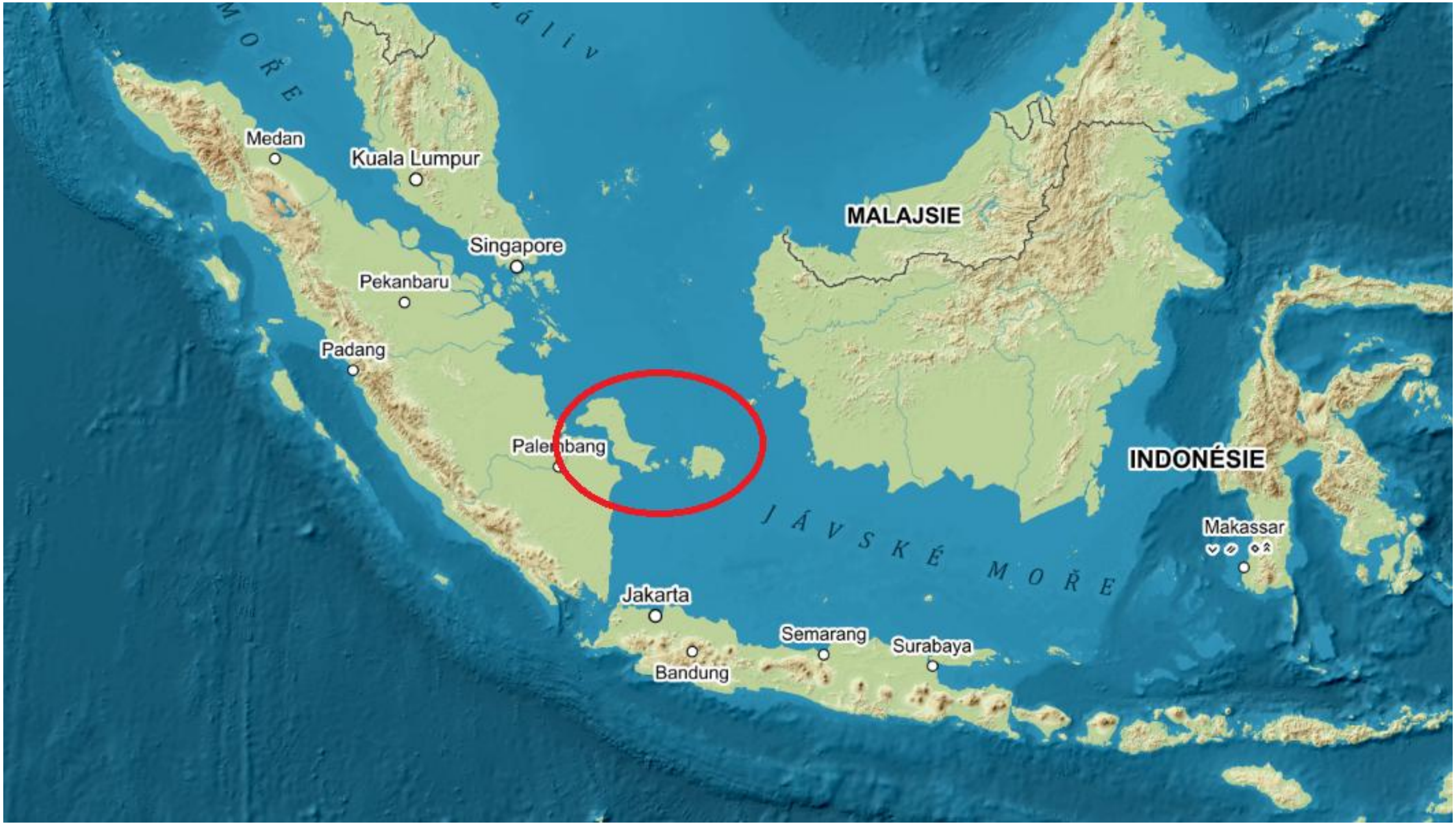
Globální koncepce ochrany životního prostředí

8. Materiální ekonomika

Přednáší: Vojtěch Kotecký
Centrum pro otázky životního prostředí UK

Agenda

1. Úvod
2. Znečištění
3. Biodiverzita a využití země
4. Klima
5. Oceány
6. Hodnoty a postoje
7. Technologie
8. **Materiální ekonomika**
9. Struktura ekonomiky
10. Věda
11. Policy
12. Firmy
13. Instituce

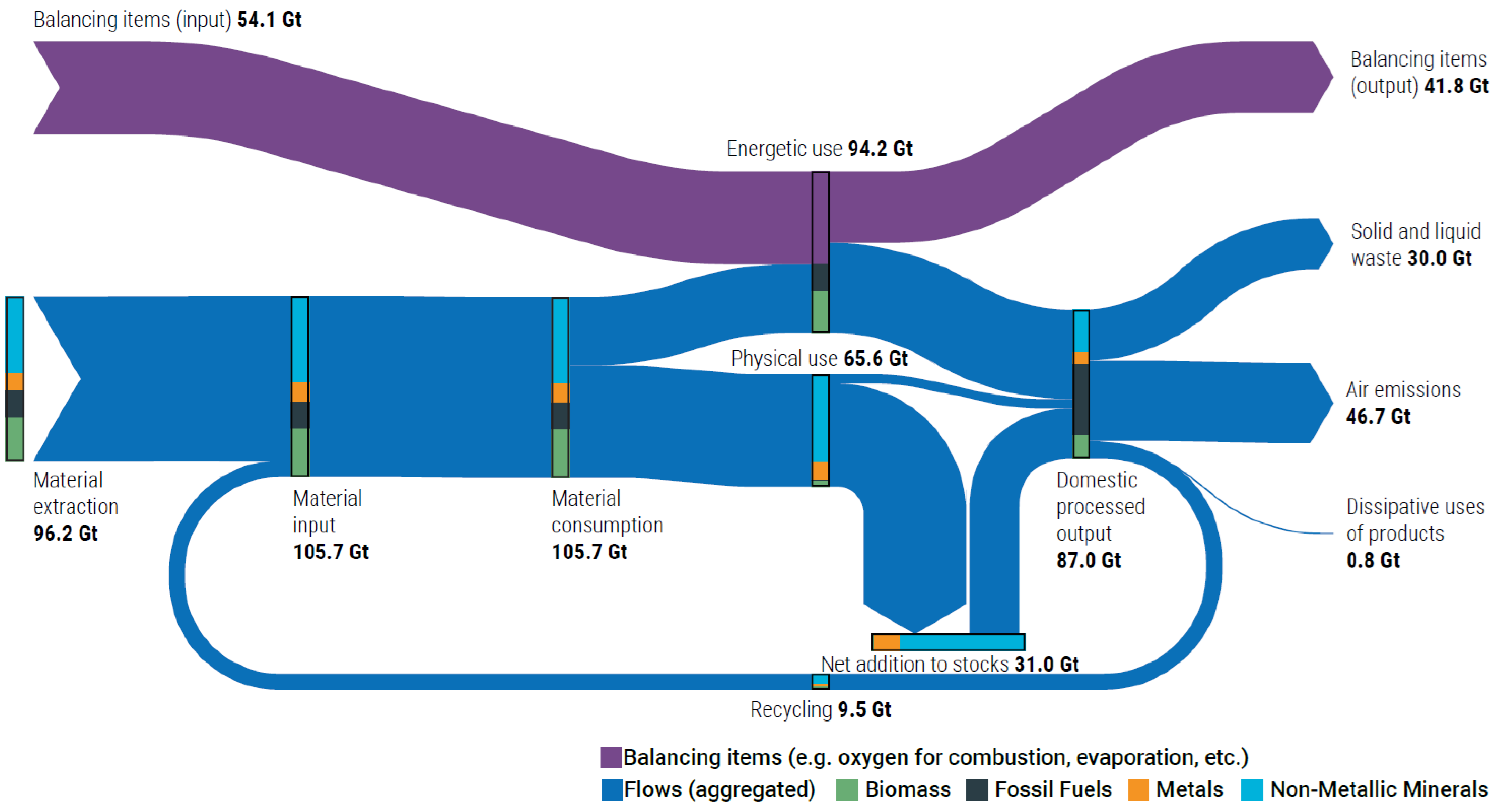


Zdroj: Mapy.cz

Foto: Ulet Ifansasti

Globální materiálové toky

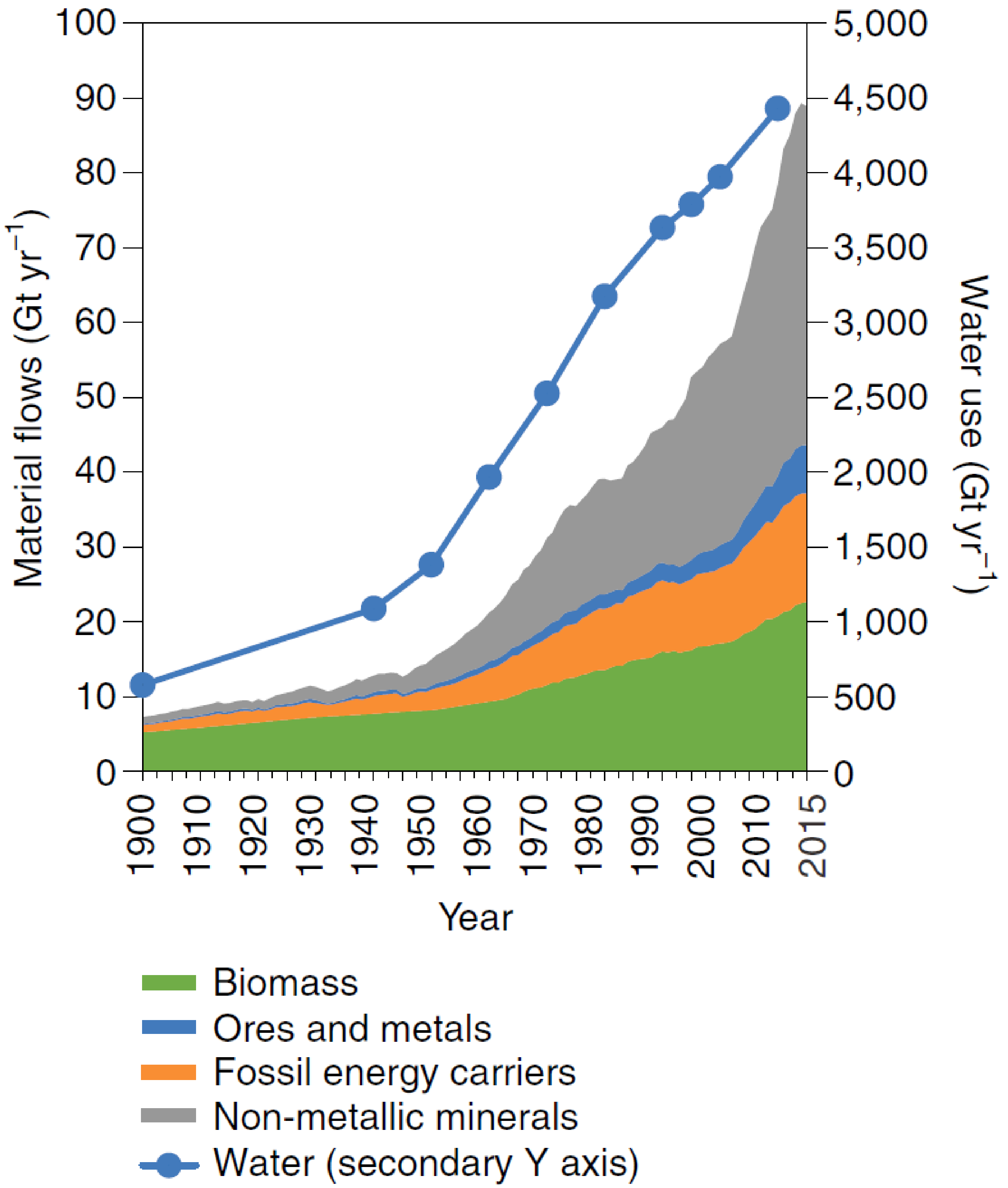
Světová ekonomika ročně spotřebuje přes100 miliard tun materiálů, z toho více než 90 % čerpá z prostředí. Necelých 10 miliard tun se recykluje. Přes 30 miliard tun se přidává do „zásob“ (většinou trvalých struktur). Zbytek končí jako odpad v prostředí.



Zdroj: UNEP 2024

Materiálová náročnost společnosti

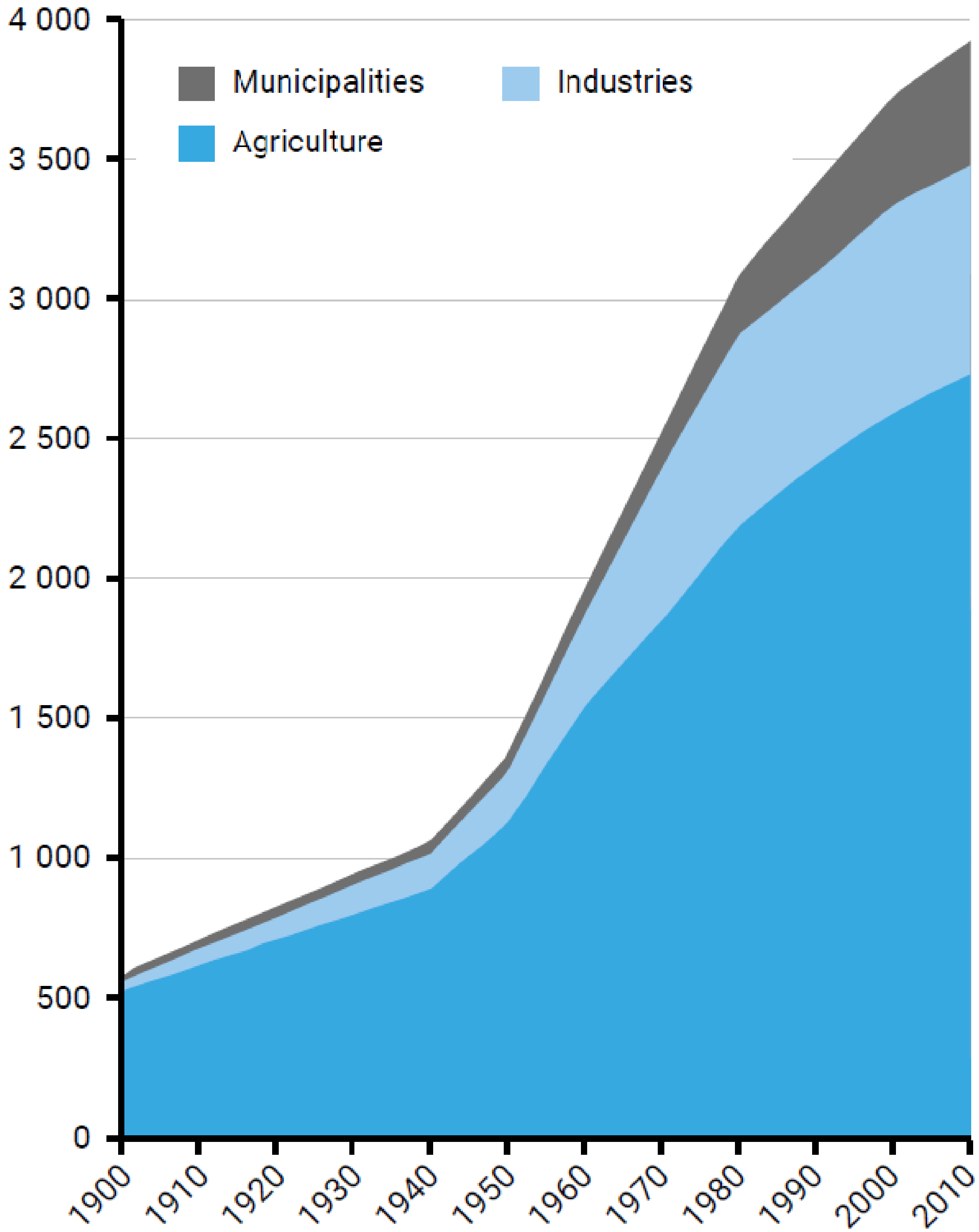
Globální spotřeba vody a materiálové toky nerud, rud, fosilních paliv a biomasy (Gt.rok^{-1}), 1900–2015



Zdroj: Haberl et al. 2019

Globální spotřeba vody podle účelů

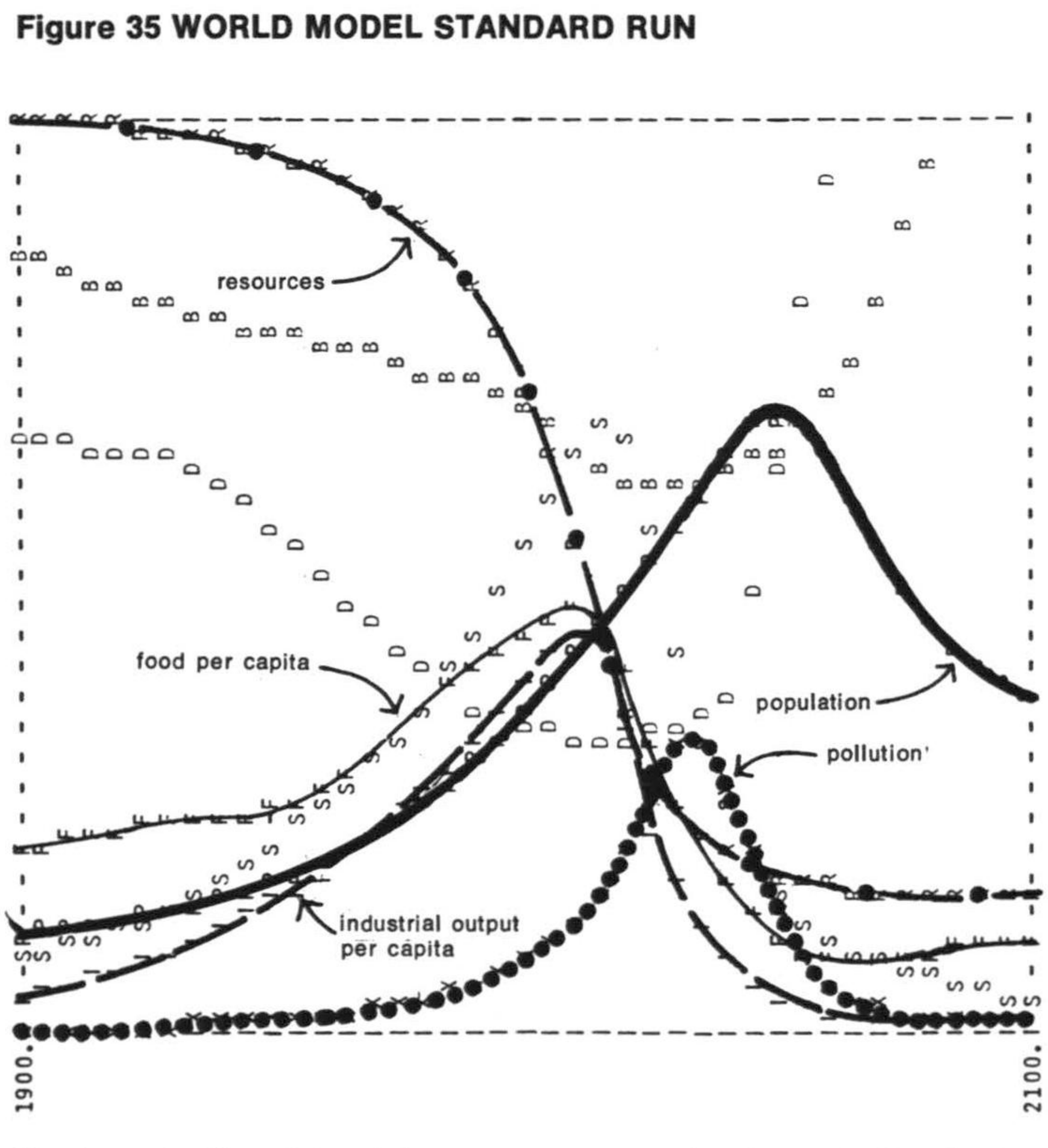
Světová spotřeba vody v komunálním sektoru, průmyslu a zemědělství ($km^3.rok^{-1}$), 1900–2010. Spotřeba soustavně roste a většina světové poptávky připadá na zemědělství, ačkoli jeho relativní podíl klesá.

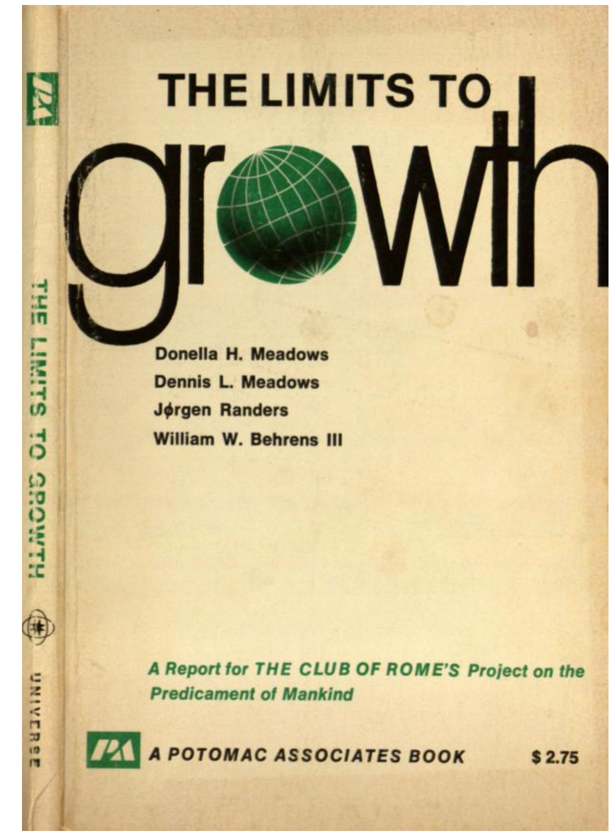


Zdroj: Haberl et al. 2019

Limity růstu 1972: nakolik se vlastně model…

Limity růstu, Graf 35 (standardní projekce)

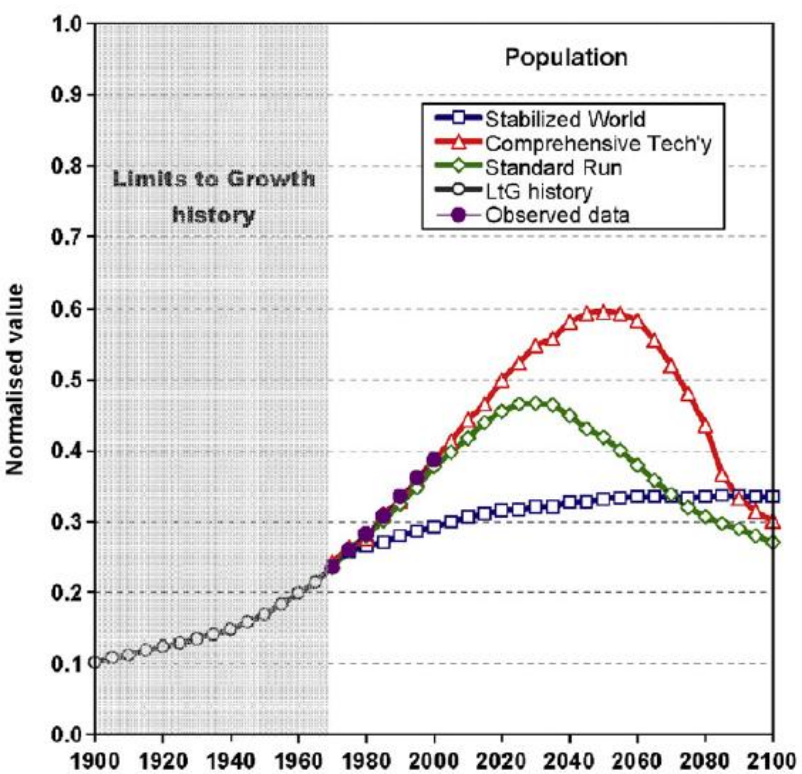


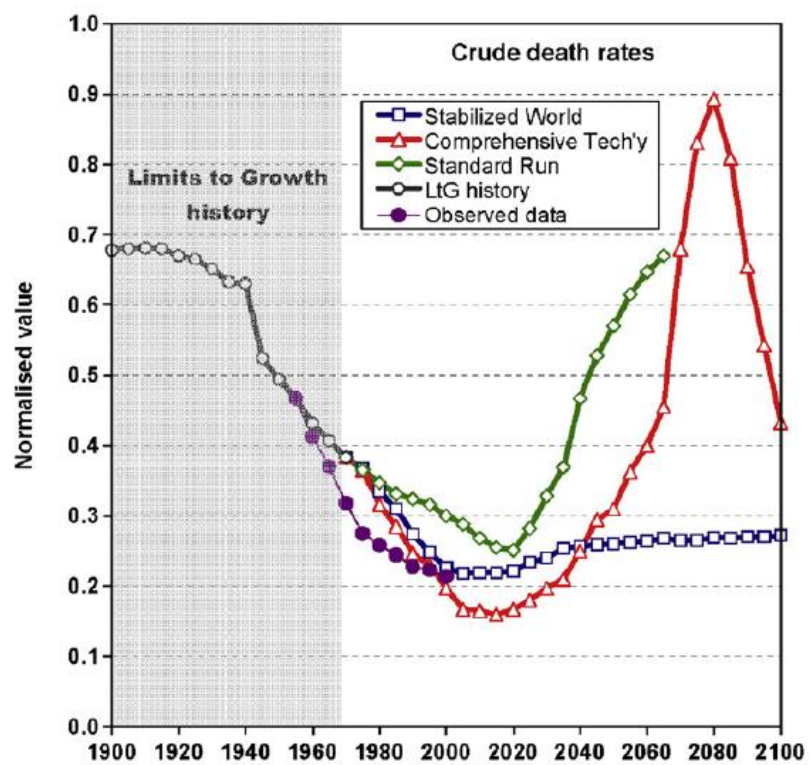


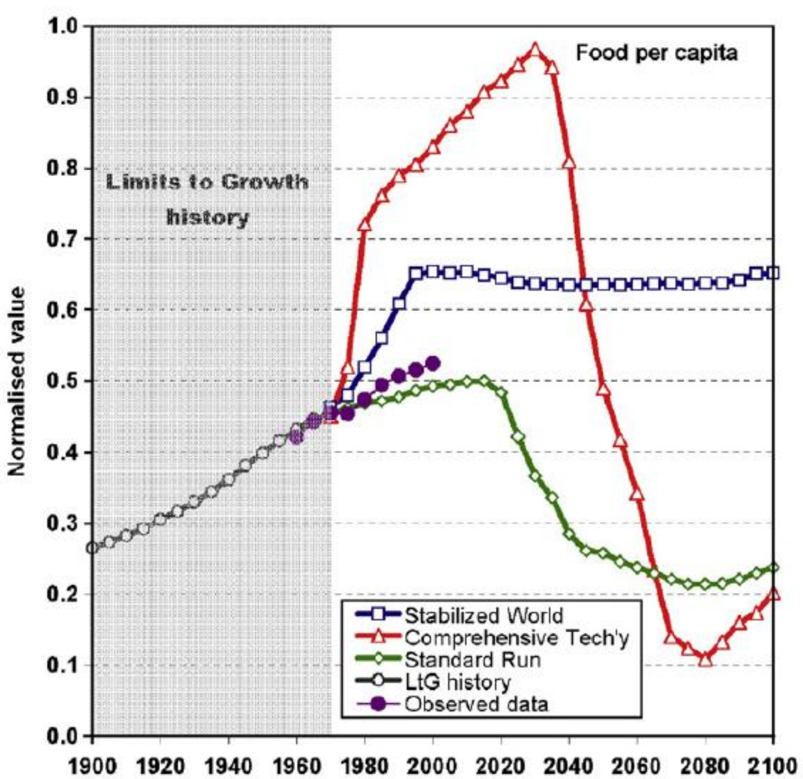
Zdroj: Meadows et al. 1972

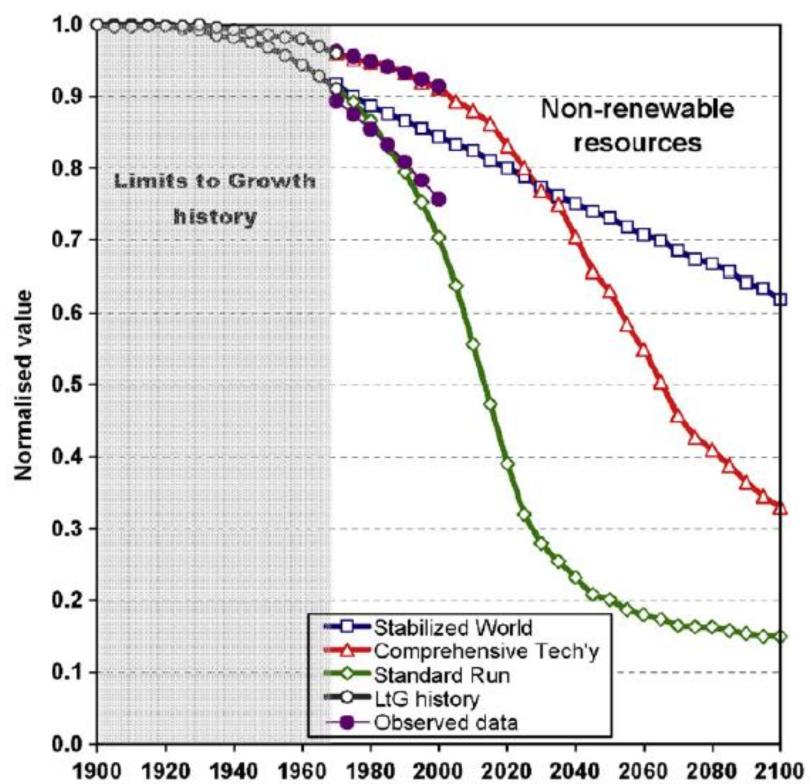
…v projekcích trefil?

Limity růstu: variantní projekce vs. historická data









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A comparison of *The Limits to Growth* with 30 years of reality

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ABSTRACT

In 1972, the Club of Rome's infamous report "*The Limits to Growth*" [Meadows, D.H., Meadows, D.L., Randers, J., Behrens_III, W. W. (1972). The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind. Universe Books, New York] presented some challenging scenarios for global sustainability, based on a system dynamics computer model to simulate the interactions of five global economic subsystems, namely: population, food production, industrial production, pollution, and consumption of non-renewable natural resources. Contrary to popular belief, *The Limits to Growth* scenarios by the team of analysts from the Massachusetts Institute of Technology did not predict world collapse by the end of the 20th century. This paper focuses on a comparison of recently collated historical data for 1970–2000 with scenarios presented in the *Limits to Growth*. The analysis shows that 30 years of historical data compare favorably with key features of a business-as-usual scenario called the "standard run" scenario, which results in collapse of the global system midway through the 21st century. The data do not compare well with other scenarios involving comprehensive use of technology or stabilizing behaviour and policies. The results indicate the particular importance of understanding and controlling global pollution.

1. Introduction

In 1972, a team of analysts from the Massachusetts Institute of Technology published "*The Limits to Growth*" (Meadows et al., 1972). This well-known and controversial book documented for the general public the results of the MIT study carried out by Meadows et al., who had been commissioned by The Club of Rome to analyse the "world problematique" using a computer model called World3 developed at MIT. The World3 model permitted Meadows et al. to examine the interactions of five subsystems of the global economic system, namely: population, food production, industrial production, pollution, and consumption of non-renewable natural resources. The time scale for the model began in the year 1900 and continues until 2100. Historical values to the year 1970 are broadly reproduced in the World3 output.

A description of the background that led to the *Limits to Growth* (subsequently abbreviated as: LtG) is given elsewhere (McCutcheon, 1979). This reference also briefly summarizes the LtG publication (pp. 7–14). A detailed description of the model, the supporting data, and an analysis of how the model behaves was also published (Meadows et al., 1974).

The release of the LtG in 1972 had immediate and ongoing impacts. Environmental issues and the sustainability debate were further popularized as millions of copies were sold, and translated into 30 languages. Scientifically, it introduced Jay Forrestor's newly founded computational approach of "system dynamics" modelling, and quantitative scenario analysis, into the environmental discipline. By linking the world economy with the environment, it was the first integrated global model (Costanza et al., 2007). The salient message from the LtG modelling was that continued growth in the global economy would lead to planetary limits being exceeded sometime in the 21st century, most likely resulting in the collapse of the population and economic system, but also that collapse could be avoided with a combination of early changes in behaviour, policy, and technology.

Despite these major contributions, and dire warnings of "overshoot and collapse", the LtG recommendations on fundamental changes of policy and behaviour for sustainability have not been taken up, as the authors recently acknowledge (Meadows et al., 2004). This is perhaps partly a result of sustained false statements that attempt to discredit the LtG. From the time of its publication to contemporary times, the LtG has provoked many criticisms which falsely claim that the LtG predicted resources would be depleted and the world system would collapse by the end of the 20th century. Such claims occur across a range of publication and media types, including scientific peer-reviewed journals, books, educational material, national newspaper and magazine articles, and web sites (Turner, unpublished). This paper briefly addresses these claims, showing them to be false.

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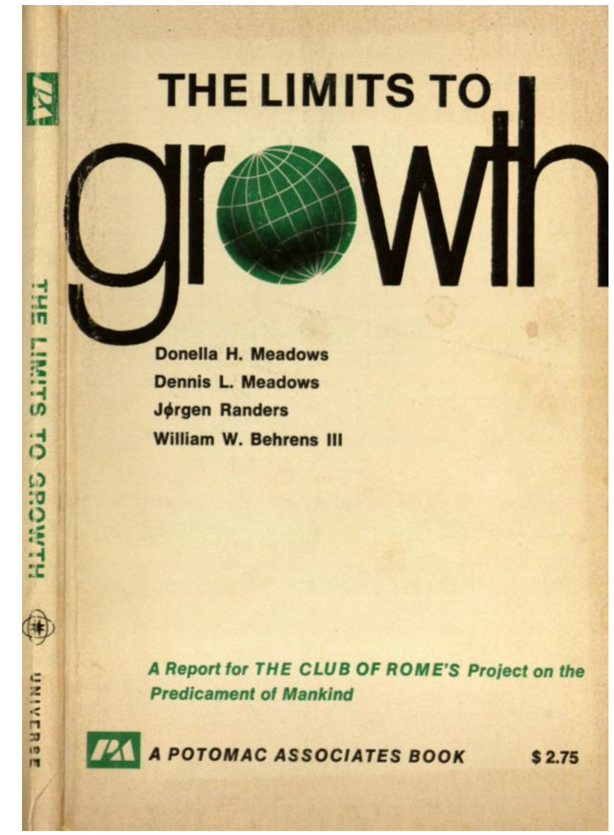
Zdroj: Turner 2008

Limity růstu 1972: předvídaly vyčerpání?

Limity růstu, Tabulka 4 (část)

Table 4 NONRENEWABLE NATURAL RESOURCES

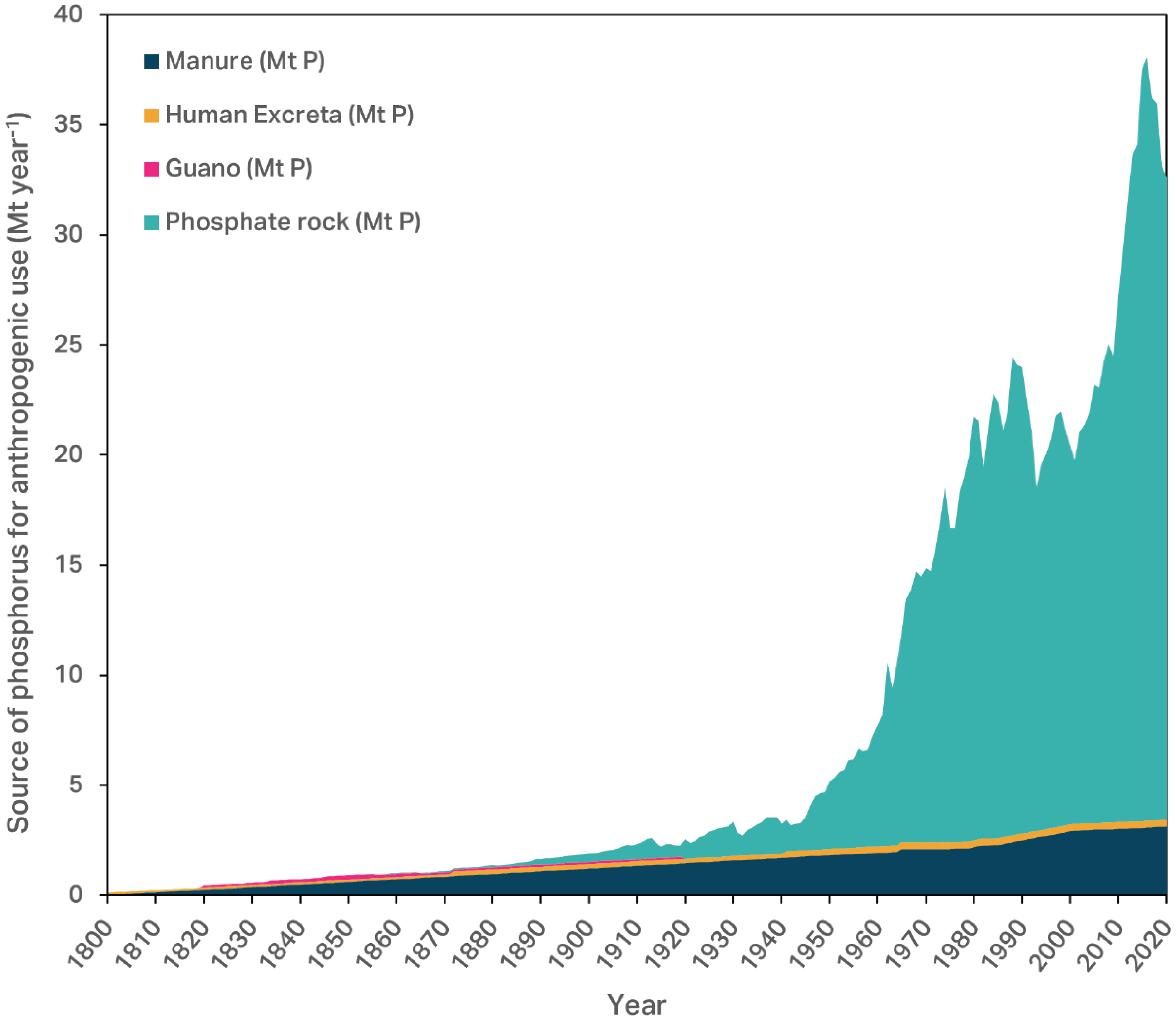
1	2	3	4			5	6
Resource	*Known Global Reserves* [a]	*Static Index (years)* [b]	*Projected Rate of Growth (% per Year)* [c]			*Exponential Index (years)* [d]	*Exponential Index Calculated Using 5 Times Known Reserves (years)* [e]
			High	*Av.*	*Low*		
Aluminum	1.17×10^9 tons [j]	100	7.7	6.4	5.1	31	55
Chromium	7.75×10^8 tons	420	3.3	2.6	2.0	95	154
Coal	5×10^{12} tons	2300	5.3	4.1	3.0 [k]	111	150
Cobalt	4.8×10^9 lbs	110	2.0	1.5	1.0	60	148
Copper	308×10^6 tons	36	5.8	4.6	3.4	21	48
Gold	353×10^6 troy oz	11	4.8	4.1	3.4 [l]	9	29
Iron	1×10^{11} tons	240	2.3	1.8	1.3	93	173
Lead	91×10^6 tons	26	2.4	2.0	1.7	21	64
Manganese	8×10^8 tons	97	3.5	2.9	2.4	46	94
Mercury	3.34×10^6 flasks	13	3.1	2.6	2.2	13	41



Zdroj: Meadows et al. 1972

Historická spotřeba (a zdroje) fosforu

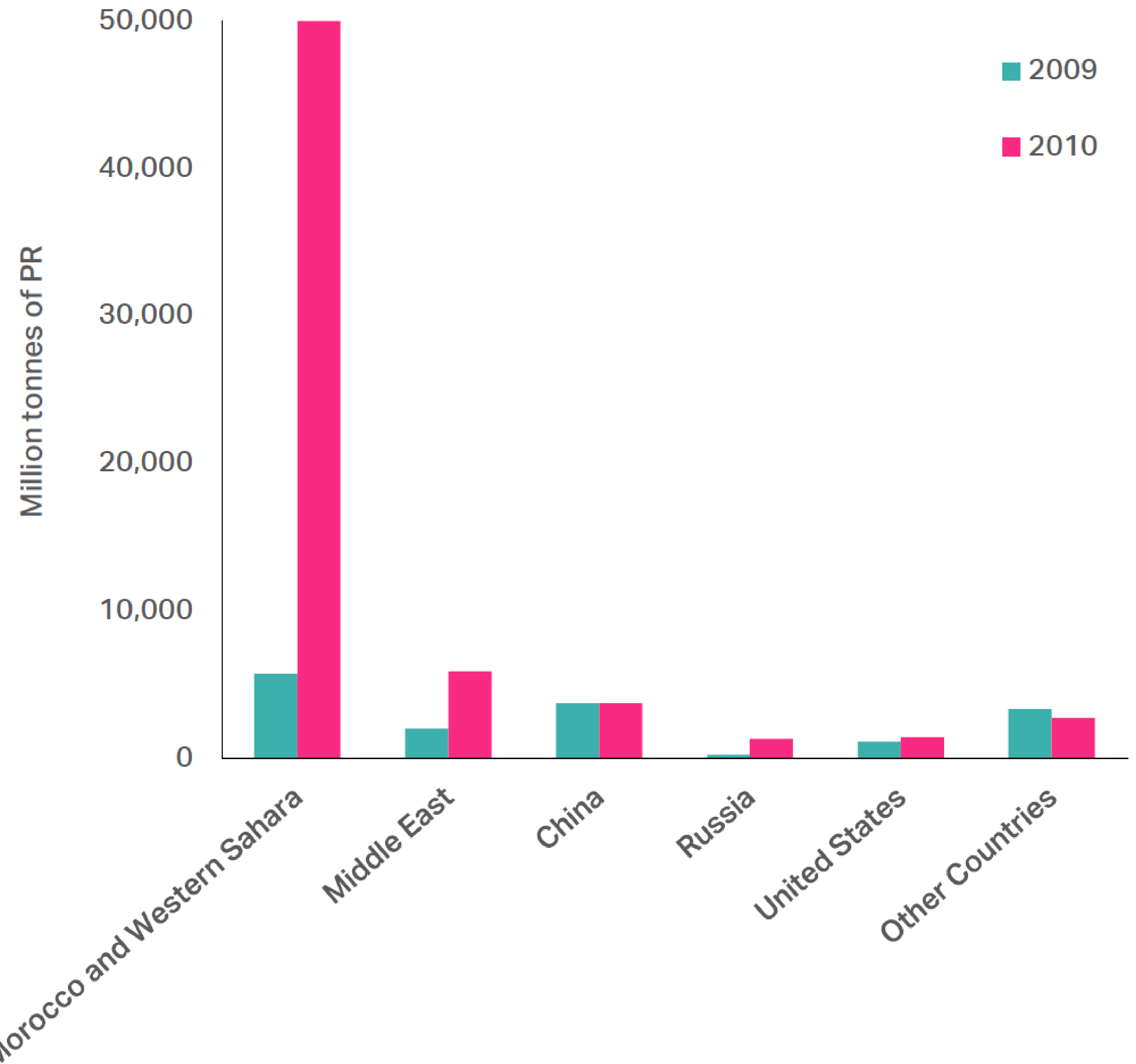
Historická spotřeba a dílčí zdroje fosforu, 1800–2020 ($Mt.rok^{-1}$)



Zdroj: Brownlie et al. 2022

Globální zásoby fosfátů

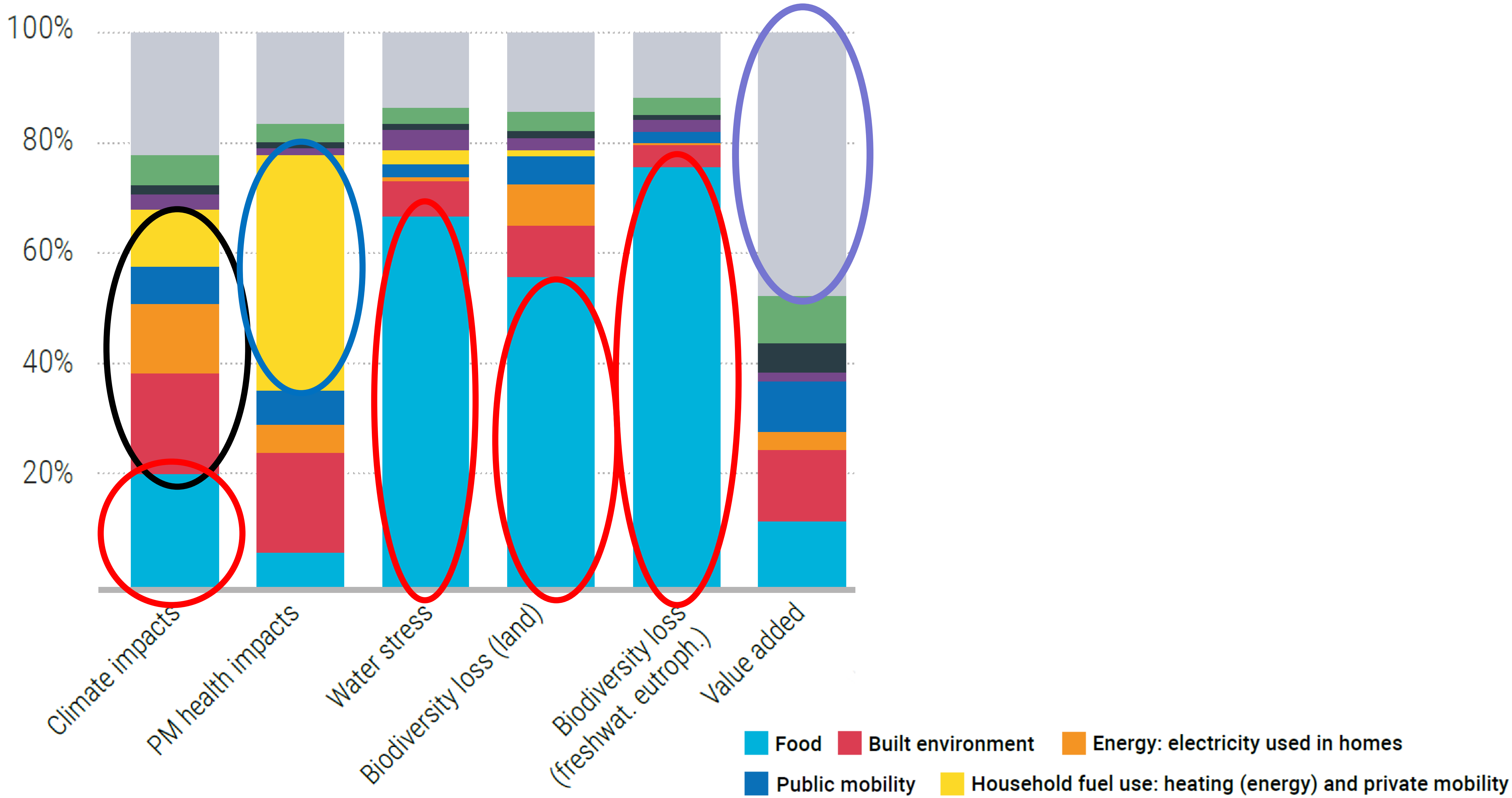
Zásoby fosfátů v klíčových zemích (Mt známých zásob, 2009 a 2010)



Zdroj: Brownlie et al. 2022

Environmentální tlaky materiálové náročnosti

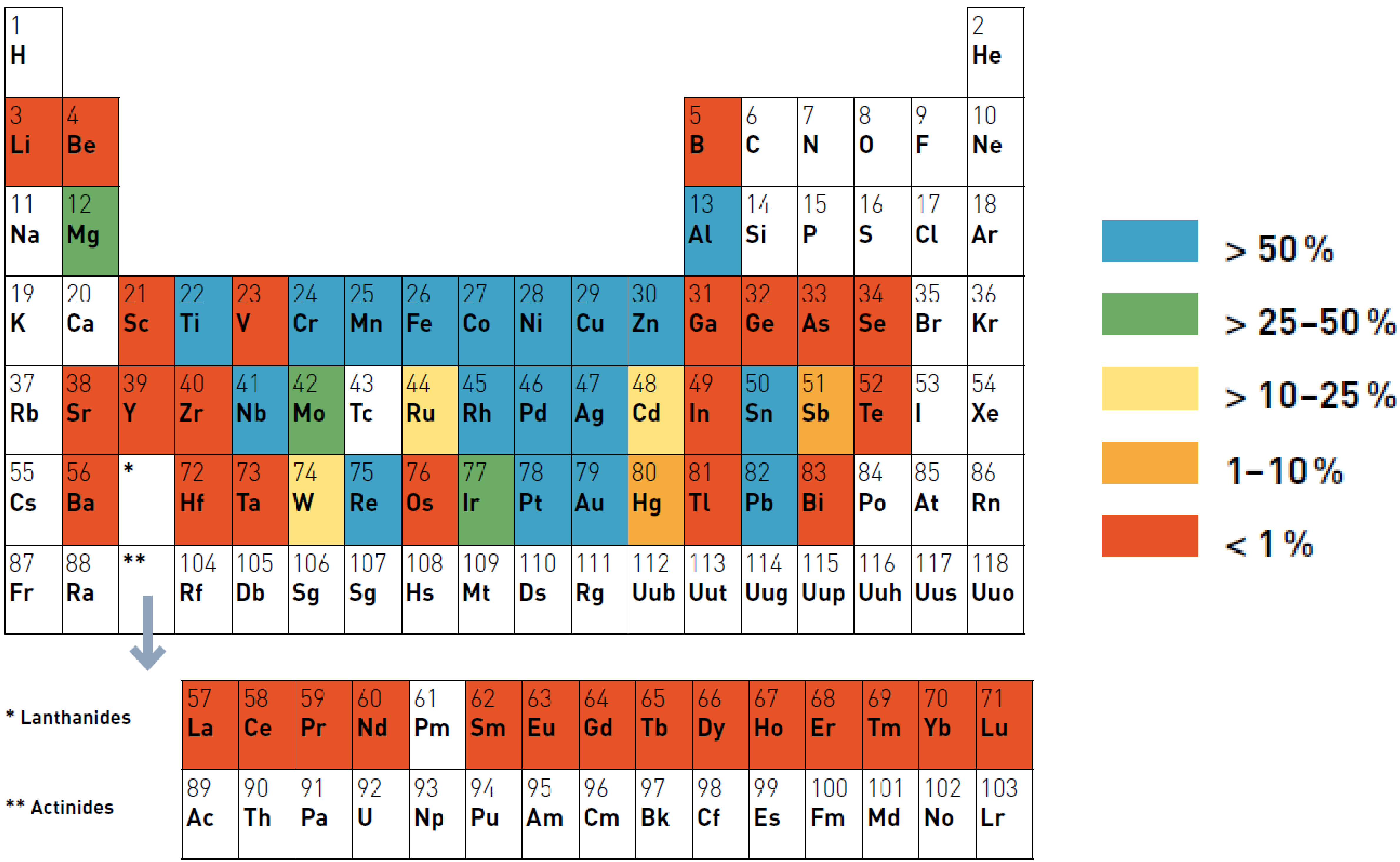
Environmentální dopady dílčích ekonomických systémů



Zdroj: UNEP 2024

Recyklace kovů

Míra funkční recyklace odpadních kovů u 60 prvků (%)



Zdroj: UNEP 2011