

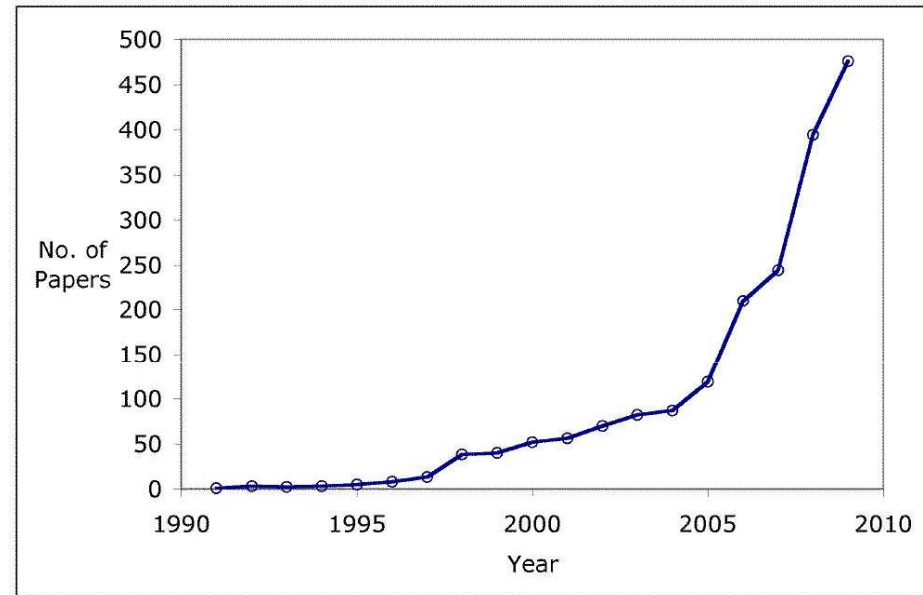
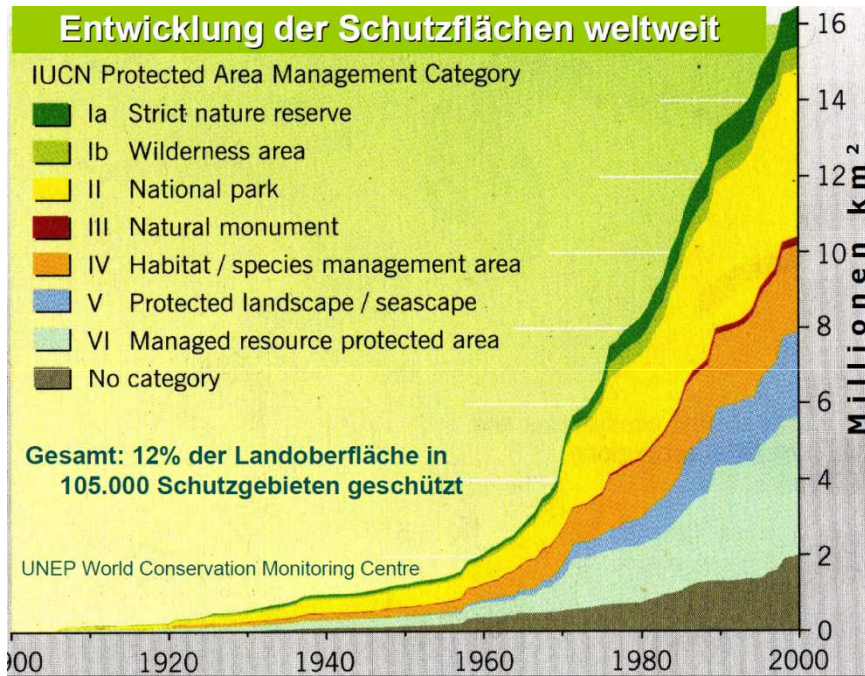
Ökosystemdienstleistungen – Potenziale und Grenzen eines Konzepts

Jahrestagung der ÖBG
6. bis 7.10.2011 in St. Florian

Karsten Grunewald

Leibniz Institute of Ecological Urban and Regional
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Human dominated world: e.g. decrease of species, biodiversity



Growth of ecosystem services concept
(ISI web of science, Peterson 2010)

Structure

- Political background
- The concept of Ecosystem Services (ES)
- ES assessment approaches
- Application of the ES concept – selected examples:
Water Framework Directive and soil services
- Conclusion

Political Background

Increasing threats on nature and environment, e.g. losses in biodiversity (e.g. *BMU 2009, CBD Nagoya 2010*), energy problems + climate change

- Search for concepts and instruments to steer and regulate the manifold human demands, and to foster **sustainable land use**
- Concept of ***Ecosystem Services (ES)***



Political Background

„In the revised Strategic Plan (UNEP/CBD/ COP/10/L.44), the COP urges governments to: [...] further *develop the **economic aspects related to ecosystem services***, and ... *integrating the **values of biodiversity** into relevant national and local policies, programmes and planning processes.*“ (IISD 2010, pp.10f.)

In 2010 the EC proposed a renewed vision and **targets for biodiversity** beyond 2010, as a part of a revised and updated strategic plan for the United Nations Convention on Biological Diversity (CBD) (European Commission, 2010).

Political Background

A crucial step in setting the new targets is the provision of a first set of **biophysical maps of ecosystem services** of key importance at the EU level.

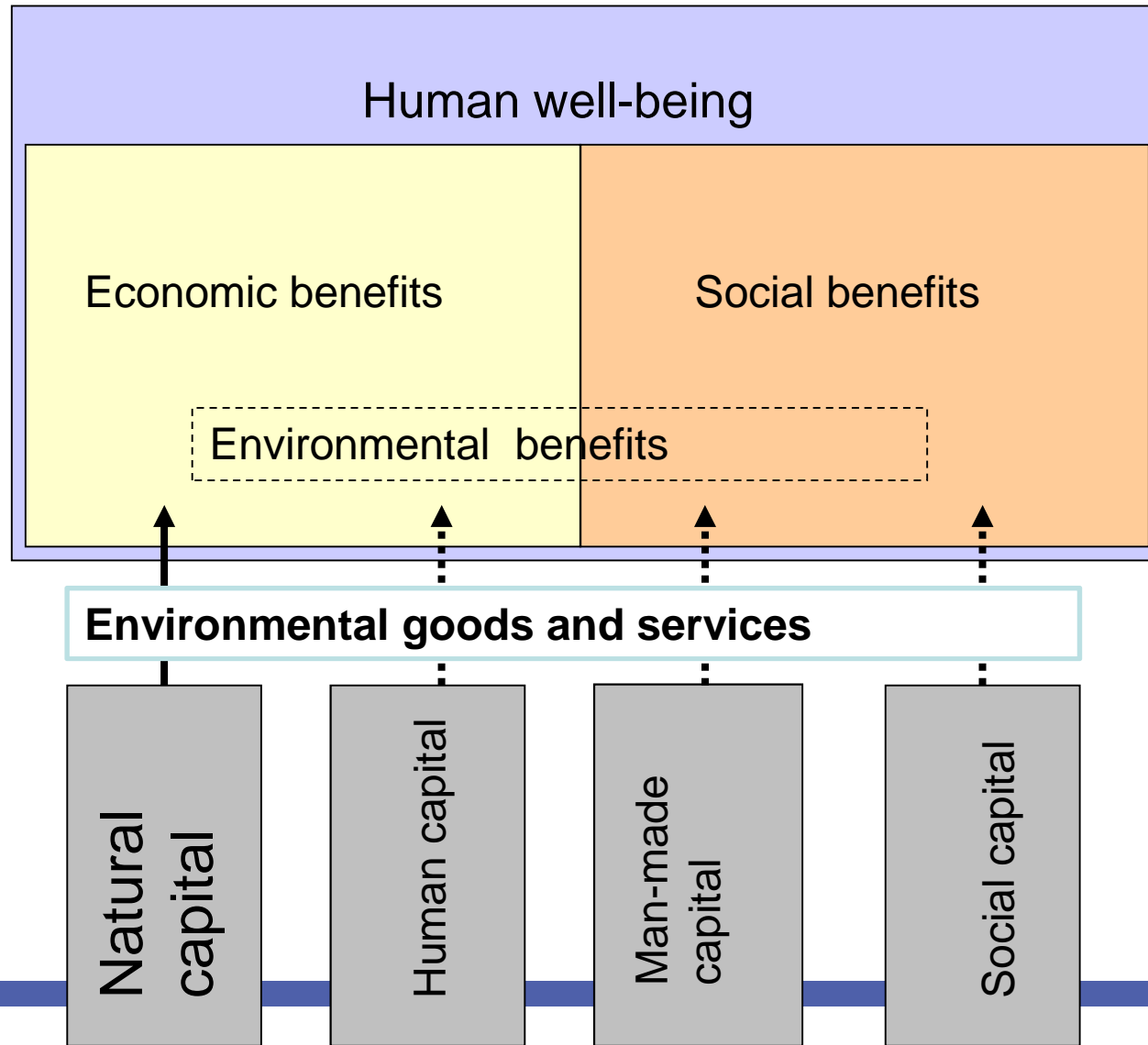
TARGET 2: MAINTAIN AND RESTORE ECOSYSTEMS AND THEIR SERVICES

Action 5: Improve knowledge of ecosystems and their services in the EU

5) Member States, with the assistance of the Commission, will map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services

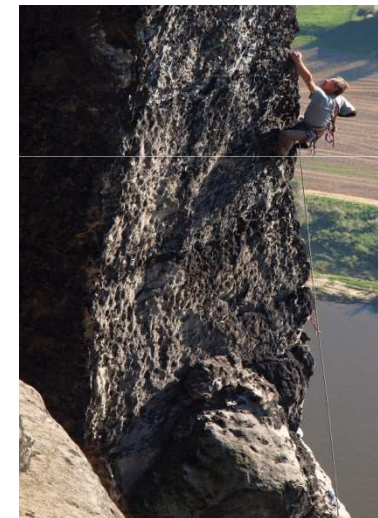
ECOSYSTEM SERVICES (ES)

- **ES = the direct and indirect contributions of ecosystems to human well-being** (*TEEB 2009*)
- Concept of ES was established mainly during the 1990s, e.g. *De Groot et al. (1992 – “goods and services”)*, *Costanza et al. (1997 – “natural capital”)*, and *Daily (1997 – “nature’s services”)*.
- **Attractiveness** of ES concept: integrative, inter- and transdisciplinary character, linking to environmental and socio-economic concepts (Müller & Burkhard 2007).
- Great **policy relevance**: e.g. Millennium Ecosystem Assessment (*MA 2005*) and *TEEB (2009)*.

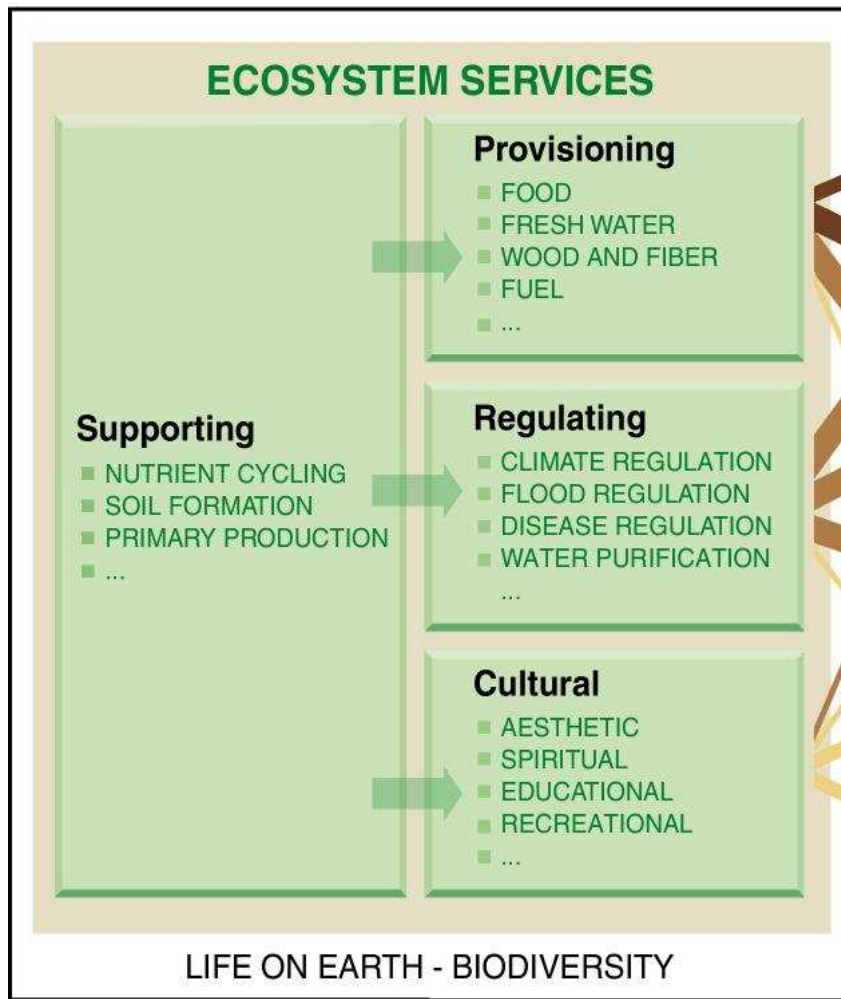


Classification of ecosystem services

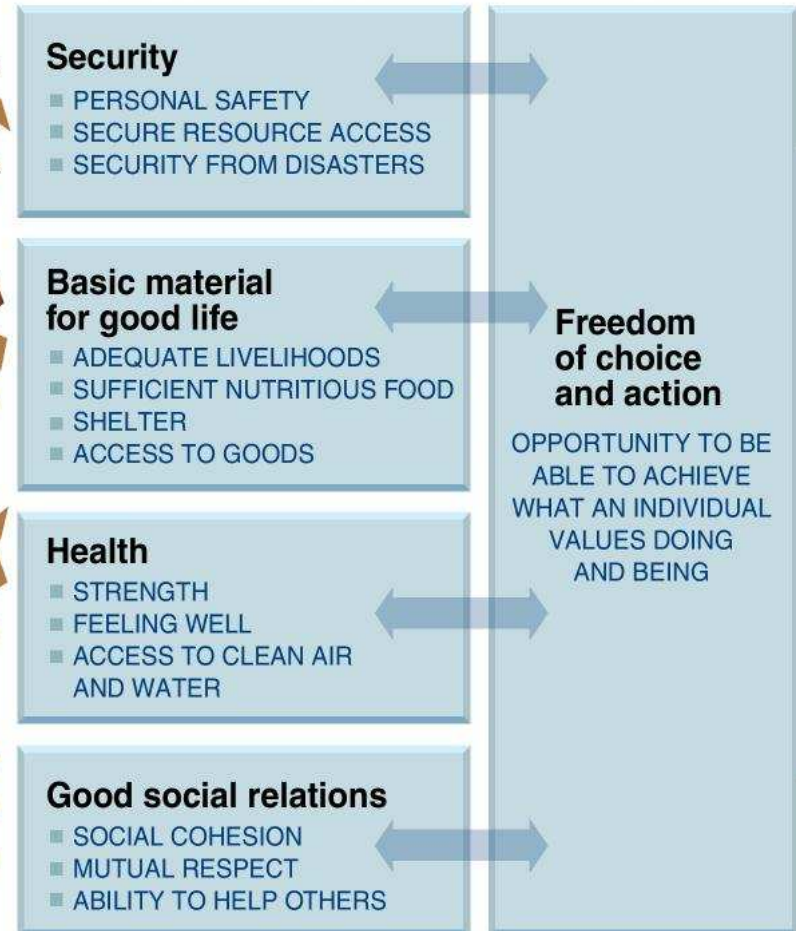
- Productive (economic / provisioning),
- Regulation (ecological) and
- socio-cultural functions / services



→ link to the concept of **sustainability** with its established ecological, economic and social development categories



CONSTITUENTS OF WELL-BEING



Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors

ARROW'S WIDTH
Intensity of linkages between ecosystem services and human well-being

Low

Weak

Medium

Medium

High

Strong

▀ **Produktions- (Versorgungs-)Leistungen (Ökonom.)**

- Nahrung: Nahrungs- und Futterpflanzen, Weidevieh
- Nachwachsende Rohstoffe: Holz, sonstige Biomasse
- Sonstige erneuerbare Naturressourcen: Süßwasser, Energie (Solar, Geothermie)

▀ **Regulations-Leistungen (Ökolog.)**

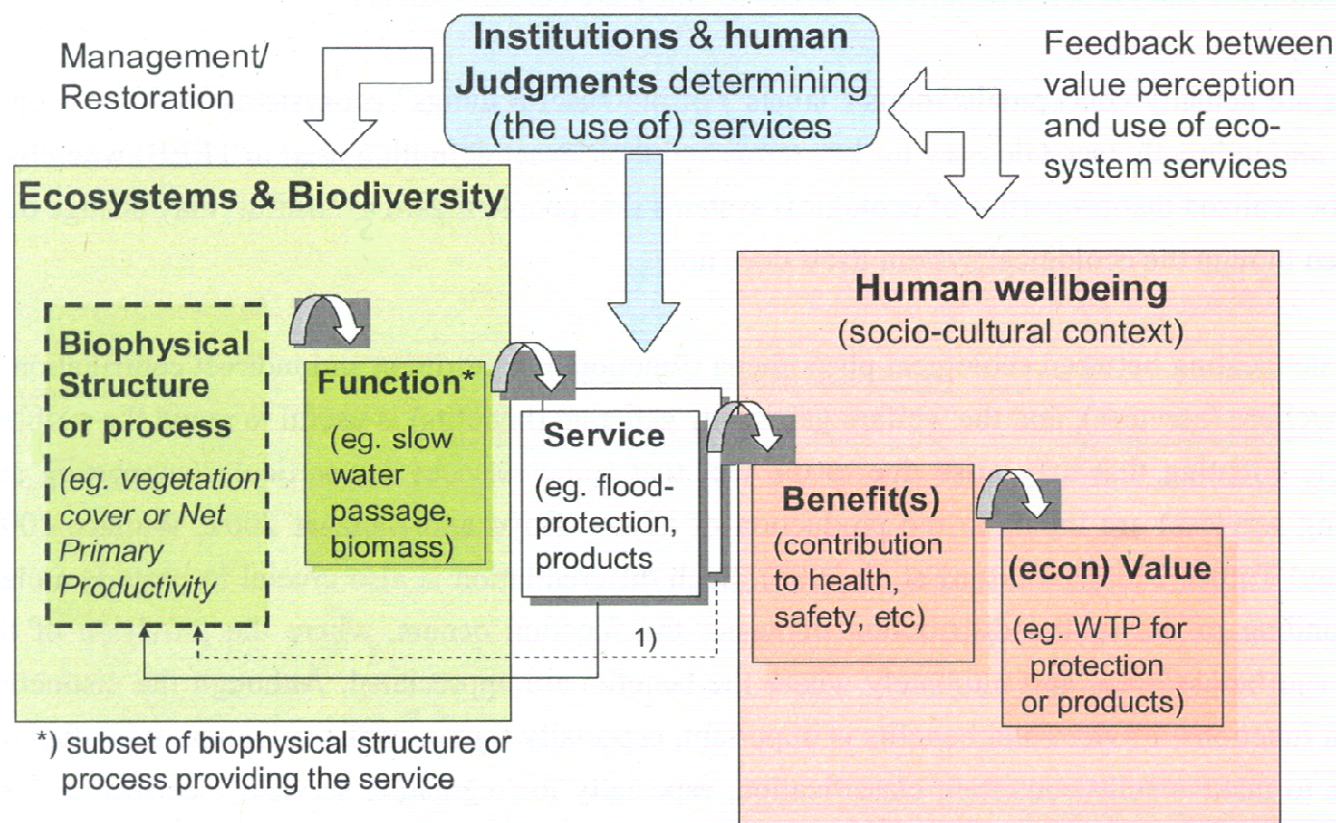
- Meteorolog. ÖSD: Kohlenstofffixierung
- Hydrolog. ÖSD: Wasserregulation, Wasserreinigung
- **Pedolog. ÖSD: Erosionsschutz, Erhalt der Bodenfruchtbarkeit**
- Biologische ÖSD: Bestäubung, Erhaltung von Arten und Biozönosen (Habitatfunktion, Biodiversität)

▀ **Sozio-kulturelle Leistungen**

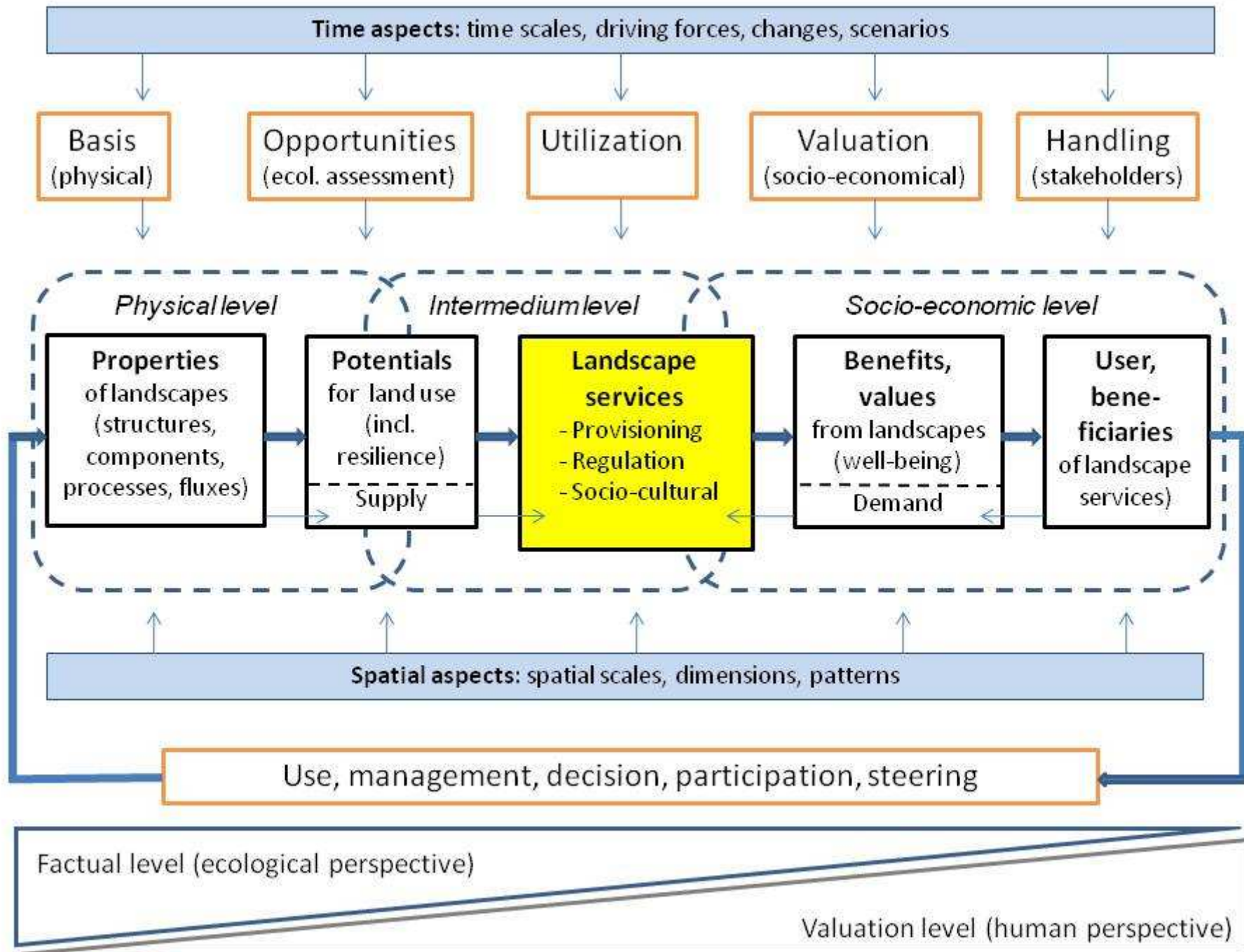
- Psychologisch-soziale ÖSD: Ethische Werte, Ästhetische Werte, Identifikation
- Informations-ÖSD: Bildungs- und Erziehungswerte

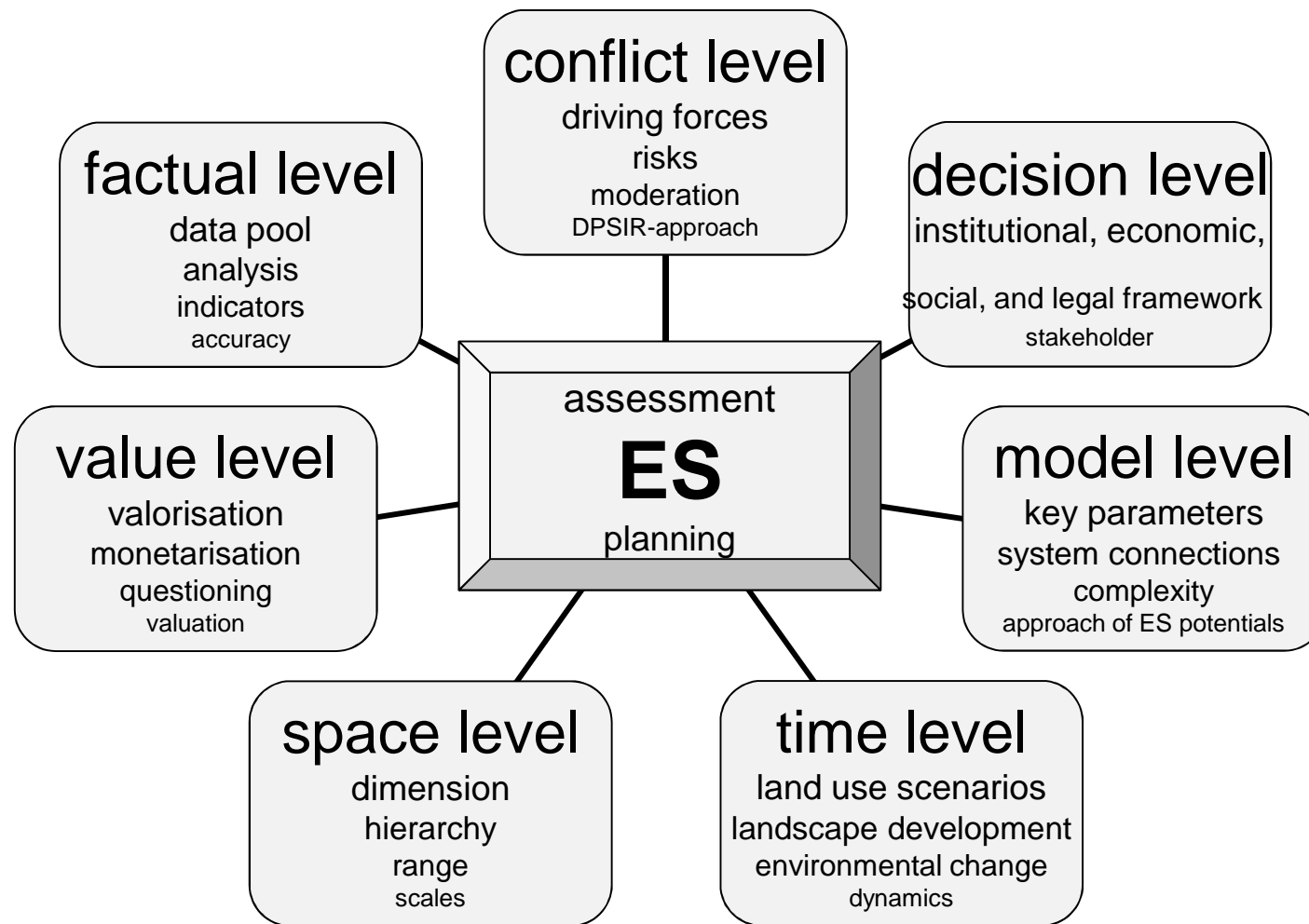


Termini and TEEB-framework



Adapted from Haines-Young & Potschin, 2009 and Maltby (ed.), 2009





Scheme of an approach to ES (multi-level approach), including both multiple socio-economic and scientific methods, numerous interdisciplinary technical terms

Four levels of ecosystem services analysis (Costanza 2011)

1. Basic value transfer (assumes values constant over ecosystem types)
2. Expert modified value transfer
3. Statistical value transfer
4. Spatially explicit functional modelling (incorporating valuation)

ES assessment approaches

	Supply oriented (costs) No strong economic value	Demand oriented (value of preference) Economic value– Readiness to pay for environmental services
Direct approaches	Direct Costs Costs for replacement, restoration <ul style="list-style-type: none"> • Replacement Costs • Restoration Costs 	Market Prices Prices on hypothetical markets (Stated preferences) <ul style="list-style-type: none"> • Contingent Valuation • Choice Experiments
Indirect approaches	Indirect Costs Costs of avoiding or substitution <ul style="list-style-type: none"> • Mitigation Costs • Substitution Costs 	Revealed preferences <ul style="list-style-type: none"> • Hedonic Pricing • Travel Cost

From Matzdorf et al. (2010)

Valuing ecosystem services through the TEV framework

Group	Direct use	Indirect use	Option value	Non-use value
Provisioning	√	NA	√	NA
Regulating	NA	√	√	NA
Cultural	√	NA	√	√

NA = Non applicable
(Kumar 2010)

Basic assessment approaches

- **Expertenurteile** (Punktwertverfahren, Nutzwertanalyse, ökologische Verflechtungsmatrizen usw.)
- **Ökonomische** (monetäre) **Verfahren** (z.B. Marktpreise, Schattenpreise)
- **Partizipative Ansätze/** Akteursbeteiligung:
z.B. Befragungen/Interviews, Bewertungs- und Szenario-Workshops, Bürgerjury, abwägende Visionen, partizipative multikriterielle Bewertungen

Spatial aspects

- Spatial **patterns** of ecosystems / ecos. services in the landscape
→ side effects, habitat connections, wildlife corridors, buffer stripe
- **Service Providing Areas**
/ Service Benefiting Areas,
Service Connecting Areas
(Benefits here, costs there /
Who sells? Who pays?)
- **Interactions / trade-offs** between
services: positive, neutral, negative;
- Temporal **trade-offs**: benefits now – costs later



Application of the ES concept

Selected projects of the IOER

- Water Framework Directive (WFD)
- Renewable energies (LÖBESTEIN)
- Natura 2000
- Landscape management
- Urban ES

Aim

- Testing of innovative application possibilities
- Enhancing theoretical fundamentals
- Developing methodical frameworks and tools

WFD

- long-term sustainable water management basing on a high level of protection for the aquatic environment, and also the optimization of ES (e.g. human health protection, economic consequences)

The goals of the WFD imply mainly the following benefits, reflecting a whole bundle of ES:

- Human health protection by water-related utilizations, e.g. bathing-water quality, drinking-water quality
- Lower costs for water purification
- Maintenance of water supply
- Improvement of life quality by increasing the recreation value of surface waters
- Coping with conflicts and regional damages through the balance of interests among different social groups



BASTIAN, O.; GRUNEWALD, K.; SYRBE, R.-U. (2011): Space and time aspects of ecosystem services using the example of the EU-Water Directive (in press)

The example of the river catchment Jahna in Saxony

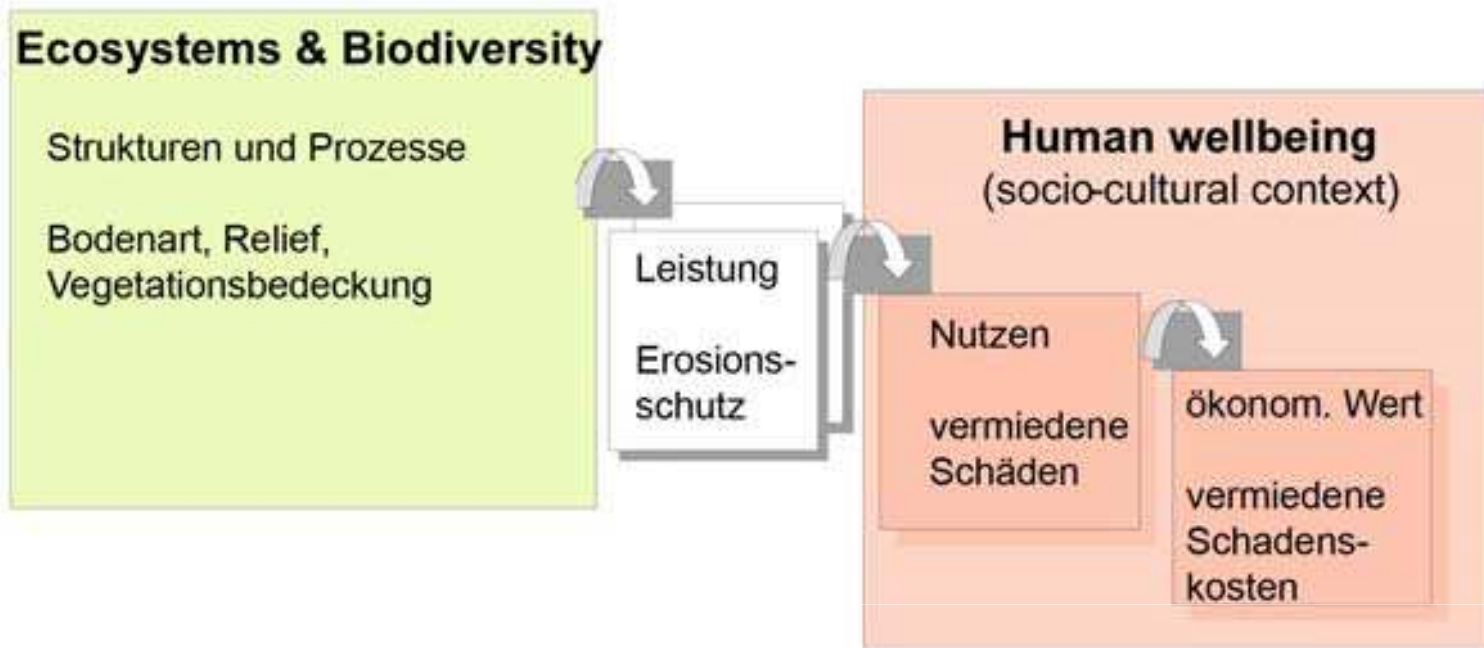


Zur Unterstützung des objektiven Entscheidungsprozesses bei der Auswahl und Priorisierung von Maßnahmen zur Reduzierung der Erosion und Nährstoffeinträge in Gewässer kam die multikriterielle Bewertung in Form der **Nutzwertanalyse** zur Anwendung.

[Grunewald & Naumann 2011 in press]

Teil- und Gesamtnutzwerte für die Zielvariablen der Maßnahmeszenarien für das Einzugsgebiet der Jahna

Maßnahmeszenarien	Zielvariablen		partikuläres P		diffuses N		Kosten		Akzeptanz		Gesamtnutzen
konservierende Bodenbearbeitung (100% SHF)	0,80	0,2	0,29	0,07	0,90	0,23	0,5	0,13			0,63
konservierende Bodenbearbeitung (100% Ackerfläche)	1,00	0,25	0,57	0,14	0,21	0,05	0,5	0,13			0,57
begrünte Abflusswege (SHF)	0,40	0,1	0,25	0,06	0,49	0,12	0	0			0,28
Gewässerschutzstreifen	1,00	0,25	0,27	0,07	0,92	0,23	0	0			0,55
Ackerland in Grünland (SHF)	1,00	0,25	0,29	0,07	0,72	0,18	0	0			0,50
Ackerland in Grünland (höchste N-Austräge)	0,20	0,05	0,45	0,11	0,72	0,18	0	0			0,34
Zwischenfruchtanbau 9%	0,20	0,05	0,57	0,14	0,87	0,22	0,5	0,13			0,54
Zwischenfruchtanbau 20%	0,30	0,08	0,97	0,24	0,60	0,15	0,5	0,13			0,60



Einordnung der Leistung Erosionsschutz in das Schema der TEEB-Studie

on-site und off-site Kosten der Erosion für die USA - ca. 100 US-\$ pro Hektar und Jahr
(Pimentel et al. 1997)

Ersatzkosten für Böden (10 €/t) und Dünger veranschlagt (600 €/t für N bzw. 750 €/t für P)
sowie **Schadenskosten** (Reinigung von Straßen, Grundstücken nach Erosionsschäden,
Entschlammung von Speichern, Teichen, Kanälen etc.)

→ ähnliche monetäre Größenordnungen der Schäden für das Einzugsgebiet Jahna
→ 20.000 ha landwirtschaftliche Nutzfläche im EZG: **Ersatz- und Schadenskosten von 1,4 Mio. € pro Jahr**

Vergleich zu Erosionsminderungsmaßnahmen:

Nutzen-Kosten-Verhältnis 5 zu 1 für die USA (Pimentel et al. 1997; 17 t/ha/a auf 1 t/ha/a)

Setzt man für das Einzugsgebiet Jahna die Kosten für die effektivsten Maßnahmen (100% konservierende Bodenbearbeitung auf den Sedimenthauptlieferflächen und Zwischenfruchtanbau auf 20% sowie aktuelle Fördersätze: 85 €/ha für Zwischenfruchtanbau; 68 €/ha für konservierende Bodenbearbeitung) mit 760.000 € an, resultiert für die Gesellschaft hier ein **Nutzen-Kosten-Verhältnis von ca. 2 zu 1.**

Conclusions

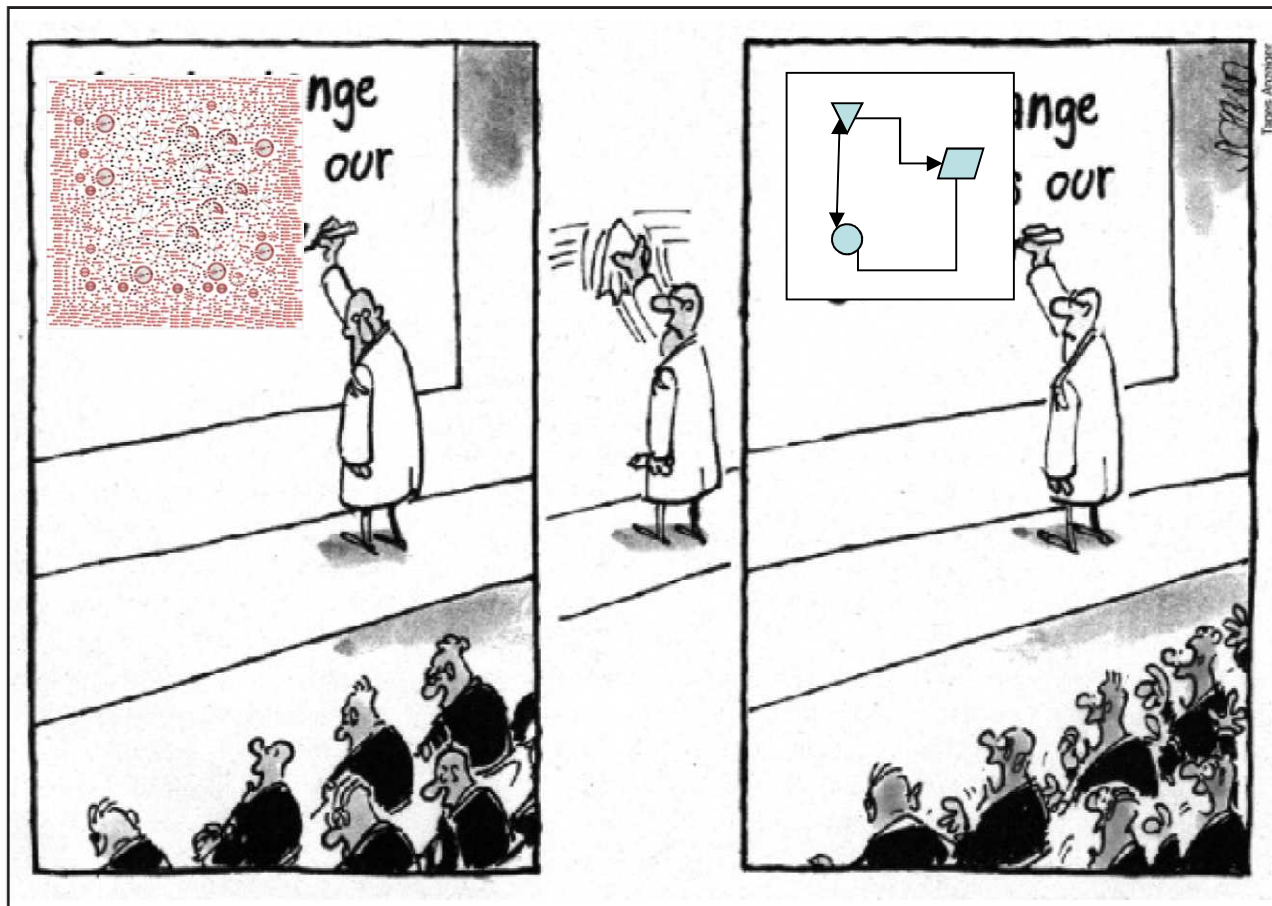
Ecosystem services are not new but of outstanding publicity



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ES concept as eye-opening Metaphor

ES Concept as Complexity Blinder



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ES = Signal of values and prices (to honour ES)

Positive stimuli / incentives (e.g. Extensivisation of soil use)

Negative price signals (e.g. Entrance fee for a NP)

Tradable usage rights for ES (e.g. Trade of CO₂-emission rights)

→ decision making mostly based on economics (- ES concept)

Ecosystem services in spatial planning - Advantages of ES

- Enrich classical landscape planning and focus on **real benefits**
- Facilitate the **choice** between different planning alternatives
- Planning decisions are more **comprehensible** (since ES show the consequences of changes)
- Economic valuation → more efficient use of **public funds**

Mapping Ecosystem Services – on regional, national and EU scales

- establish a methodology for ecosystem service mapping
- summarize the key resources needed for this mapping exercise
- map the provision of ecosystem services
- assess synergies and trade-offs of ecosystem services
- estimate the contribution of ecosystems to the provision of ecosystem services.

Criticism on ES

- ES plannings don't aim absolutely at a maximal conservation of **biodiversity**
- ES focus only on functions (services) for **humans**
- Difficulty to **quantify** different planning alternatives
- Deficient knowledge on **social and cultural values**
- Economic valuation should not suppress **other decision criteria**

Barkmann et al. 2010

Trade-offs and Choices in ES / SD

- People want to sustain what they value, but the values differ.
- It is not possible to sustain everything, everywhere, simultaneously.
- Future generations are important, but people live in poverty now.
- The best course of action is not always known.

→ The future is open...

Thank you for your attention!

