



# Ecological Debts measured for land-take: an experiment in France and potential uses

Clément Surun, Yann Kervinio, Adrien Comte, Harold Levrel

[clement.surun@agroparistech.fr](mailto:clement.surun@agroparistech.fr)

**Economic Valuation of Biodiversity Wealth and Debt  
in National Accounting**

International online workshop, 20/21 November 2023



Leibniz Institute of  
Ecological Urban and  
Regional Development

# Building an accounting system to contribute to policy targets

- **More and more policy targets** in the EU:
  - Bird and Habitat directives; Water framework directive, Marine Strategy framework directive
  - Now: nature restoration law, Green Deal
- Recent adoption of CSRD: focus on double materiality (financial & **impact materiality**)
- Evidences still lack regarding ES valuation and accounting use... (*IPBES, 2022; Selina WP4; Comte et al., 2022*)
- ...while there's a growing demand for **biodiversity financing needs** analyses and building **trajectory to targets**
- Need to include a large set of value (IPBES, 2022\*)... in monetary accounts too

~~2010': Should we preserve biodiversity?~~

->

2020': How to preserve biodiversity?

**What ecosystem accounts to fit in this new context?**

*\* In June 2023, the UNCEEA "Noted the request to take a range of perceptions of value into account in ecosystem accounting, including those of indigenous peoples" (18<sup>th</sup> UNCEEA, minutes)*

# Methods to design and calculate ecological debts

- Based on:

- The **history** of national accounting and of the SEEA
- **Business accounting** theory (& the C.A.R.E. model)
- **Conservation** science and policy
- A **sociological** perspective on statistics & NA

*Vanoli, 2005; Surun, 2023*

*Rambaud et Richard 2015; Rambaud et Feger, 2019*

*IPBES, 2022; Feger and Mermet, 2021; Feger et al. 2018*

*Desrosières, 2002; Miller, 1986*

- **Experimental accounts** (in France):

- Water bodies (WFD)
- Marine ecosystems (MFSD / MAIA project)
- No net land-take (« Climate and resilience » law)
- Protected species and habitats (Habitats directive)
- Carbon emissions

*Surun, 2023*

*Comte et al., 2022*

*Surun, 2023; Gonon, 2021*

*Surun, 2023*

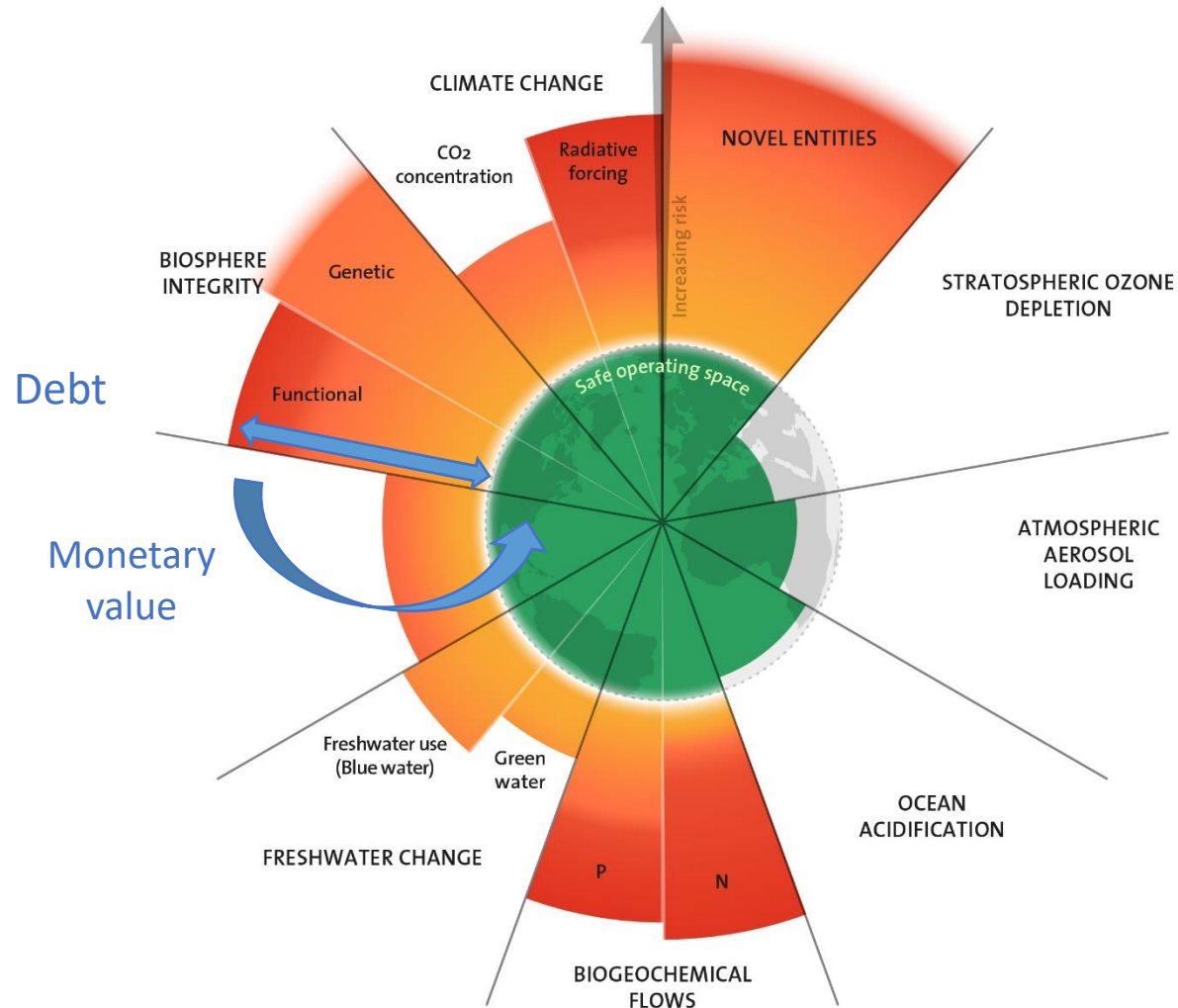
*Germain et Lellouch, 2020; INSEE*

- We developed an **accounting proposal**

*Kervinio & Surun et al., 2023*

# HOW TO DEFINE ECOLOGICAL LIABILITIES?

# Basics



## Definition

**An ecological debt arises as a result of (reversible) environmental degradation.**

It is expressed as a difference between a current condition indicator and a reference level.

## Monetary valuation method\*

**Budgeted costs to ensure the preservation of the ecological entity:**

- Prevention costs (ex ante; e.g. water treatment plant, birds and dolphins scaring devices)
- Restoration costs (ex post)

**In line with the CSR spirit and business « historical cost accounting »\*\***

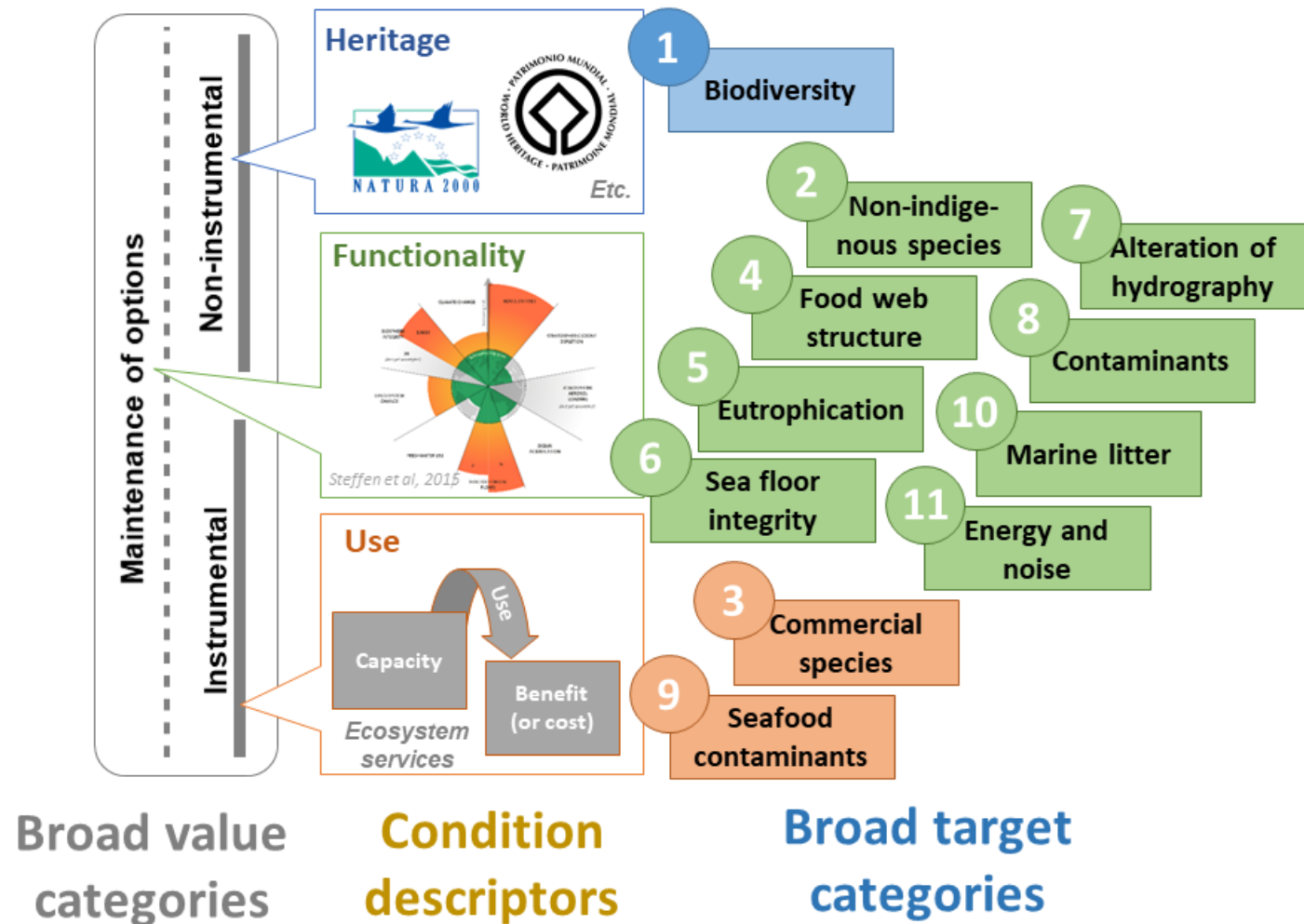
\* Similar (but not identical) to "Restoration cost-based approaches" (SEEA EA, part 12.3.2)

\*\* Business accountants have gone backwards from net present value (the IFRS has change its "fair value" from NPV to market value)

# An inclusive perspective on ecosystems

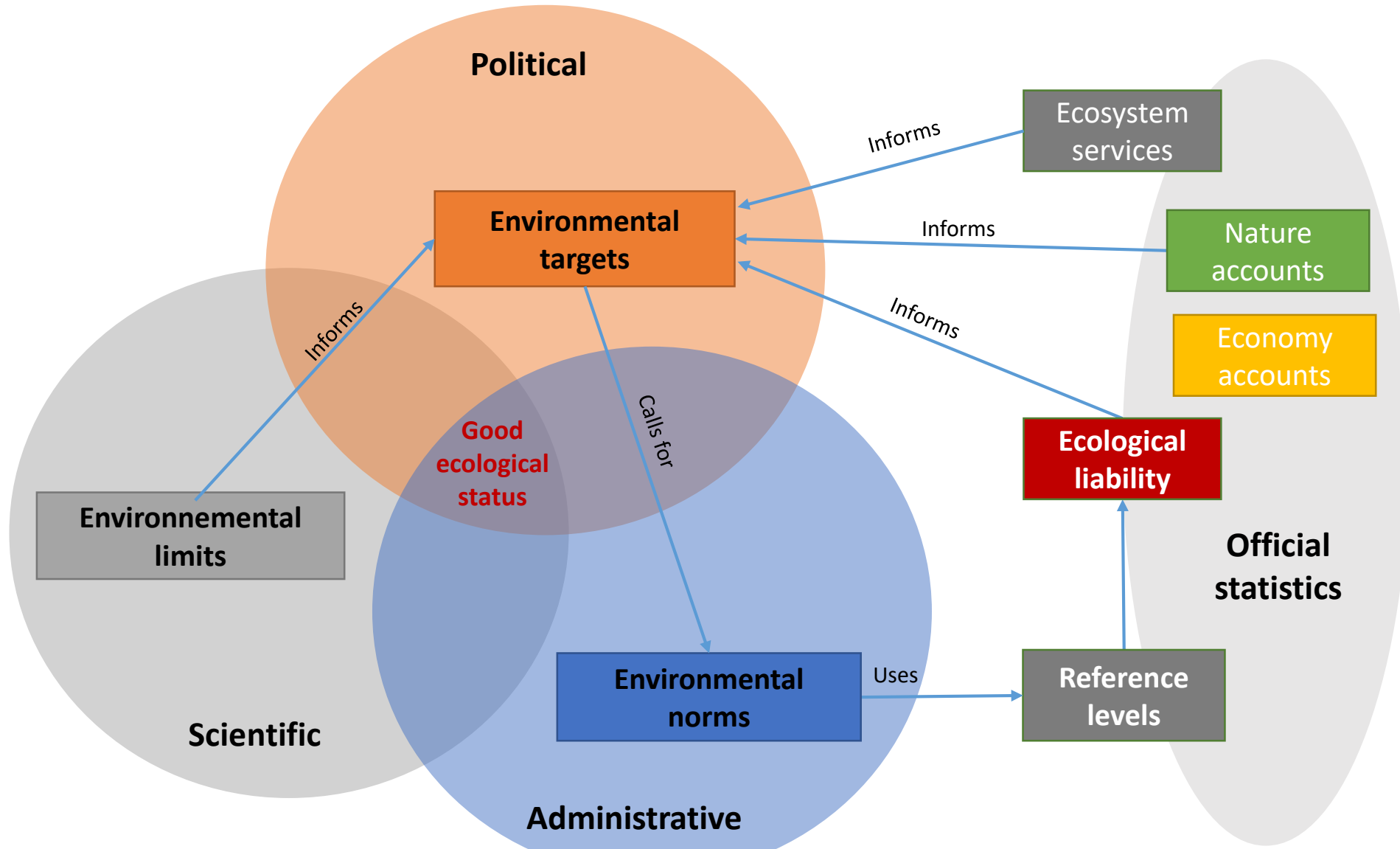
Thanks to:

- Condition indicators coming from **policy and management schemes** -> reflect actual stakeholders' matters of concerns (collective « willingness to preserve »)
- Need for **scientific robustness** to ensure indicators truly represent ecosystems, species, etc.
- This choice allows for environmental **NA to be directly useful** for environmental policies



# Good ecological status as legitimate targets

- **Scientifically robust, politically accepted, and manageable**
- **Rather stable over time** (like carbon neutrality, or no net loss of biodiversity, GES is a kind of focal point for policy-makers)
- Part of **institutional arrangements** (defined outside statistical offices)



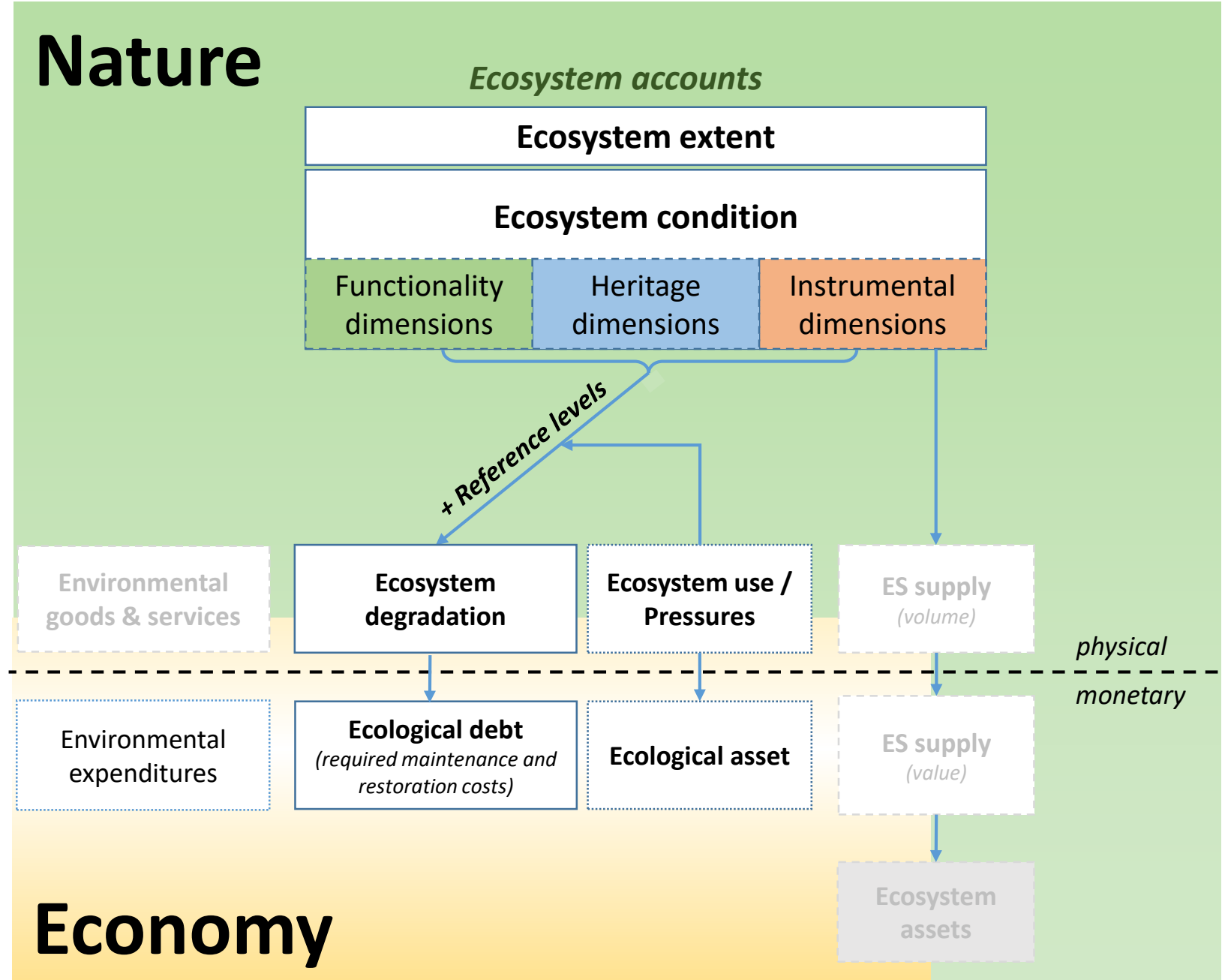
IS IT COMPATIBLE WITH NATIONAL ACCOUNTING?  
NO NET LAND-TAKE AS AN EXAMPLE



# Integrated accounts proposal

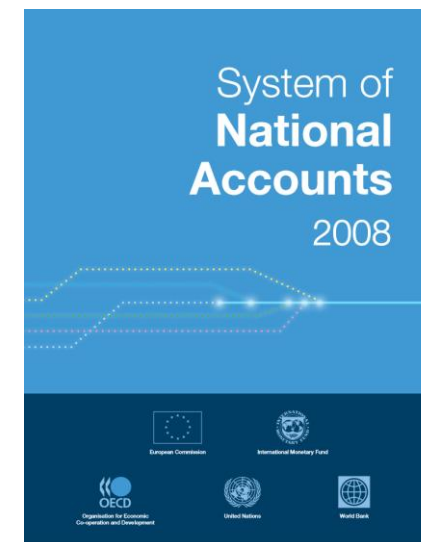
(based on Kervinio & Surun et al., 2023)

- **Most SEEA EA and CF biophysical accounts**
- **Monetary accounts for all dimensions of interest** (not only instrumental), including non-use values
- Leave apart the ecosystem services framework
- Articulate condition, biodiversity funding needs and NA to **truly connect ecosystem values to economic decision**



# A SNA-compatible system

- A **biophysical extension** of the SNA
- Two kinds of monetary valuation:
  - **Economic perspective**: modelled prospective debts by environmental ministry / agencies
  - **Accounting perspective**: bottom-up aggregation of organizations' liabilities (CSR reports, impacts studies, ...)
- The *accounting perspective* gives **exchange values**, in accordance with the SNA (*SNA 2008; van de Ven, 2023*)
  - Liability = commitment to pay in the future
  - Need for an external validation: contract or obligation -> today, degradation authorisation, by derogation to law or policy targets
  - Third party: "Ecosystem trustee" -> today, this is often public administrations
- Accounting structure is:
  - different from Vanoli's « unpaid ecological costs » -> **no imputations**
  - aligned with business « historical cost » accounting (see the C.A.R.E model)



# Land-take example (2021 data)

Method ("economic perspective"):  
 Land-take: 214,5 km<sup>2</sup>  
 Target: 194,6 km<sup>2</sup>  
 Debt: 19,9 km<sup>2</sup>

Restoration costs: 95-350 €/m<sup>2</sup>  
 Monetary debt: €1,9-7 billion

CURRENT ACCOUNTS							
		Uses	Construction	Nature	Nature	Construction	Resources
Production account		Intermediate consumption	198			322	Production
		Preservation activities	1				
		<b>GDP</b>	124				
		Consumption of fixed capital					
		On non-financial assets	9				
		On natural assets	0,2				
	<b>NDP</b>	105					
Generation of income account		Compensation of employees	80				
		<b>Op. surplus / Mixed income</b>	34				
Allocation of primary income account							
Secondary distribution of income account							
Use of disposable income account							
		<b>Savings</b>	34				
						1	Preservation activities
						124	<b>GDP</b>

CHANGES IN ASSETS AND LIABILITIES							
		Changes in assets	Construction	Nature	Nature	Construction	Changes in liabilities and net worth
						34	<b>Savings</b>
Capital account		Gross fixed capital formation	10				
		Consumption of fixed capital	-9				
		<b>Net lending (+) / net borrowing (-)</b>	15				
Natural capital		Gross natural capital formation					
		Activities area	7				
		Consumption of natural capital					
		Activities area	-0,2				
	Ecological loans			7 -1		7 -1	Natural loans - Natural, agriculture & forestry areas
Financial account		<b>Net acquisition of financial assets</b>					<b>Net acquisition of liabilities</b>
		Monetary gold and SDRs					Monetary gold and SDRs
		Currency and deposit	6 -1				Currency and deposit
		Loans					Loans
		Equity and investment fund shares				7 -1	Equity and investment fund shares
Other volume changes							
Revaluations							

WHAT'S NEXT?

# Ways forward

- On the conceptual side :
  - Better define and **create typologies** of “debts”, “ecological assets” and “ecological intermediate consumptions” (*note: ≠ SEEA’s “ecosystem assets”*)
  - Develop the corresponding **supply and use tables**
- On the practical side:
  - More experiments on other environmental topics (e.g.: **agriculture ecosystems**) and **countries**
  - Develop **standardised preservation cost databases**
- Articulate scales:
  - Model macroeconomic debts using: Copernicus, reporting under nature directives, CGE models, etc.
  - Use **new data from business**: CSR business reports, impact studies, etc.
- **Survey potential users** to adjust the accounting details

**=> We’re looking for collaborations!**

# Key takeaways

- Conceptual developments confirm **consistency with the SNA** and statistical principles
- Ecological liabilities:
  - Fit much more within the **current context** than in the 1990's (when cost-based approaches were dominant in the SEEA)
  - Directly **answer policy needs** to make a transition and *then* stay in a sustainable situation
  - Can **balance the hegemony of GDP** (-> an adequate indicator for the « Beyond GDP » movement)
  - Allows to **connect non-use values and national accounting**
- Technical developments and experiments are still required



## Defining ecological liabilities and structuring ecosystem accounts to support the transition to sustainable societies

Yann Kervinio<sup>‡</sup>, Clément Surun<sup>‡</sup>, Adrien Comte<sup>§</sup>, Harold Levrel<sup>‡</sup>

université  
PARIS-SACLAY

La comptabilité des dettes écologiques  
nationales et d'entreprises, un outil de  
pilotage vers une économie durable

*Accounting for national and corporate environmental liabilities: a steering tool  
towards a sustainable economy*

Thèse de doctorat de l'université Paris-Saclay

École doctorale n° 581, Agriculture, alimentation, biologie, environnement, santé (ABIES)  
Spécialité de doctorat : Sciences économiques  
Graduate School : Biosphera. Référent : AgroParisTech

Thèse préparée dans l'UMR CIREAD (Université Paris-Saclay, AgroParisTech, CNRS, École des Ponts  
ParisTech, Cirad, EHESS),  
sous la direction de Harold LEVREL, Professeur,  
et le co-encadrement de Clément FEGER, Maître de Conférences

Thèse soutenue à Nogent-sur-Marne, le 20 mars 2023, par

**Clément SURUN**

### Composition du Jury

Membres du jury avec voix délibérative

<b>Dominique MÉDA</b> Professeure, Université Paris Sciences et Lettres	Présidente
<b>Marc FLEURBAEY</b> Directeur de Recherche, CNRS (École d'économie de Paris)	Rapporteur & Examinateur
<b>Laetitia GUÉRIN</b> IPEF (HDR), INRAE (centre Occitanie-Montpellier)	Rapporteur & Examinatrice
<b>David BARTON</b> Chercheur, Norsk institutt for naturforskning (Norvège)	Examinateur

***Soon available in English***

# To go further

- Kervinio, Y., Surun, C., Comte, A., Levrel, H., 2023. [Defining ecological liabilities and structuring ecosystem accounts to support the transition to sustainable societies](#). OE 8, e98100.
- Surun, C., 2023. [La comptabilité des dettes écologiques nationales et d'entreprises, un outil de pilotage vers une économie durable](#) (Thèse de doctorat)
- > **To be translated in English (available on request by email to [clement.surun@agroparistech.fr](mailto:clement.surun@agroparistech.fr))**
  
- Comte, A., Legrand, S., Levrel., H. (2022). [MAIA Country factsheet: France](#).
- Germain, J.-M., Lellouch, T., 2020. The Social Cost of Global Warming and Sustainability Indicators: Lessons from an Application to France. Ecostat 81–102. <https://doi.org/10.24187/ecostat.2020.517t.2024>

# References

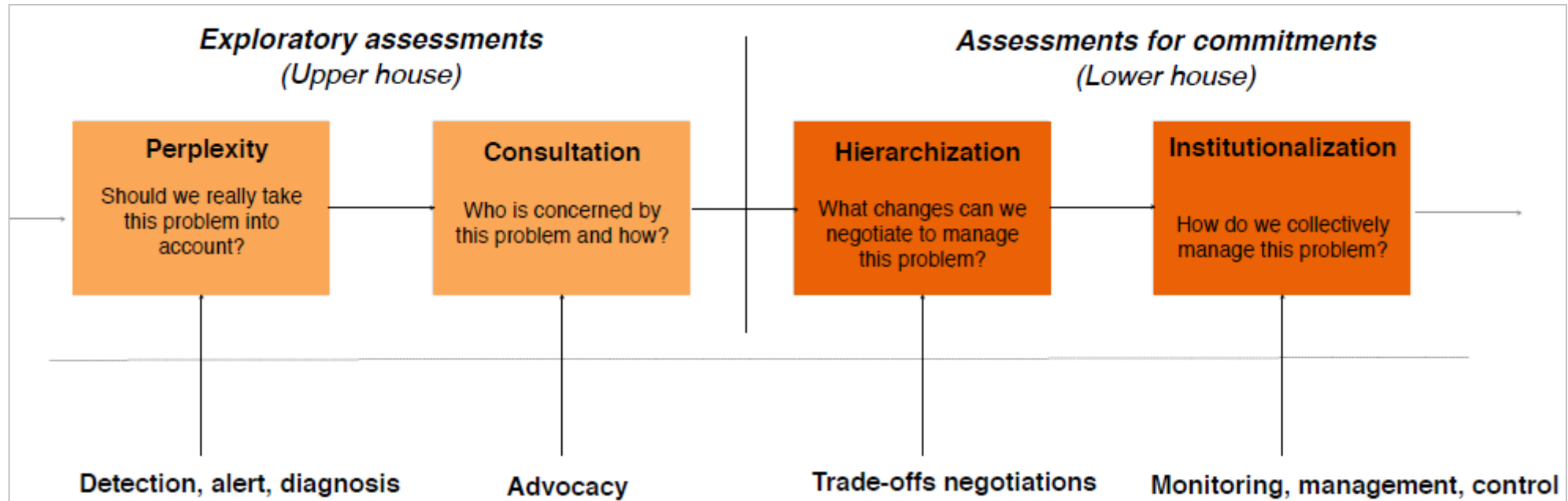
- Comte, A., Sylvie Campagne, C., Lange, S., Bruzón, A.G., Hein, L., Santos-Martín, F., Levrel, H., 2022. Ecosystem accounting: Past scientific developments and future challenges. *Ecosystem Services* 58, 101486. <https://doi.org/10.1016/j.ecoser.2022.101486>
- Desrosières, A., 2002. *The Politics of Large Numbers: A History of Statistical Reasoning*. Harvard University Press, Cambridge, MA.
- Feger, C., Mermet, L., 2021. Advances in accounting for biodiversity and ecosystems: A typology focusing upon the environmental results imperative. *Accounting Auditing Control* Volume 27, 13–50.
- Feger, C., Mermet, L., Vira, B., Addison, P.F.E., Barker, R., Birkin, F., Burns, J., Cooper, S., Couvet, D., Cuckston, T., Daily, G.C., Dey, C., Gallagher, L., Hails, R., Jollands, S., Mace, G., Mckenzie, E., Milne, M., Quattrone, P., Rambaud, A., Russell, S., Santamaria, M., Sutherland, W.J., 2018. [Four priorities for new links between conservation science and accounting research](#). *Conservation Biology*.
- Gonon, M., 2021. *Une dette écologique pour fonder les politiques de préservation du vivant (Rapport de stage)*. Université Paris-Dauphine.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, I., 2022. [Methodological assessment of the diverse values and valuation of nature](#)
- Miller, P., 1986. [Accounting for progress — National accounting and planning in France: A review essay](#). *Accounting, Organizations and Society* 11, 83–104.
- Rambaud, A., Feger, C., 2019. [Natural capital visibility in financial accounting – Method 3 – Extended Version](#) 25.
- Rambaud, A., Richard, J., 2015. [The “Triple Depreciation Line” instead of the “Triple Bottom Line”: Towards a genuine integrated reporting](#). *Critical Perspectives on Accounting* 33, 92–116.
- van de Ven, P., 2023. [AI.1 Valuation principles and methodologies](#).
- Vanoli, A., 2005. *A history of national accounting*. IOS Press, Washington, DC.
- Vanoli, A., 2017. [The Future of the SNA in a Broad Information System Perspective](#). *Review of Income and Wealth* 63, S238–S265.



# APPENDIX

# Maturity of environmental issues and accounting systems

Source: Surun 2023; based on Feger et al., 2017, Latour, 2004, *Politics of nature: how to bring the sciences into democracy*, and SEEA EA chap. 8)



Main purpose of the information system

SEEA EA monetary accounts

Modelled liabilities

Monetary ecological liabilities and assets

# What level of reality? Who make the disputable choices?

Source: Kervinio & Surun et al., 2023

	Economic (modelling) approach	Accounting (observation) approach
Who produce the numbers?	Ministry services, researchers	Business accountants (-> row data for NSO)
What data?	- State of the environment - Global / mean preservation costs	- Real uses of the environment - Individual preservation budget
Disputable choices	Hypothesis in the model	Actual institutional arrangements
Status	<b>External estimates</b> -> <b>abstract models to imputations</b>	<b>Economic facts -&gt; accounts</b>

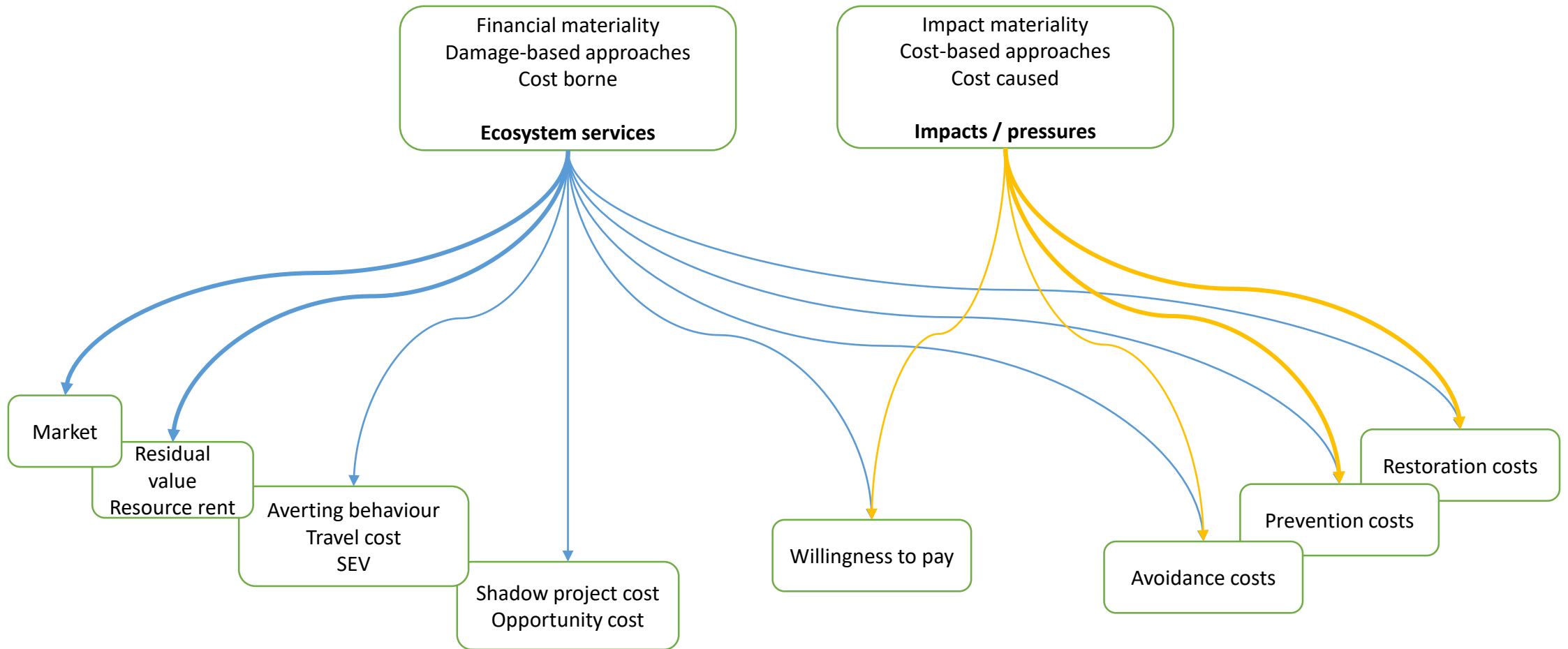



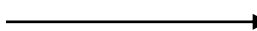
Towards a **satellite account** of financing needs for the ecological transition?



Towards **extended NA** based on observations?

# Valuation framing & methods (tentative)



 Good consistency with exchange value  
 Poor consistency with exchange value