

Doctoral Schools ABIES and EGAAL

Economic valuation of ecosystem services

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Menu

- 1. Ecosystem services and all their friends**
- 2. Economic valuation of ecosystem services**
- 3. Aggregation and other issues**
- 4. Alternative approaches to valuation**

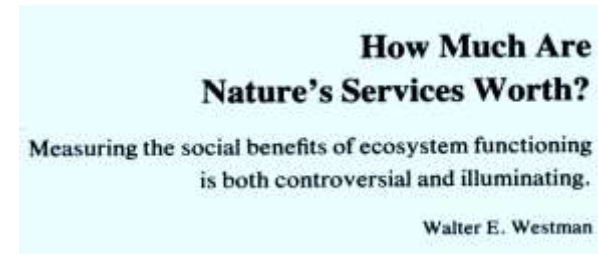
Ecosystem services and all their friends: Roots ...

- Ecosystem services are defined by the Millennium Ecosystem Assessment (2005) as "***the benefits people obtain from ecosystems***" and by the IPBES as "***nature's benefits to people***"
- A fairly trivial idea explicitly present in ancient texts :
 - of Plato, especially on the effects of deforestation (because of the construction of the Athenian fleet to fight the Persians) on the climate (drier spring)
 - of Pliny the Elder, on the relationship between deforestation, rainfall and degradations related to torrential effects
- More recently and in a more systematic way, it is generally the book of Georges Perkins Marsh *Man and Nature: or Physical Geography as Modified by Human Action* (1864) which is considered as the starting point of the modern history of the interest for the "benefits from nature".
- This interest developed in the 1960s with the rise of scientific ecology (and of political ecology)



Ecosystem services: birth of a concept?

- The current scientific framework is probably born with an article in the journal *Science* that analyzes the value to society of services derived from nature :
Westman, W., 1977. How much are nature's services worth? *Science* 197, 960–64.
- The term ‘*ecosystem services*’ appeared in a book on the consequences of the species extinction:
Ehrlich, P.R., Ehrlich, A.H., 1981. *Extinction: the causes and consequences of the disappearance of species*. Random House, New York.
- Its use spread rather slowly.
- Ecosystem services are still not very present in the book that formalizes the word "biodiversity":
Wilson, E. O. (1988). *Biodiversity*. 1988. *National Academy of Sciences, USA*.
 - in which A. Randall (1988) develops a framework of "utilitarian" analysis of the economic value of biodiversity.



Ecosystem services: a central concept for analyzing and communicating on societies-natures relations

The popularization of the term is clearly related to two (quite different) publications of the same year :

- Daily, G.C., 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC.

Is an interdisciplinary work gathering contributions from prominent ecologists and other points of view on the dependence of our societies on functional ecosystems

- Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, G.R., Sutton, P., van der Belt, M., 1997. The value of the world's ecosystem services and natural capital. *Nature* 387, 253–260.

Is one of the most cited articles, but often critically. It provides an assessment of 17 ecosystem services related to the 16 major biomes worldwide.

Result: the total value would be twice the Gross World Product (+/-50%)

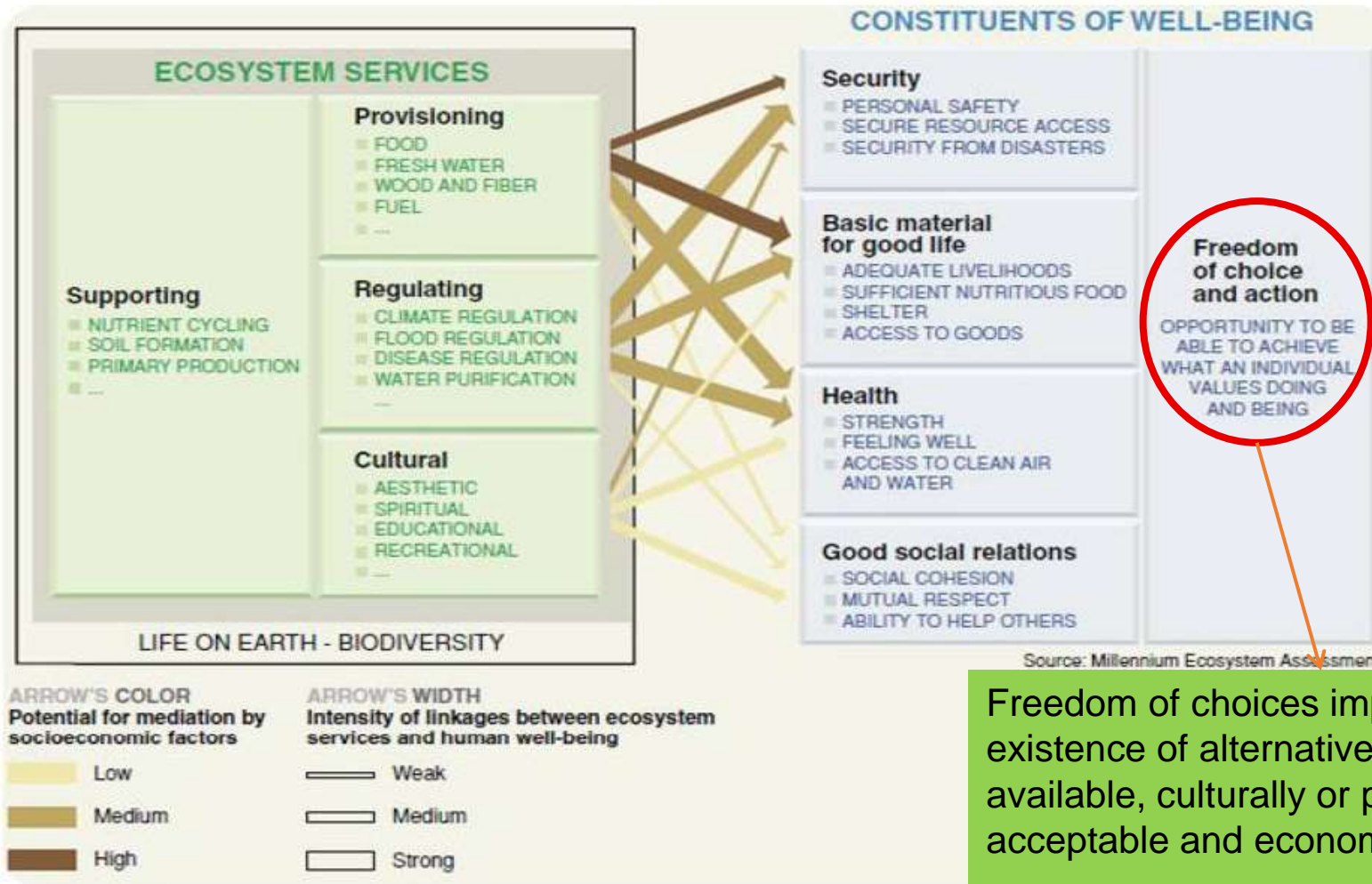
Will the ecosystem services concept soon become outdated?

- The IPBES and the idea of « Nature's contributions to people »
 - Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... & Maris, V. (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability*, 26, 7-16.
 - A rather unexpected situation since *IPBES* means *Intergovernmental Platform on Biodiversity and Ecosystem Services*
- What is the issue?
 - Certain social scientists believe that the concept of ES is too closely linked to utilitarianism and therefore does not adequately account for the richness of society-nature relationships
 - Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., ... & Polasky, S. (2018). Assessing nature's contributions to people. *Science*, 359(6373), 270-272.
 - Braat, L. C. (2018). Five reasons why the Science publication "Assessing nature's contributions to people" (Díaz et al. 2018) would not have been accepted in Ecosystem Services.

Is the notion of “ecosystem disservices” useful?

- Ecological processes not only have positive effects, but can also have negative impacts on human activities and social well-being
 - Zhang, W., Ricketts, T. H., Kremen, C., Carney, K., & Swinton, S. M. (2007). Ecosystem services and dis-services to agriculture. *Ecological Economics*, 64(2), 253-260.
 - Lyytimäki, J., & Sipilä, M. (2009). Hopping on one leg – The challenge of ecosystem dis-services for urban green management. *Urban Forestry & Urban Greening*, 8(4), 309-315.
- Some cases are well known or easy to understand:
 - Pest to agricultural production
 - Degradation of human constructions and artificial infrastructures
 - Vectors or reservoirs of animal or human disease
- **NB: Ecosystem disservices are not externalities of human activities**
- The French Evaluation of Ecosystems and Ecosystem Services (EFESE) chose to dismiss the concept of disservice and to designate negative impacts as environmental constraints
- But disservices remain a useful idea which is the object of a still limited but growing scientific literature

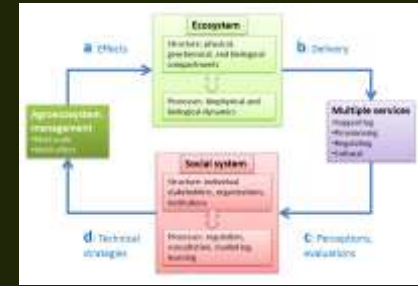
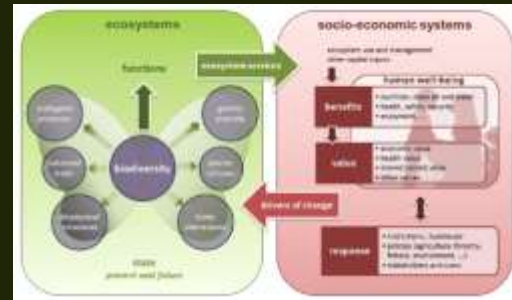
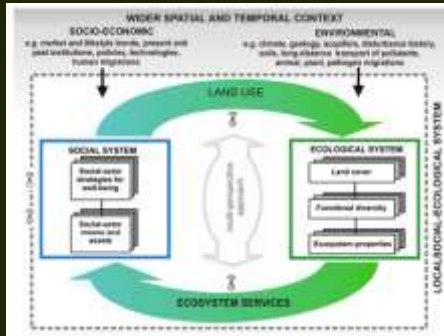
The benefits derived from ecosystems and their links with the constituents of human welfare



(Source : Millenium Ecosystem Assessment, 2005)

Freedom of choices implies the existence of alternatives, technically available, culturally or politically acceptable and economically viable

We will see that it is also a way for approaching the economic valuation



Ecosystem services: representations of relations

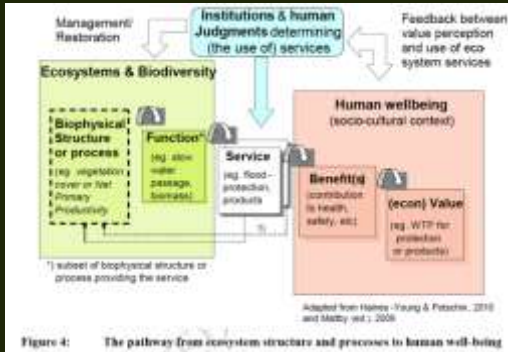
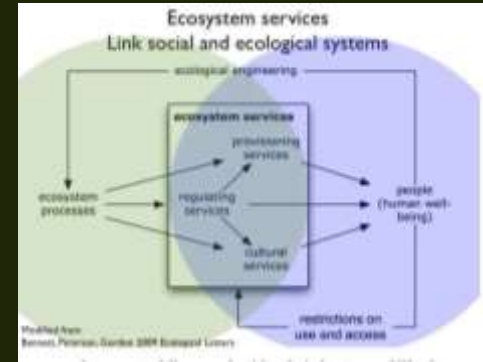
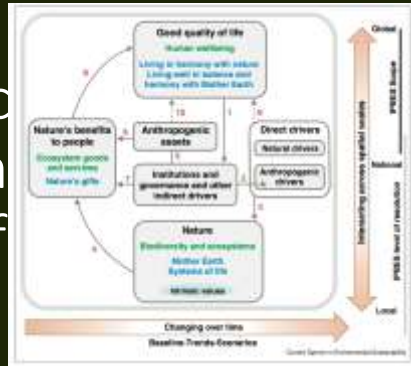
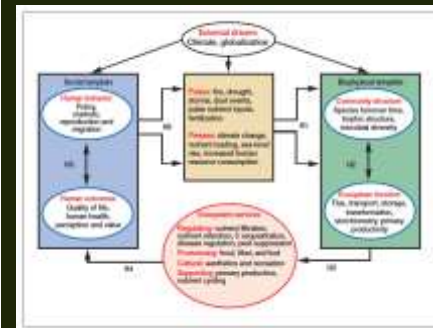
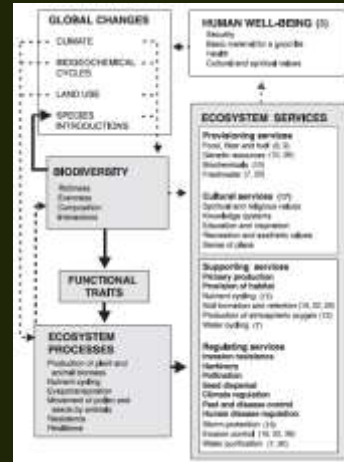
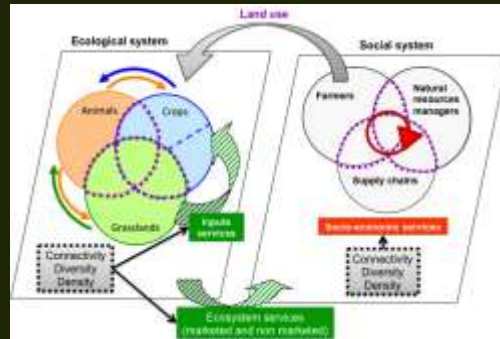
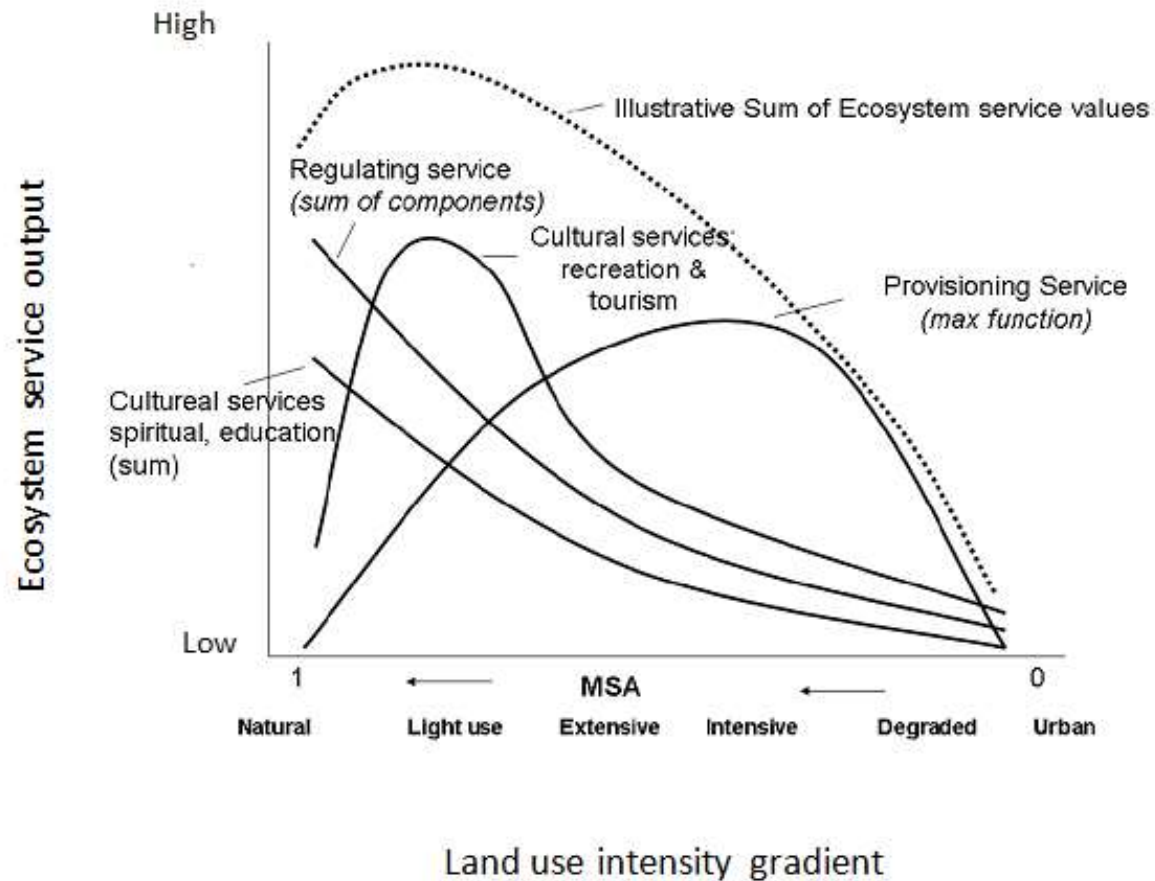


Figure 4: The pathway from ecosystem structure and processes to human well-being



Relationships between the different categories of ecosystem services and the degree of artificialisation of ecosystems



- Source : Braat et Ten Brink, 2008 (MSA = Mean Species Abundance)

Valuing biodiversity in an economic perspective

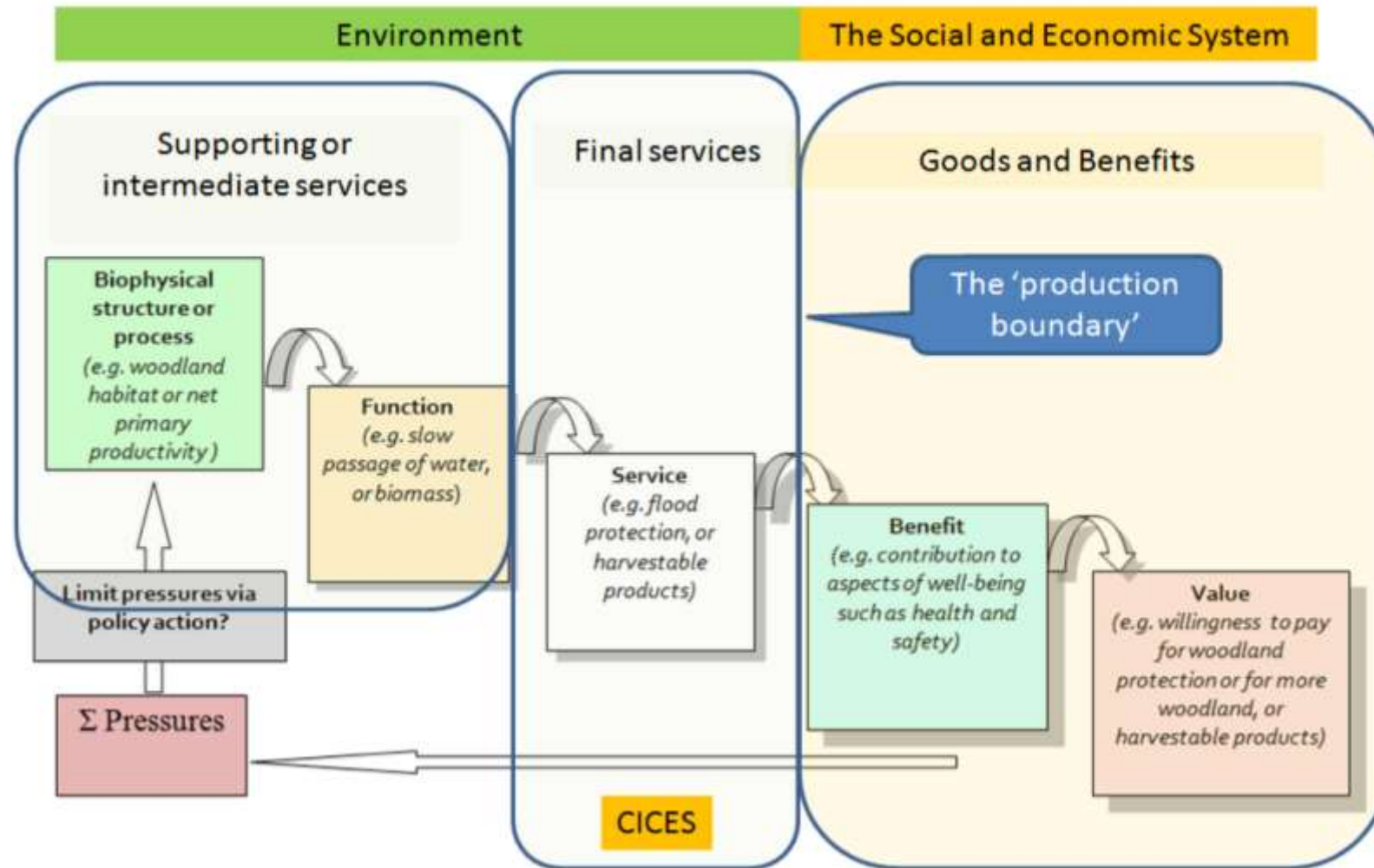
- The economic conception of value:
 - Anthropocentric: based on the sole interests of human beings
 - Instrumental: relevance of a means to an end
 - Consequentialist: the choices are valued according to their results
 - Utilitarianist: an arithmetic of pains and pleasures
 - Subjective: everyone is the best judge of its preferences
 - Marginalist: we measure by comparison "at the margin"
- Aims to build (monetary) indicators reflecting the utility and scarcity of assets in order to inform collective choices
- Economic valuation and markets
 - Observed prices do not (generally) reflect values
 - Is valuation a prerequisite toward commodification? Not primarily
 - Evaluation appears rather as an alternative to markets in the quest for efficiency: it helps clarify regulatory choice issues for public policy making

Biodiversity: a (mostly) non-market good

- Biodiversity is not an economic good. Most often, biodiversity and ecosystem services are not traded on markets and thus they have no price.
- However, many elements of biodiversity have been traded, sometimes for a very long time (land, forests, wood, game, mushrooms...).
- **Be careful: values \neq costs \neq prices**
 - **Values** are moral or social norms that guide our choices and actions ; they are based on notions of utility, preferences, well-being
 - **Cost** is the best opportunity you have to renounce to in order to obtain something
 - **Prices** are (monetary) variables that indicate the tensions and can help to balance supply and demand on the markets
 - **There is no general hierarchy *a priori* between the three measures**
- In the absence of any indicator of the value of biodiversity, it can not be properly taken into account in the optimization processes of economic agents and, from an efficiency perspective, there is thus a risk of misallocation of resources

The valuation framework of the *Common International Classification of Ecosystem Services (CICES)*

The Ecosystem Service Cascade (after Potschin and Haines-Young, 2011)



Economic valuation of ecosystem services: what does it really mean?

❖ What is economic analysis?

- A social science that studies "*relationships between people about things*" and aims to "*allocate scarce resources with alternative uses*"
- Better understand the tensions on resources and analyze the capacity of institutions (market and other) to manage them

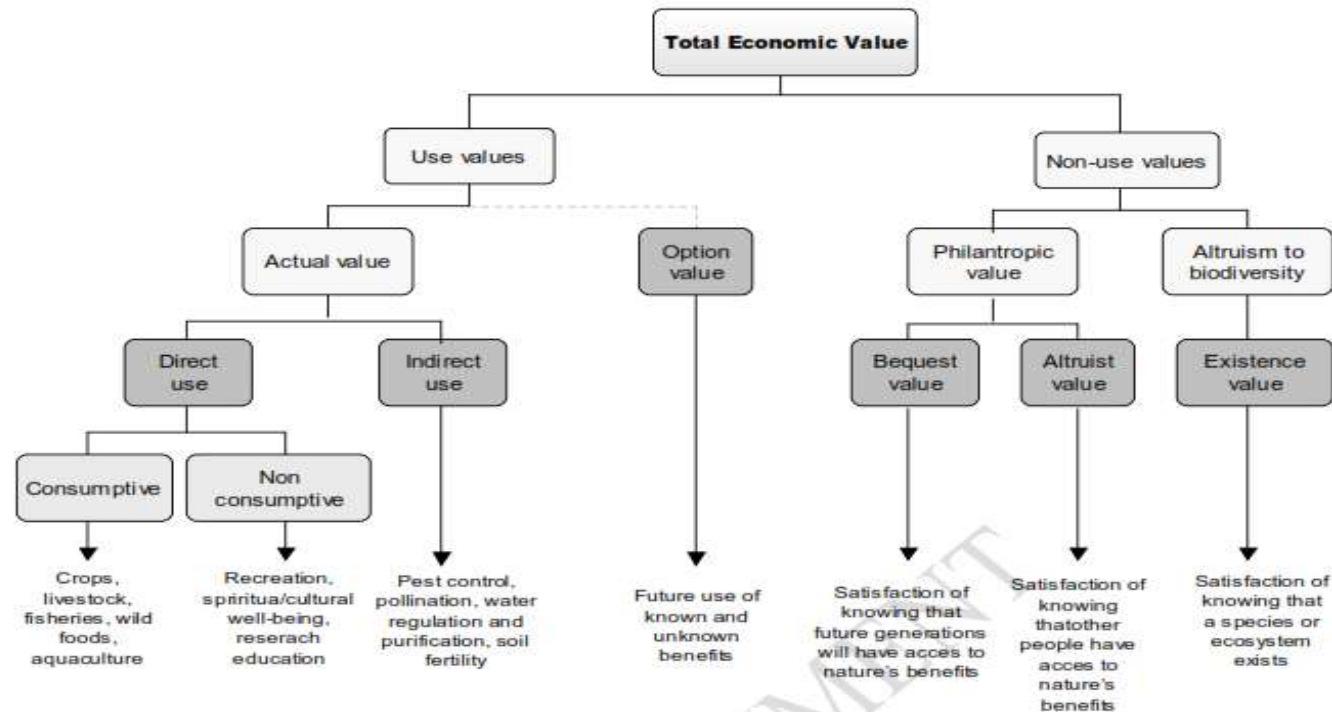
❖ The economic concept of « value »

- A specific concept of value that aims at providing information on utility and scarcity in order to compare the possible options of choice
- An indicator that is usually expressed in monetary terms

❖ The purpose of the economic evaluation is to build indicators to provide useful information to improve collective choices

The concept of total economic value

- A necessary extension of the notion of value to apply it to choices that involve a plurality of impacts on well-being
 - Since the importance of functional ecosystems for societies reflects a plurality of economic motives
- To compare situations, it is useful to summarize them in a single indicator... ..but it is not compulsory, if there is another way to correctly aggregate the preferences of the agents (multi-criteria analysis, political consultation, markets...)



In order to evaluate ecosystem services, multiple methods have been developed

| Approach | | Method | Value |
|---------------------|------------------|-----------------------------------|-------------------------|
| Market valuation | Price-based | Market price | Direct and indirect use |
| | Cost-based | Avoided cost | Direct and indirect use |
| | | Replacement cost | Direct and indirect use |
| | | Restoration cost | Direct and indirect use |
| | Production-based | Factor income | Indirect use |
| | | Production function approach | Indirect use |
| Revealed preference | | Travel cost method | Direct (indirect) use |
| | | Hedonic pricing | Direct and indirect use |
| Stated preference | | Contingent valuation | Use and non-use value |
| | | Choice modeling/conjoint analysis | |
| | | Contingent ranking | |
| | | Deliberative group valuations | |

Is the value of ecosystem services really measured in a reliable and robust way?

- All these methods are imperfect:
 - They try to respond to the need to collect and organize information "from the field", from real people
 - They all rely, directly or indirectly, on the preferences of agents (people)
- Choosing an approach is a compromise between
 - What we want to measure (recreational, productive, heritage value...)
 - The type of accessible basic information
- No method can be implemented independently of limits from 'the field'
 - People with little or false information, poorly trained, uninterested...
 - Existence of individual strategies, fake information, lobbies...
- What to do otherwise?
 - Follow the preferences of the "prince" or the best-defended interests (lobbies)
 - Follow "in the mood" ideas (which will get out of fashion someday)
 - Rely on technical elites (better trained, better informed ...)?

A practice that remains regularly criticized

- Positions are most often critical or hostile (in France?):
 - This is not technically realistic (N. Bouleau, J. Weber)
 - Values are social constructions that can not be applied as such to Nature (J. Gadrey, J.-M. Harribey, F. Jany-Catrice)
 - Evaluations raise ethical issues (V. Maris, J. Weber), and they may lead to circumventing legitimate political deliberation
 - Economic evaluations are not actually used to make collective choices in the real world (R. Billé, Y. Laurans, L. Mermet)

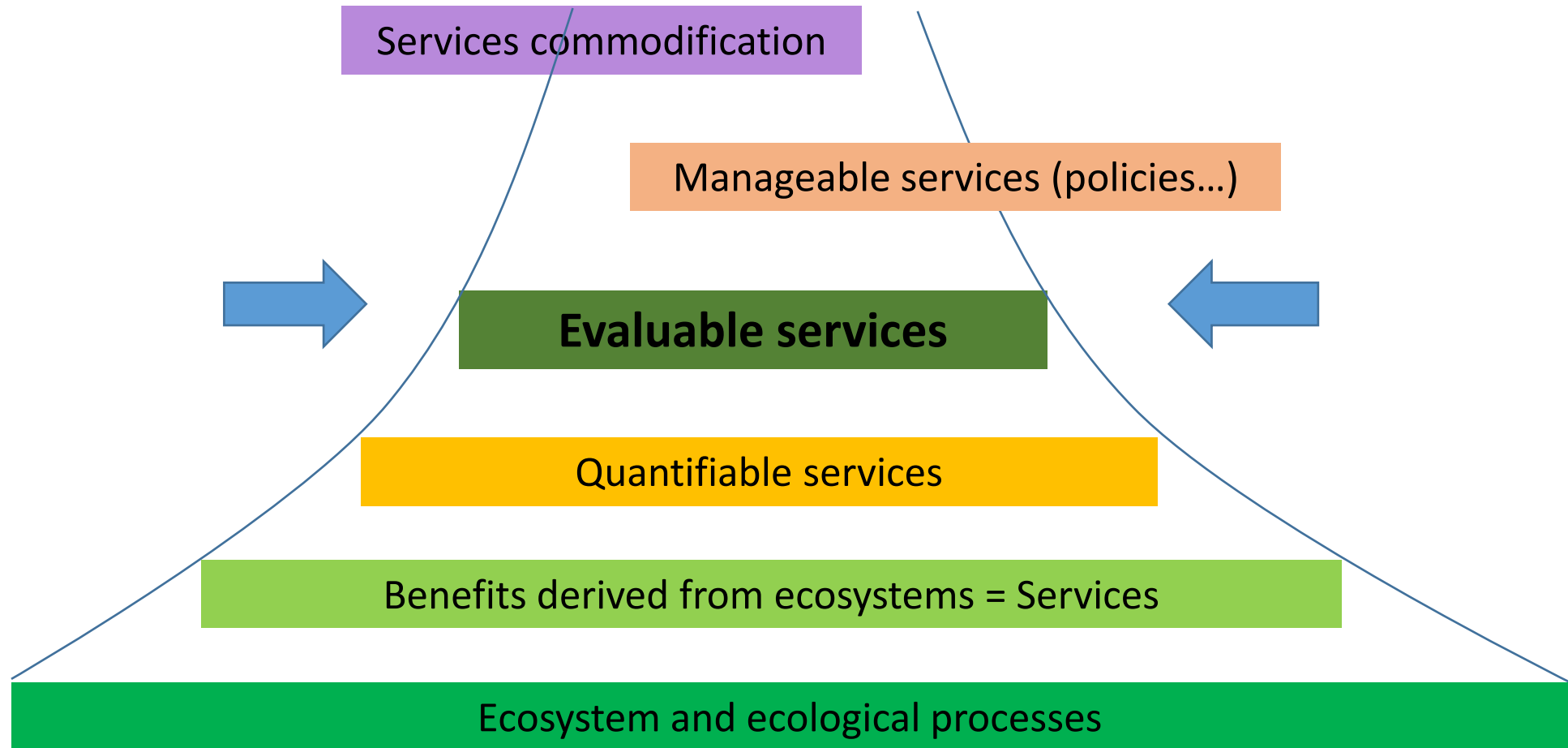
Their main proposal is to avoid preference-based valuations and fall back on cost-based approaches (which appear more robust... but do not have the same meaning and whose legitimacy implies that ecosystems conservation is a requirement)

- We are often faced with the temptation to limit the study to partial evaluations:
 - reduced to what is well known, well understood, less controversial
 - but which can become an argument in favor of destruction (since they systematically underestimate the value of natural assets)

How to build reference values to inform public policies (in France, see the Chevassus report)

- The fatal attraction towards reference values:
 - If no quantified approach, then value = 0?
 - Take "ecosystems" into account (national accounts, project analysis) in parity with other socio-economic issues
 - Have "standardized" values (as for time savings and discounting)
- But :
 - Uncertain and controversial values, with strong spatial (but also contextual, temporal...) variability
 - No reference values for exceptional ecosystems or sites (by definition!) (but they should be "protected areas", don't they?)
 - Values which remain however (too) weak with regard to the valorization of the land by the residential uses or by the industrial or commercial activities ...
 - Limited use in and for real world decisions

Actual valuations tend to be « conservative »
(under-valued and sometimes biased)



Reference values in the 'Chevassus report'

Reference values for forests ES

| Services | Proposed value |
|---|---|
| Extraction services | |
| - wood | € 75 (€ 75 to € 160) |
| - other forest products (excluding game) | € 10 to € 15 |
| Regulation services | |
| - carbon sequestration | € 115 |
| - carbon storage | € 414 (€ 207 to € 414) |
| - other atmospheric gases | Not rated |
| Regulation services (continued) | |
| - water (annual quantity) | € 0 |
| - water (flow regulation) | Not assessed |
| - water (quality) | € 90 |
| - protection (erosion, floods) | Not assessed |
| - biodiversity | Not assessed directly |
| - other regulation services (health, etc.) | Not assessed |
| Cultural services | |
| - hiking (excluding hunting and subsidiary produce) | € 200 (€ 0 to € 1,000) |
| - hunting | € 55 - 69 |
| - other cultural services | Not assessed |
| TOTAL* (min.-max.)** | approx. € 970 € 500 to over € 2,000 |

Reference values for permanent grasslands ES

| Services | Value proposed |
|---|------------------------|
| Extraction services | |
| - livestock products | Not assessed (market) |
| - subsidiary products (excluding game) | € |
| Regulation services | |
| - carbon sequestration | € 23 to € 47 |
| - carbon storage | € 320 (€ 160 to € 320) |
| - other atmospheric gases | Not assessed |
| - water (annual quantity) | € 0 |
| - water (flow regulation) | Not assessed |
| - water (quality) | € 90 |
| - protection (erosion, floods) | Not assessed |
| - pollination | € 60 to € 80 |
| - biodiversity | Not assessed directly |
| - other regulation services | Not assessed |
| Cultural services | |
| - hiking (excluding hunting and subsidiary produce) | Not assessed |
| - hunting | € 4 - 69 |
| - other cultural services | € 60 |
| TOTAL* | approx. € 600 |

Valuing biodiversity and ecosystem services raises many issues

- Studies that extrapolated these valuation to all ecosystems worldwide or for an entire country raise serious questions:
 - Provocations and invitations to think (Costanza et al, 1997, etc.)
 - Better-defined projects (TEEB, 2011) whose results have been contextualized and discussed / differentiated according to stakeholders
- The debate between the evaluation of ecosystem services and the costs of conservation policies:
 - Evaluating Services: A Cost-Benefit Perspective
 - Evaluating Costs: A Cost-Effectiveness Perspective
- The status of these evaluations and the fears they may arouse when their purpose seems to be the commodification of these services (implement payment for environmental services, new property rights?) :
 - Assessments aim to inform decisions (nothing to fear, if nothing to hide?)
 - The creation of a market or any other mechanism to institutionalize values is a political choice (to be reasoned on a case-by-case basis), without any necessary link with the evaluations

Valuing ecosystem services: the aggregation issue

- To enlighten the choices, it is necessary to compare the issues comprehensively, therefore to aggregate the values of all the services considered.
- Standard valuation methods, based on revealed and even more declared preferences, are well suited to well-delimited objects (valuing one service at a time)
- The evaluation of bundles of services raises many difficulties:
 - There is not necessarily a spatial superposition of the different ES (the dynamics and the time steps can also be very different)
 - The different ES may also concern significantly different beneficiary populations
 - The different ESs in a bouquet can be synergistic or antagonistic, and these relationships can evolve over time or depending on the context

Alternative approaches to valuation

- Deliberative approaches
 - There are many reasons to consider that people do not have clear and complete preference regarding ecosystem services:
 - Complexity of the processes and poor familiarity with them
 - Plurality and incommensurability of values (deontology, virtue, etc.)
 - Limited interest, etc.
 - It could therefore be of real interest (in order to collect information on citizens' preferences) to first organize some kind of deliberative process in order to allow a better construction of their preferences:
 - Citizens jury; consensus conference
 - Deliberation groups
 - Based on the deliberative democracy theory:
 - Democratic legitimacy is to meet with the consent of the governed
 - Deliberation encourages individuals to explore/discover their own preferences, taking into account the arguments of other participants
 - Looking for more sustained political outcomes, which better represent the interests of aware participants
 - Cognitive improvement on the topic of interest

Alternative approaches to valuation

- Assessments based on rankings
 - Simpler and therefore more practicable
 - More able to evaluate service bundles (and not services one by one, while the issue is often to promote synergies)
 - Can allow the use of expert knowledge
- Experts assessments: the capacity and use matrix
 - Expert-based assessments being faster, it becomes possible to assess a large scope of services for multiple ecosystems (landscape scale)
 - “capacity matrix” aim at integrating these judgements
 - They may allow to compare ecosystem capacities and actual uses
- Enlarging the perspective: « *emergy* » analysis and Life Cycle Assessments
 - some innovative research aims to analyze ecosystem services in a framework integrating the downstream and upstream consequences of these services
 - thus allowing them to be confronted with alternative management options

To evaluate ES more effectively and appropriately:
institutionalize deliberative practices for contextualized assessments

- Valuing biodiversity and ecosystem services is actually a political choice which is based on a belief: we live in a world of growing scarcity (more numerous and more powerful people) that will imply more and more awkward choices between the different uses of ecosystems
- The management of "ordinary" biodiversity is a priority (we must strive to preserve "remarkable" biodiversity) that the reflection on ecosystem services contributes to achieve more efficiently, perhaps more accurately, in any case more in a more conscious way and, if possible, within collective deliberations
- Since they are context-dependent, it is better to design and implement evaluations in an explicit decision-making perspective
- The evaluation of the ecosystem services should allow for better consideration in the choice of broader contextual elements in space and time.. Biodiversity is a global common : biodiversity policies should be able to articulate local and global interests



Thank you for your attention and your questions

