

Reconciling a positive ecological balance with human development: the role of population in low-fertility countries

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Background

We presented a new **sustainability criterion** based on **two constraints**, which are able to reconcile a positive ecological balance and human development if **simultaneously** satisfied.

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Original Articles

Reconciling a positive ecological balance with human development: A quantitative assessment

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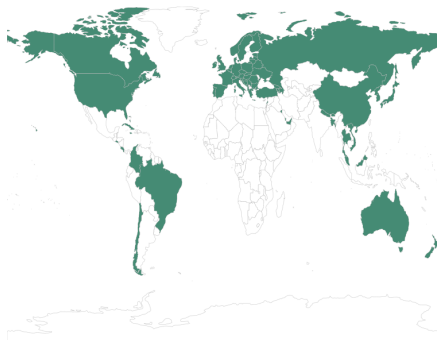
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Research questions

Here, I will apply the criterion to **low-fertility countries**

fertility rate ≤ 2.1
(replacement rate)



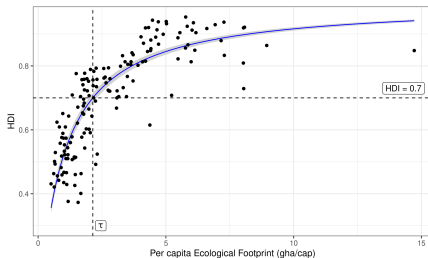
- ▶ How is the ecological balance for these countries?
- ▶ what is their level of human development?
- ▶ do they satisfy both constraints of the sustainability criterion?
- ▶ if not, what can they do in order to satisfy them?
- ▶ what is the role of population?

New sustainability criterion

$$\begin{cases} (H) & EF_{pc} \geq \tau \\ (E) & EB \geq 0 \end{cases}$$

(H)–constraint: the per-capita ecological footprint must be at least τ

- ▶ τ is a value corresponding to a **high level** of human development ($HDI = 0.7$)
- ▶ HDI is an indicator of human development introduced by the UNs
- ▶ $\tau = 2.14$ gha per person



New sustainability criterion

$$\begin{cases} (H) & EF_{pc} \geq \tau \\ (E) & EB \geq 0 \end{cases}$$

(*E*)–constraint: the eco-balance must be positive

- ▶ eco-balance *EB* is a novel ecological indicator:
 $EB = 1 - EF_{pc} \times PB$
- ▶ population biodensity *PB* is the ratio between population and *BC* (biocapacity)
- ▶ (*E*)–constraint is equivalent to the sustainability condition used by the GFN: $EF \leq BC$

Graphical visualization of the criterion

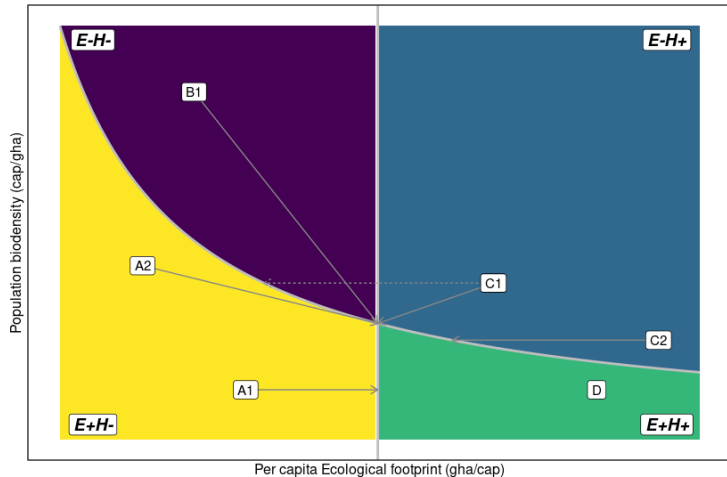


Figure: (E)-constraint is equivalent to be below the curve $y = 1/x$ (hyperbola), (H)-constraint is equivalent to be on the right-hand side of the vertical line $x = \tau$

Results for low-fertility countries I

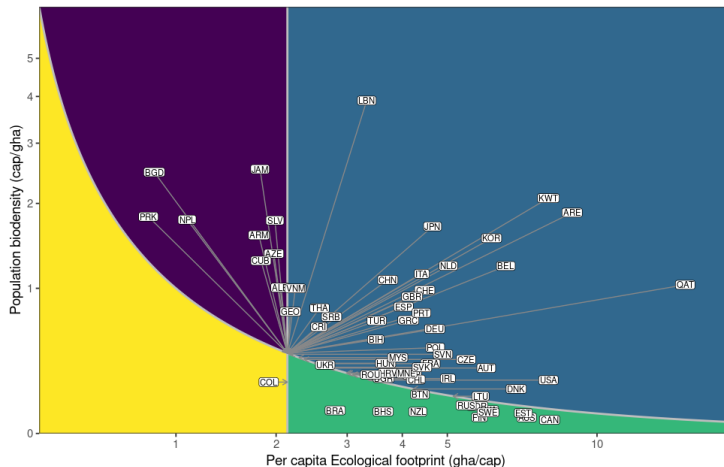


Figure: Several countries cannot reach the sustainable region without a vertical move

Results for low-fertility countries II

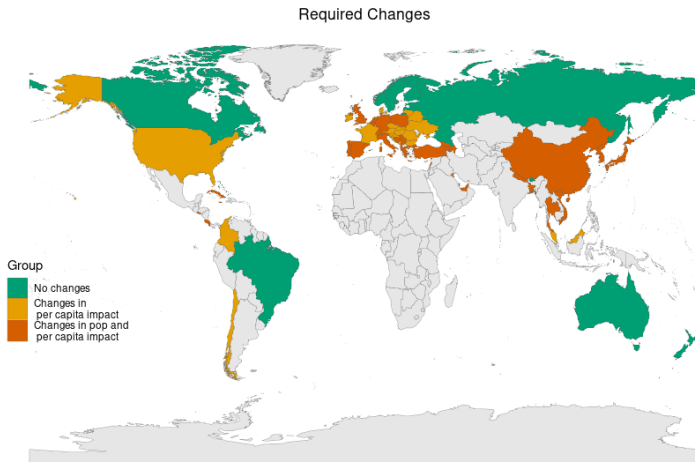


Figure: 33 countries cannot satisfy both constraint by only reducing EF_{pc} and need hence a **population reduction** as well (**red group**)

Conclusion I

Many low-fertility countries:

- ▶ have a **very high population** compared to their **biocapacity**
- ▶ need a further **population reduction** in order to become environmentally sustainable **without violating the human constraint**

Strategy 1: countering depopulation

- + retirement schemes
- it postpones the decline
- eco-balance becomes worse

Strategy 2: promoting depopulation

- + sustainability
- + it is easy and cheap
- ageing phase

Conclusion II



The ageing phase can be managed without dramatic costs.

Japan is still one of the richest and most innovative countries of the world.

Vice versa, almost all the poorest and least innovative countries have a rapid population growth and high fertility rates.

⇒ **Strategy 2** should be at least taken into consideration!



Thank you for your attention!

