SESSION 2 · ACCOUNTING FOR THE DIVERSE ECONOMIC VALUES CONNECTED TO ECOSYSTEMS

The economic costs of ecosystem degradation

A cost-based framing for ecosystem accounts in support of the transition to sustainable societies

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Challenges in the Measurement of Nature in Official Statistics - Istat, Rome, 25–26 May 2026

An open methodological question - and an opportunity

A persistent tension

Demand for monetary indicators on ecosystems keeps rising - in policy, finance, and beyond-GDP debates.

Valuation methods remain contested - most rely on assumptions of substitutability and comparability of values incompatible with strong sustainability principles.

Standards are still being negotiated - outstanding methodological aspects in SEEA-EA chapters 8–11, EU EA regulation deadline approaching.

This talk

Argue that a cost-based framing - anchored in policy targets - offers a conceptually sound and statistically tractable way to capture the economic costs of ecosystem degradation.

Based on Kervinio, Surun, Comte & Levrel (2023), One Ecosystem 8: e98100.

Two ways to frame and value the costs of ecosystem degradation

Damage-based (cost-borne, ES framing)

Values the lost benefits to humans following ecosystem degradation.

Reference: a counterfactual scenario where the service is lost.

Methods: social cost of carbon, hedonic prices, contingent valuation, damage functions…

Implicit assumption: substitutability of natural capital - weak sustainability.

Cost-based (cost-caused, restoration/maintenance)

Values the costs to be incurred to restore or maintain ecosystems at agreed reference levels.

Reference: explicit policy targets (e.g. carbon neutrality for climate; 'good ecological status' for marine ecosystems).

Methods: abatement / restoration / maintenance costs - modelled (top-down) or aggregated (bottom-up, CARE).

Implicit assumption: targets reflect a collective commitment to maintain ecosystems - strong sustainability.

⚠ *Terminology has drifted: in SEEA-EA (2021) the term "cost-based" is used loosely and may cover replacement-cost methods used to value lost benefits (i.e. damage-based framing). I focus on restoration/maintenance cost-based valuation of ecosystem degradation.*

An ecological debt as the costs of achieving reference levels

Ecological debt = the costs that would have to be incurred to attain agreed reference levels on dimensions of interest of ecosystem extent and condition.

Vanoli (2017)

"Unpaid ecological costs" - value of avoidance / restoration costs of degradation, recorded as a liability.

Germain & Lellouch (2020)

"Prospective debt" - discounted future expenditure stream required to meet a given liability (here climate targets).

Kervinio et al. (2023)

Generalised debt - anchored in policy targets across all ecosystem dimensions of interest.

Reference levels are not arbitrary - they come from policy targets

Why this matters

Targets express a society's commitment to maintain ecosystems and reveal underlying values.

When specific enough, the **cost of meeting them** provides an implicit valuation of ecosystem degradation.

This anchors monetary accounts in a **collective, deliberated valuation process** - not in market or stated preferences.

« The practical reach of social choice theory, in its traditional forms, is considerably reduced by its tendency to ignore value formation through social interaction. […] Many of the more exacting problems of the contemporary world – varying from famine prevention to environmental preservation – actually call for value formation through public discussion. »

Amartya Sen (1995)

Example - EU Marine Strategy Framework Directive (MSFD)

11 descriptors of "good ecological status" (GES)

1. Biodiversity
2. Non-indigenous species
3. Commercial species
4. Food-web structure
5. Eutrophication
6. Sea-floor integrity
7. Hydrographic conditions
8. Contaminants
9. Seafood contaminants
10. Marine litter
11. Energy & noise

→ *For each descriptor: ecologically - and politically- defined targets.*

The cost of meeting them = the implicit value of degradation.

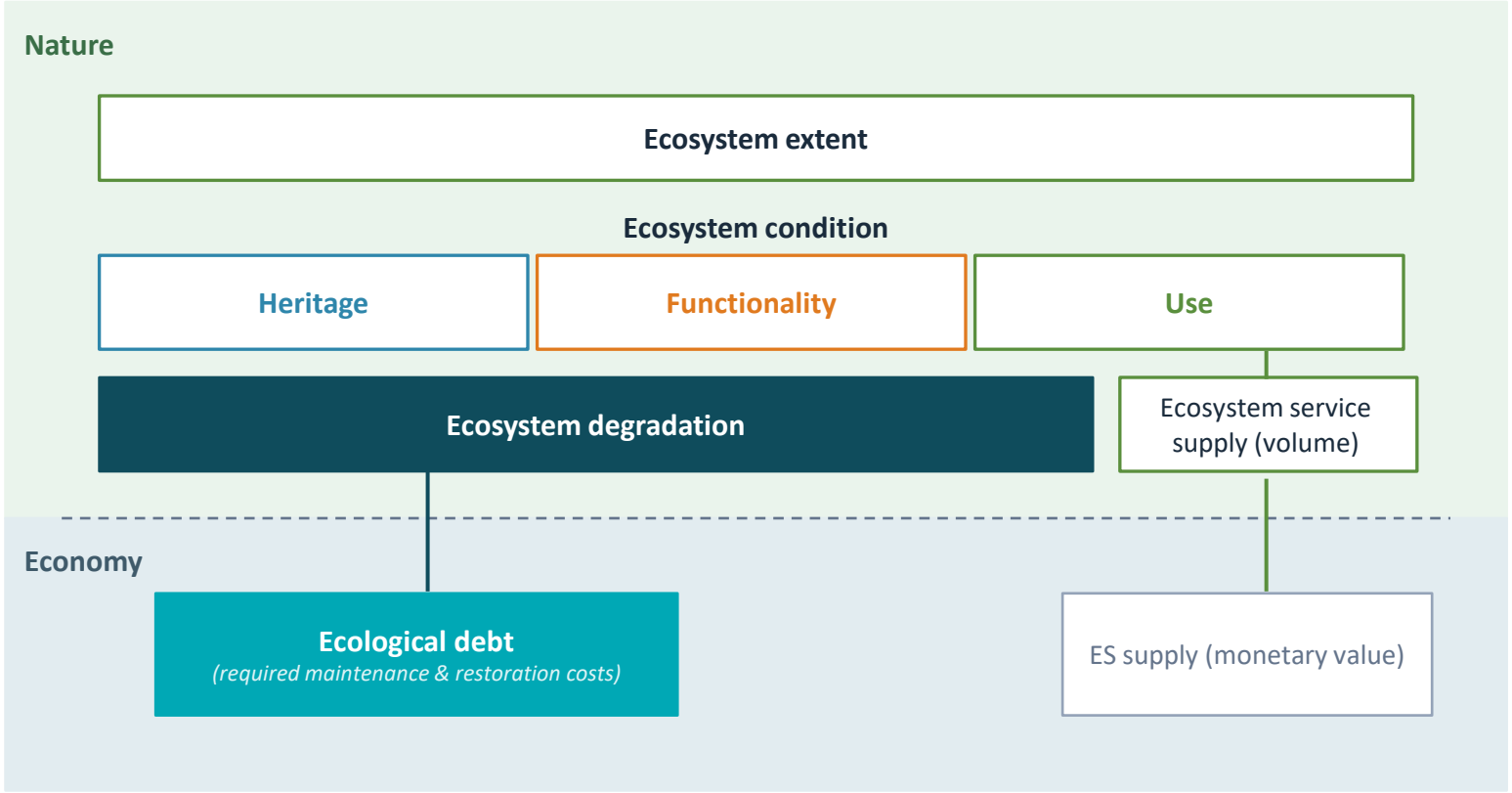
Three categories for an inclusive ecosystem condition account

Drawing on Comte et al. (2020), each value rationale for monitoring ecosystems can be matched with a category of condition indicators.

HERITAGE	FUNCTIONALITY	USE
Non-instrumental value - intrinsic worth	*Non-instrumental - maintenance of options*	*Instrumental - direct benefits to humans*
Value features deemed remarkable for non-use reasons.	Value features ensuring overall ecosystem resilience and safe operating space.	Value features determining the capacity to sustainably deliver ecosystem services.
e.g. species of community interest, Natura 2000, World Heritage sites.	*e.g. food-web structure, eutrophication, planetary-boundary indicators.*	*e.g. MSY for commercial species, freshwater availability.*

➢ *Applying this to MSFD: 8 of 11 GES descriptors belong to Functionality - a category currently under-served by SEEA-EA, which is dominated by the Use rationale (for monetary accounts).*

A structured set of accounts linking biophysics, targets and monetary debt



Key features

Biophysical core: the extent & condition accounts (top) are the foundation. The cost-based approach binds them to monetary accounts (bottom).

Two parallel monetary tracks: an ecological debt (left, cost-based) and an ES supply value (right, can be price- or cost-based).

Explicit reference levels link condition to degradation - they are the policy hinge.

The ecological debt: two complementary perspectives for implementation

Economic perspective

A modelled prospective debt

Top-down: techno-economic or macroeconomic models cost out the path to targets.

Strengths: scalable, comparable across scenarios, exploitable for forward-looking analysis; produce techno-economic data useful beyond indicator production.

Limits: uncertainty in future costs and technical progress; requires model intercomparison & regular updates.

References: *Germain & Lellouch (2020), French climate prospective debt (Larrieu & Roux, 2024).*

Accounting perspective

A bottom-up aggregation of organisations' liabilities

Bottom-up: extended organisational accounting (e.g. CARE) records the cost of avoidance & restoration measures as liabilities.

Strengths: auditable, tied to identifiable agents, complements financial reporting (CSRD).

Limits: may neglect opportunity costs; needs consistent reference levels across units, private and public; institutional infrastructure not yet in place.

References: *Rambaud & Richard (2015), Rambaud & Chenet (2021).*

Both yield aggregable estimates at the national scale; both depend on the same physical and target infrastructure proposed in this framework.

What the Insee “augmented national accounts” shares with this approach

Shared methodological family

The Quinet shadow price - used in INSEE's “climate net savings” - is the marginal cost of meeting France's climate target along an efficient mitigation pathway.

Conceptually, it shares the **cost-based logic**: collective target → cost of meeting it → implicit valuation.

→ A point of methodological alignment between the augmented national accounts and the ecological-debt framework.

See: Larrieu & Roux (2024) and Sébastien Roux's presentation, Session 3.

...but the extension is not mechanical

Climate is the easy case

- one target, one indicator, mature cost models, no genuine multifunctionality.

Other ecosystems are not just harder

- they are qualitatively different: multidimensional condition, non-use values, irreducible target arbitrations.

The extension is therefore not a per-service Quinet for each ES.

It is a reframing through **integrated targets on the ecosystem itself**, *from which costs and debt follow.*

Extending latent value to instituted targets

Oras et al. (2025) – the connected values framework

Entry point: *ecosystem services*

Valuable contribution: deploys the plurality of monetary values per ES - a welcome counter to single-price fictions.

Notion of **latent value**: the value that *would appear* in a hypothetical scenario where the ES is restored or substituted.

This approach

Entry point: *ecosystems and their integrated management targets*

Same latent-value logic, anchored differently: once management targets are instituted, *whatever enables their efficient achievement has value*.

This shift accommodates the **multifunctionality** of ecosystems and the **non-use values** built into target-setting through collective deliberation.

...and a productive shift in purpose

The connected-values framework supports comparing the costs of action vs inaction - yet its authors themselves conclude that safeguarding ecosystems is *"usually the most cost-effective way to secure long-term value"*. Starting from instituted targets shifts attention the open question:

How to reach them efficiently?

An inquiry that produces useful data of its own, and can feed back into target revision when costs prove disproportionate.

What this approach would unlock - and what is needed

1

Data infrastructure

Reveals data gaps in biophysical monitoring - drives priorities for ecosystem extent & condition accounts.

2

Policy process

Shifts focus to how to reach targets efficiently, generates useful intermediate data, and lets targets be revisited if their costs prove disproportionate.

3

Aggregate indicator

An ecological debt comparable to a public debt - and, combined with INSEE-style adjustments, an extended sustainability scorecard.

A call for a proof of concept

Beyond the conceptual case, what matters now is **to demonstrate operational feasibility on a concrete case**.

This would require a partnership between researchers, statistical institutes and policy users.

THREE TAKE-HOMES

Cost-based valuation of ecosystem degradation deserves its own conceptual home

1. The approach is conceptually distinct from damage-based valuation and rests on a fundamentally different premise - collective targets as conventions, not preferences.

2. It shares a methodological family with cost-based ES valuations (actual or latent) but starts from the ecosystem and its integrated management targets - not from a per-service decomposition.

3. Its practical feasibility now needs to be demonstrated through a focused proof of concept - **collaboration welcome!**

Thank you - looking forward to the discussion

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