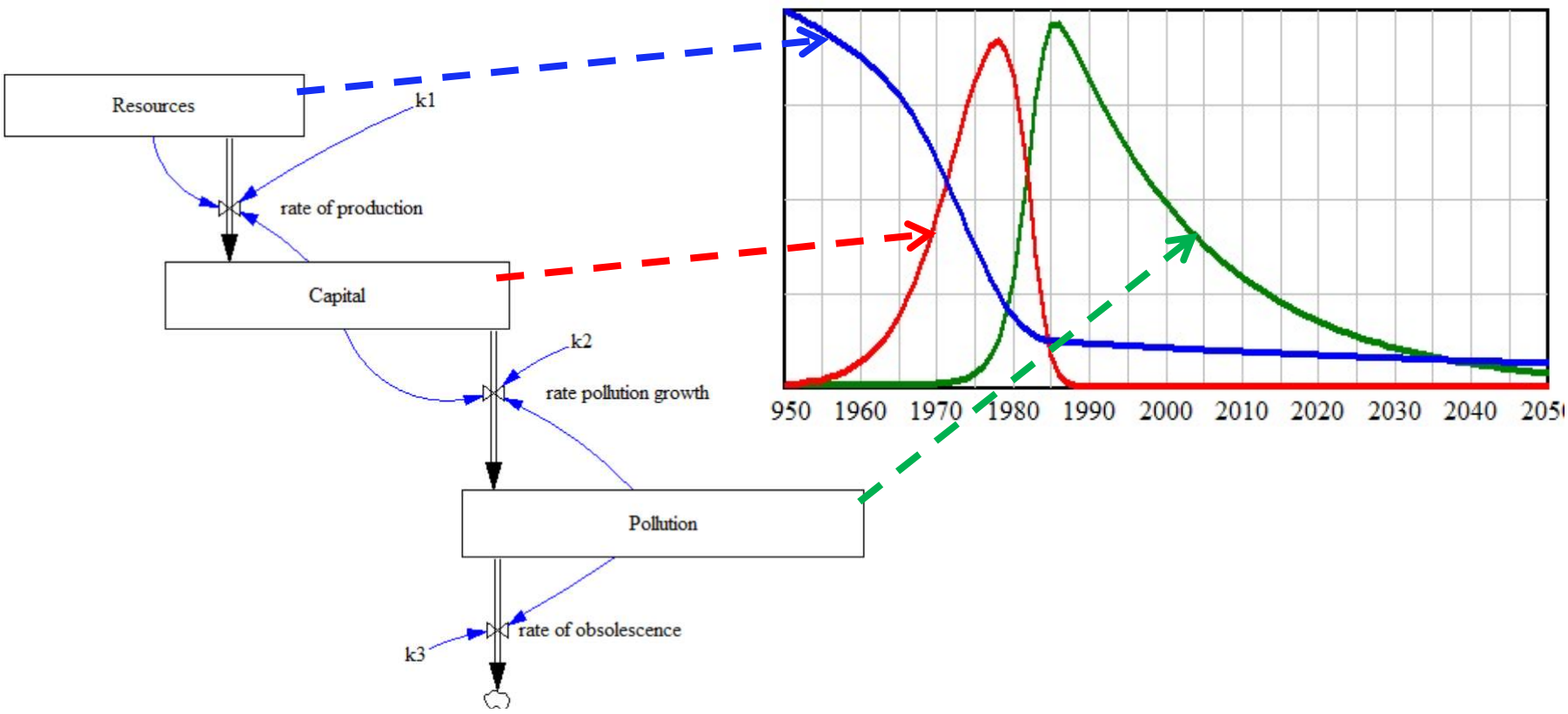

Capital is dissipated to remove pollution

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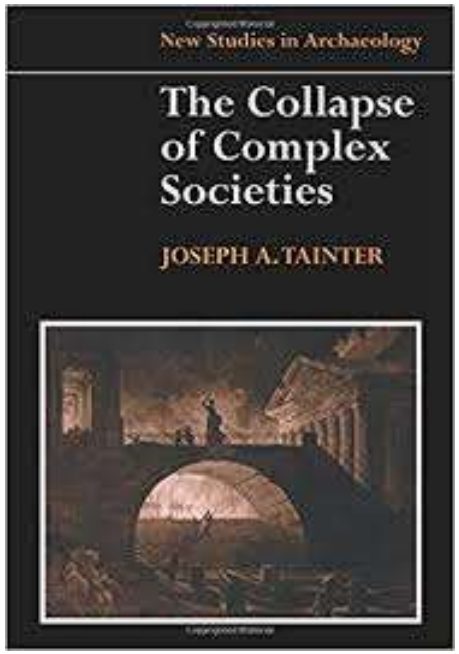
Natural resource crisis and the planetary boundaries

Joseph Tainter (1988)

As these civilizations become larger, they become less efficient, to the point the economic returns they provide is smaller than their cost.



Tainter's study is qualitative!

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Natural resource crisis and the planetary boundaries

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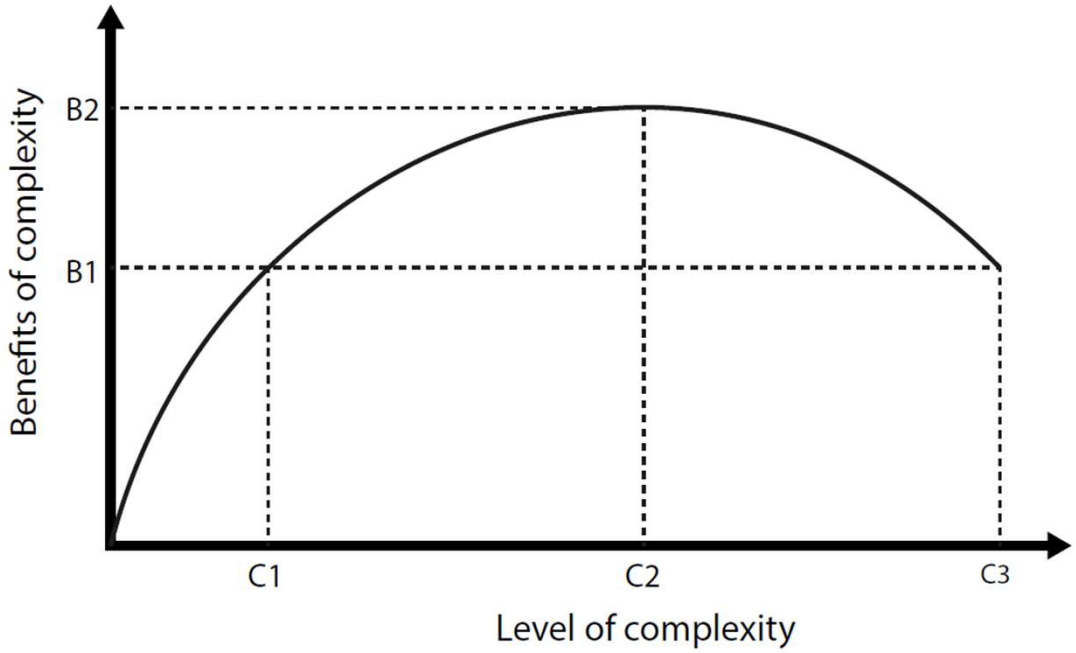

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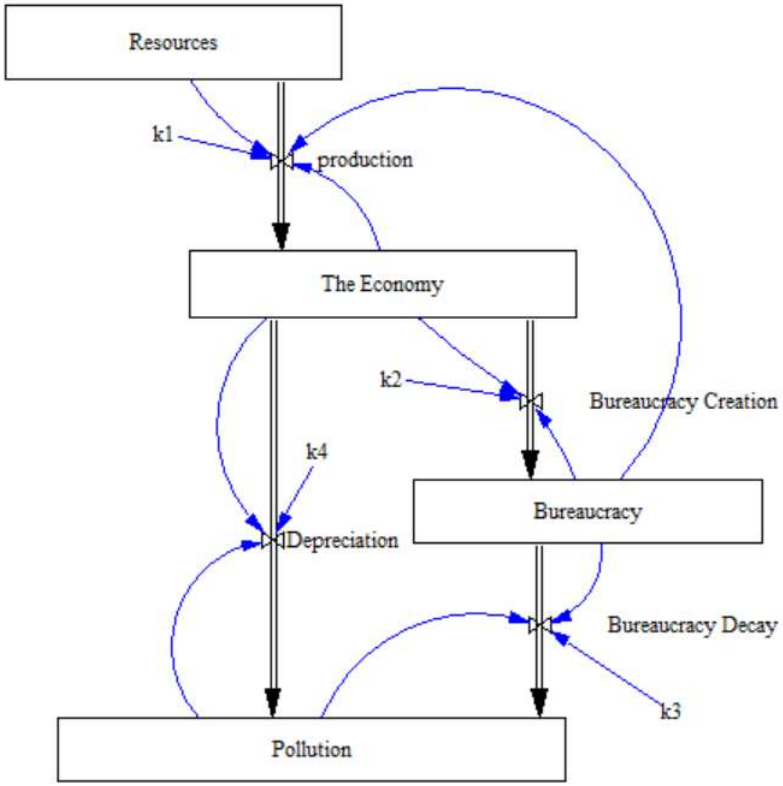

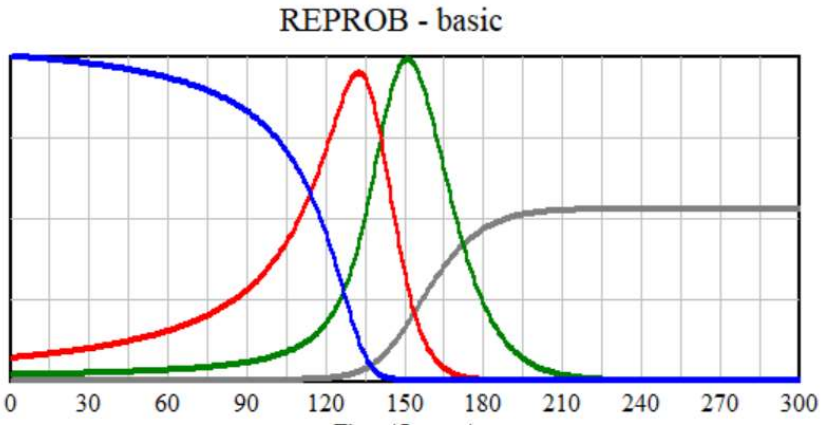

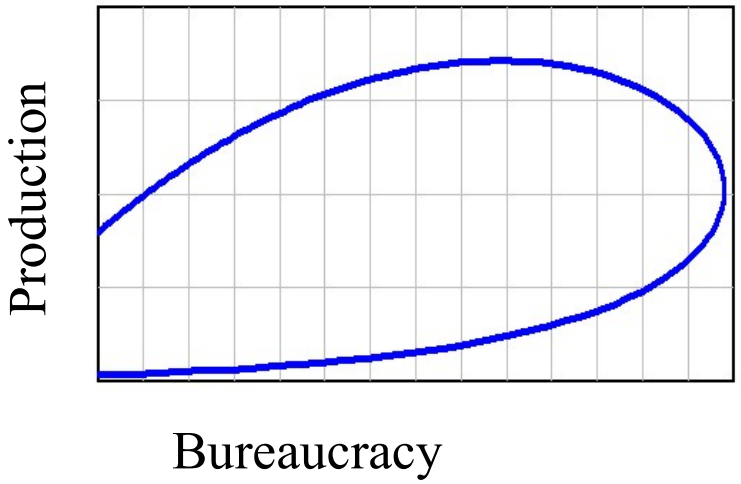

REsources**PRO**duction**B**ureaucracy
socioeconomic system similar to an ecosystem

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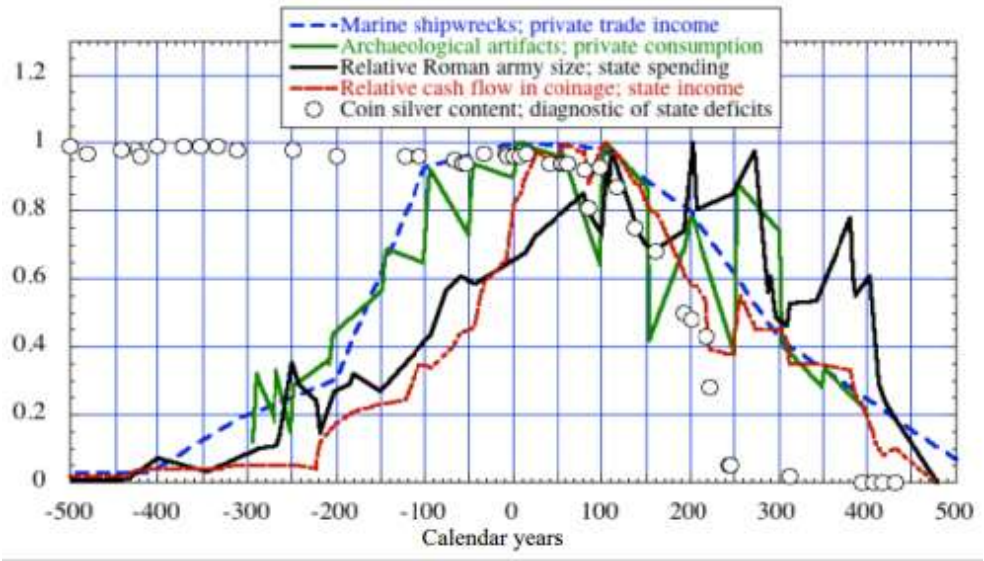
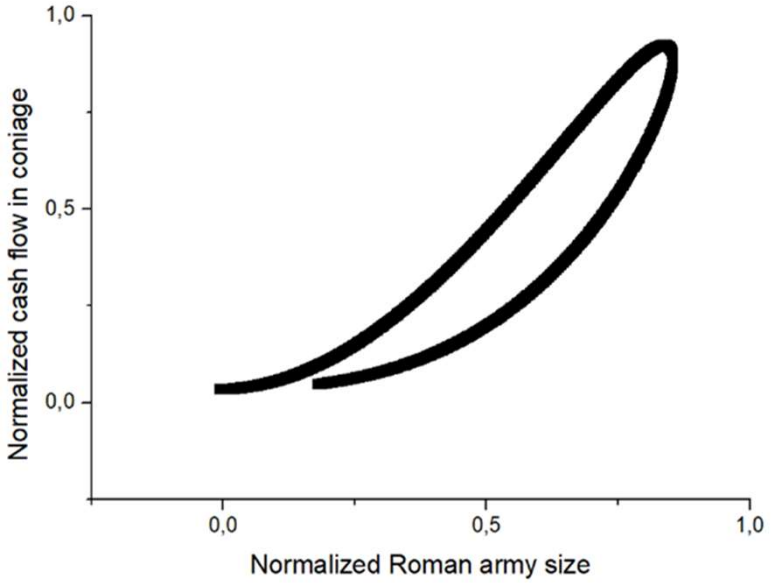
Natural resource crisis and the planetary boundaries

Historical data about
the rise and fall of Western Roman Empire





Sverdrup et al., 2013

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Natural resource crisis and the planetary boundaries

The basic factor at the origin of the contraction and the crisis of a complex system is the phenomenon called “overexploitation” of resources.

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Natural resource crisis and the planetary boundaries

Special thanks to:

Ugo Bardi

Sara Falsini

Jordi Solé

Coordinator of MEDEAS project

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Despite **quotas,** however, there exist several historical and recent cases where stock collapses still occurred, as shown by the case of the closure of the sardine fishing season off the length of the U.S. West Coast, recommended by the Pacific Fishery Management Council (*Decision Summary Document Pacific Fishery Management Council*, 2016) in April 2016. **It was closed mid-season in 2015 due to low stocks**, but it has since fallen further. Federal rules mandate that the harvest must be closed if adult stocks fall below 150,000 tons, and the government estimates that there are now less than 65,000 tons.