CIRAIG™

International Reference Centre for the
Life Cycle of Products, Processes and Services

A bi-dimensional assessment to measure the performance of circular economy: a case study of tires end-of-life management

Lonca, G., Imbeault-Tétreault, H., Muggéo, R., Bernard, S. and Margni, M.

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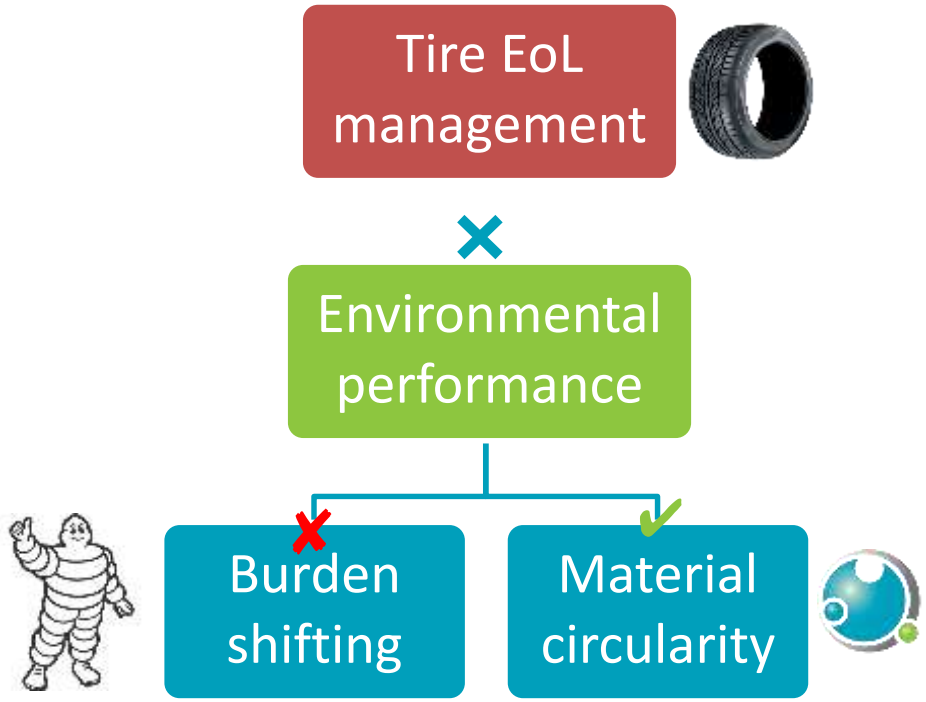
Life Cycle Management 2017, Luxembourg.

TU-102: Raw materials supply chains in the light of the circular economy

ESG UQÀM

POLYTECHNIQUE MONTRÉAL

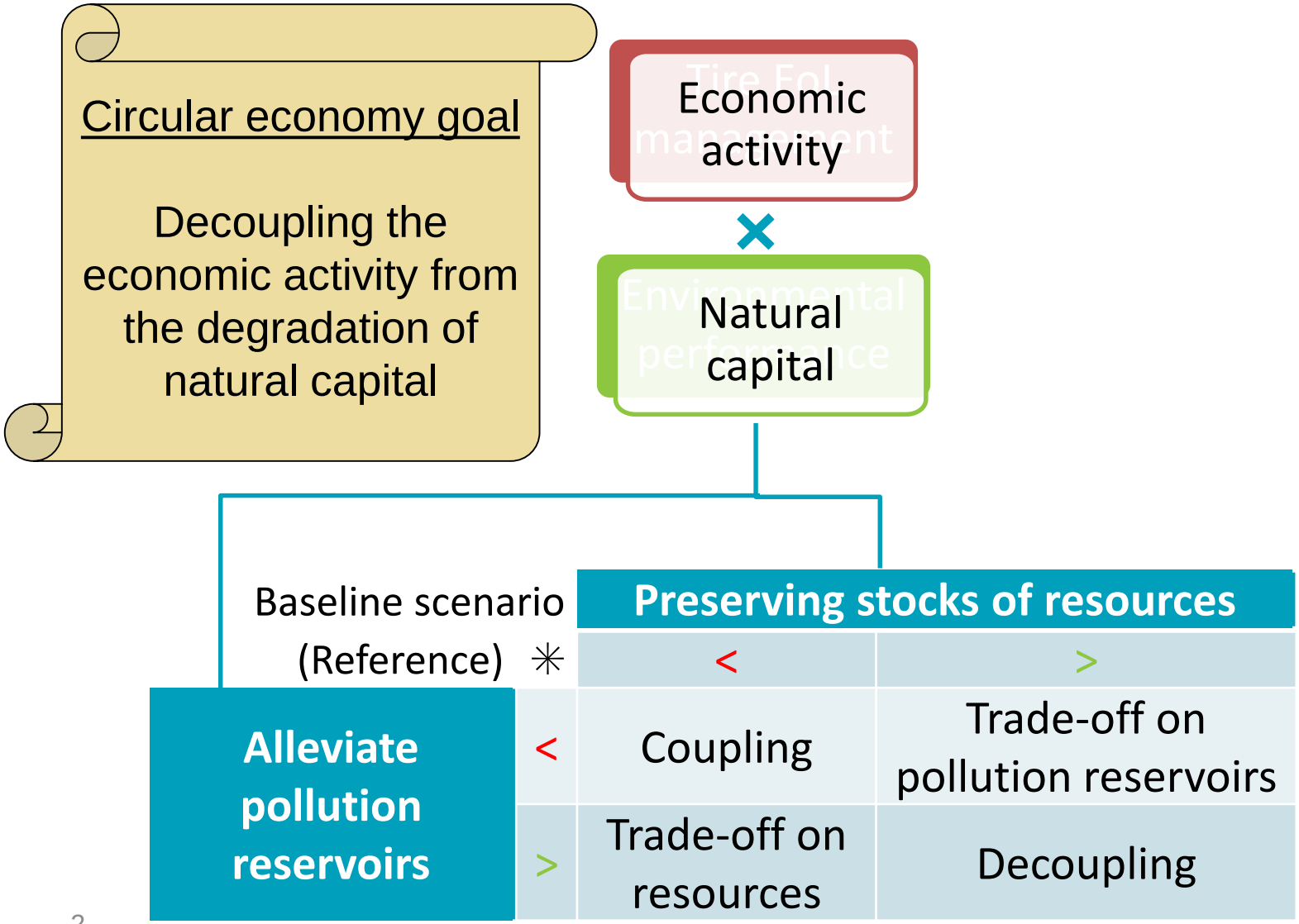
Tire circularity and circular economy



How to qualify the relationship between material circularity and environmental performance ?

↳ How to assess material circularity ?

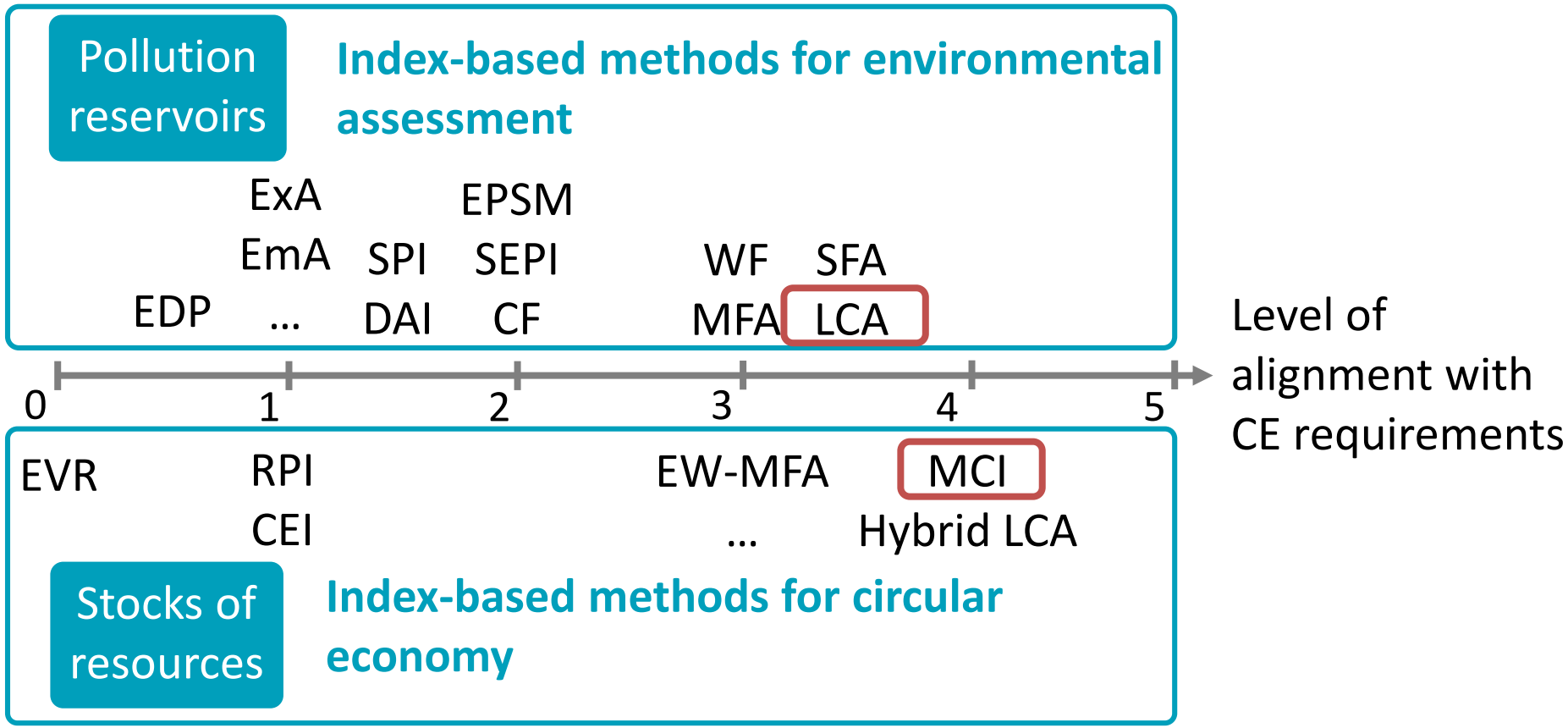
About the relationship: a trade-off approach



Baseline scenario (Reference) ✳		Preserving stocks of resources <	Preserving stocks of resources >
Alleviate pollution reservoirs	<	Coupling	Trade-off on pollution reservoirs
	>	Trade-off on resources	Decoupling

About quantification: a literature review

Assessment tool review by Elia *et al.*, 2017:



Case study: key features

$$MCI = 1 - LFI \times F(X) \quad \in [0;1]$$

Linear Flow Index

- virgin feedstock
- non-recovered material
- process efficiencies

Utility Function

- product lifetime
- industry average

LCA

Context	Brazilian haulage trucks 32 tons average load in 2012
Functional unit	Provide haulage truck's tires for 600 000 km and manage tires EoL
Methodology (LCA)	ReCiPe (H)
Data	Michelin Ecoinvent 2.2

Case study: 3 tire end-of-life scenarios

- 83 tires
- 72 240 l Biofuel B5

BASELINE

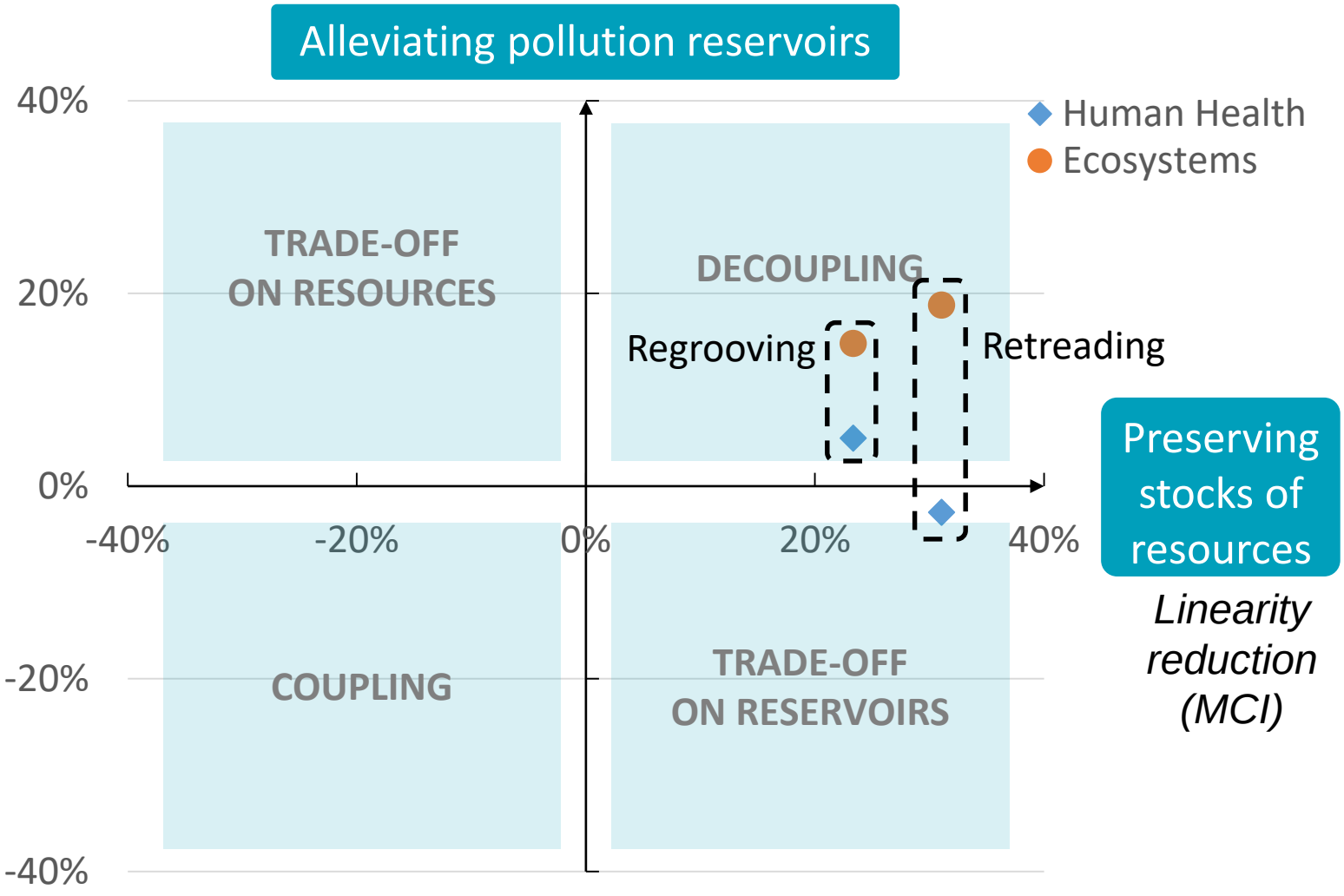
REGROOVING

- Lifetime : +30.5%
- Fuel consumption : -5.4%

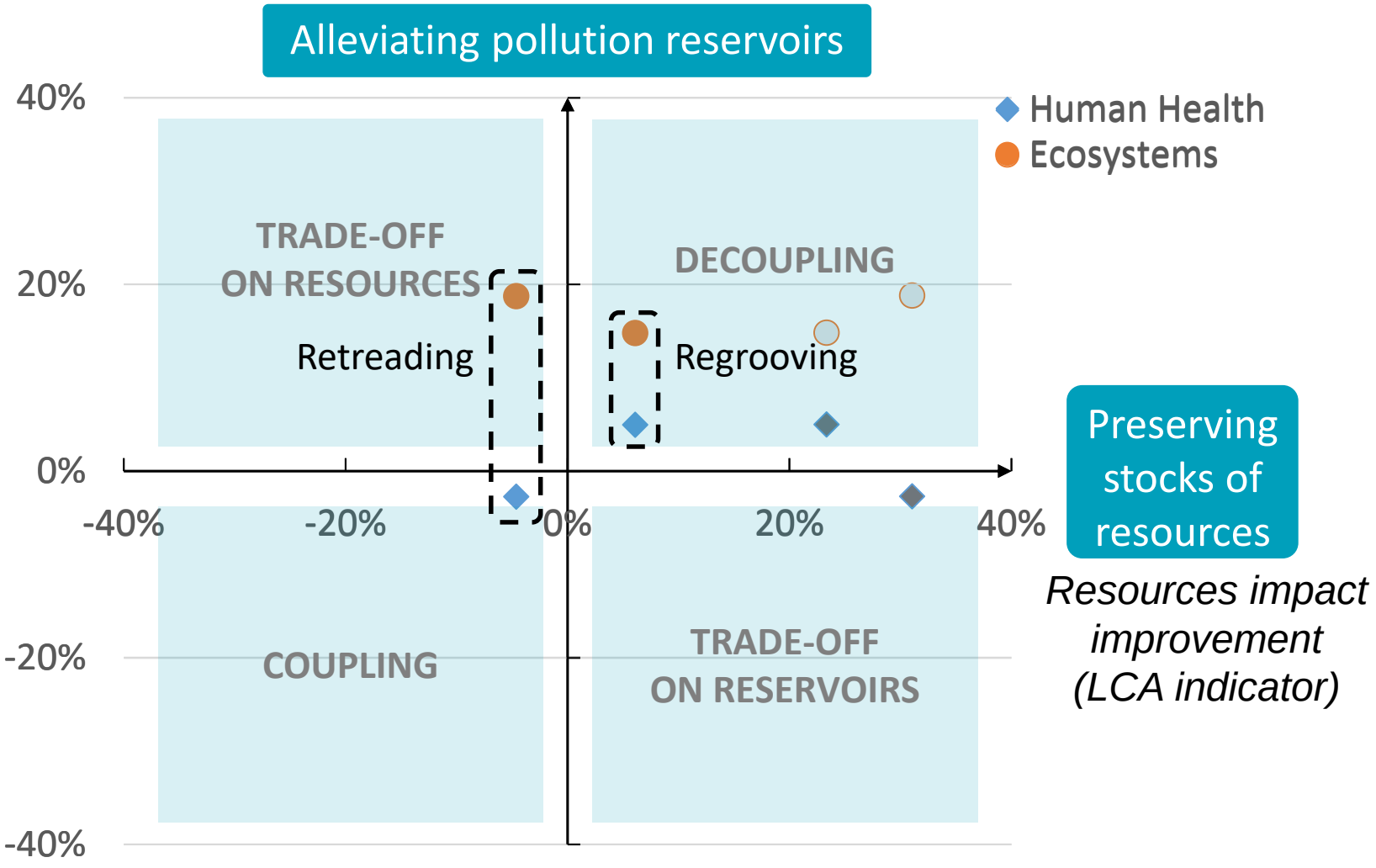
RETREADING

- Lifetime (casing) : +50%
- Fuel consumption : +6.8%

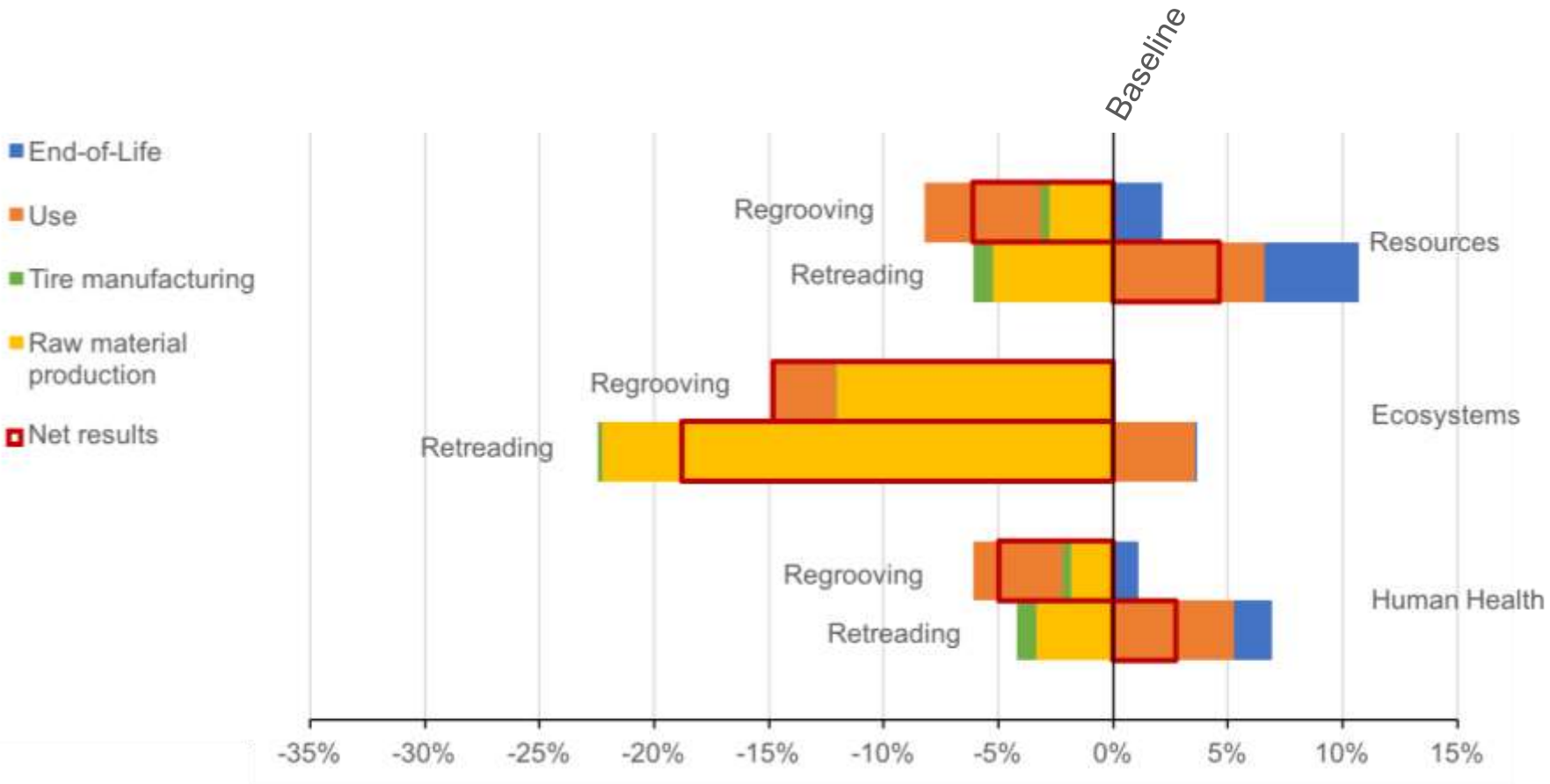
Results


Alleviating pollution reservoirs
40%
20%
0%
-20%
-40%
-40%
-20%
0%
20%
40%
Human Health
Ecosystems
TRADE-OFF ON RESOURCES
DECOUPLING
Regrooving
Retreading
COUPLING
TRADE-OFF ON RESERVOIRS
Preserving stocks of resources
Linearity reduction (MCI)

Results


Alleviating pollution reservoirs
40%
20%
0%
-20%
-40%
-40%
-20%
0%
20%
40%
Human Health
Ecosystems
TRADE-OFF ON RESOURCES
DECOUPLING
Retreading
Regrooving
COUPLING
TRADE-OFF ON RESERVOIRS
Preserving stocks of resources
Resources impact improvement (LCA indicator)

Results



Contribution of variations to endpoint scores relatively to the baseline scenario

Step back: MCI vs Resource (LCA)

	MCI	Resource (LCA)
Includes	Foreground system	Foreground and background systems
Issue	Improving product circularity	Preserving future resource access
Level concerned	Product / company	Societal

Concluding remarks

- Defining resources: material and energy.
- Accounting for processes along the product life cycle
- Identifying scale issues: firm and societal.

THANK YOU