Introducing ecosystem services into LFM impact assessment

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Ecosystem Services

"…are benefits provided by the natural environment to human society and include, for example, food and water provision, flood control, purification of water, recreational and cultural benefits, soil formation, nutrient cycling, etc …"

Why Ecosystem Services?

ES concept…..

- describes some of the ways humans are linked to and depend on nature

- reveals that the environment is a social asset that should be preserved under increasing scarcity conditions

- Emphasizes the importance of economic benefits of certain habitats and land cover types

ES and environmental policy

ES concept is becoming an important component of mainstream environmental decision making:

- Convention on Biological Diversity's voluntary guidelines on including biodiversity and ES in EIA (2006)
- OECD's recommendations on how to include ES in SEA (2008)
- IPIECA/OGP's guidelines for considering ES for oil and gas developments (2011)
- UNEP's "Project for Ecosystem Services" (ProEcoServ) (2014)
- World Resources Institute's guidance framework "Ecosystem Services Review (ESR) for Impact Assessment (IA)" (2011 & 2014)

EU wide ecosystem assessment
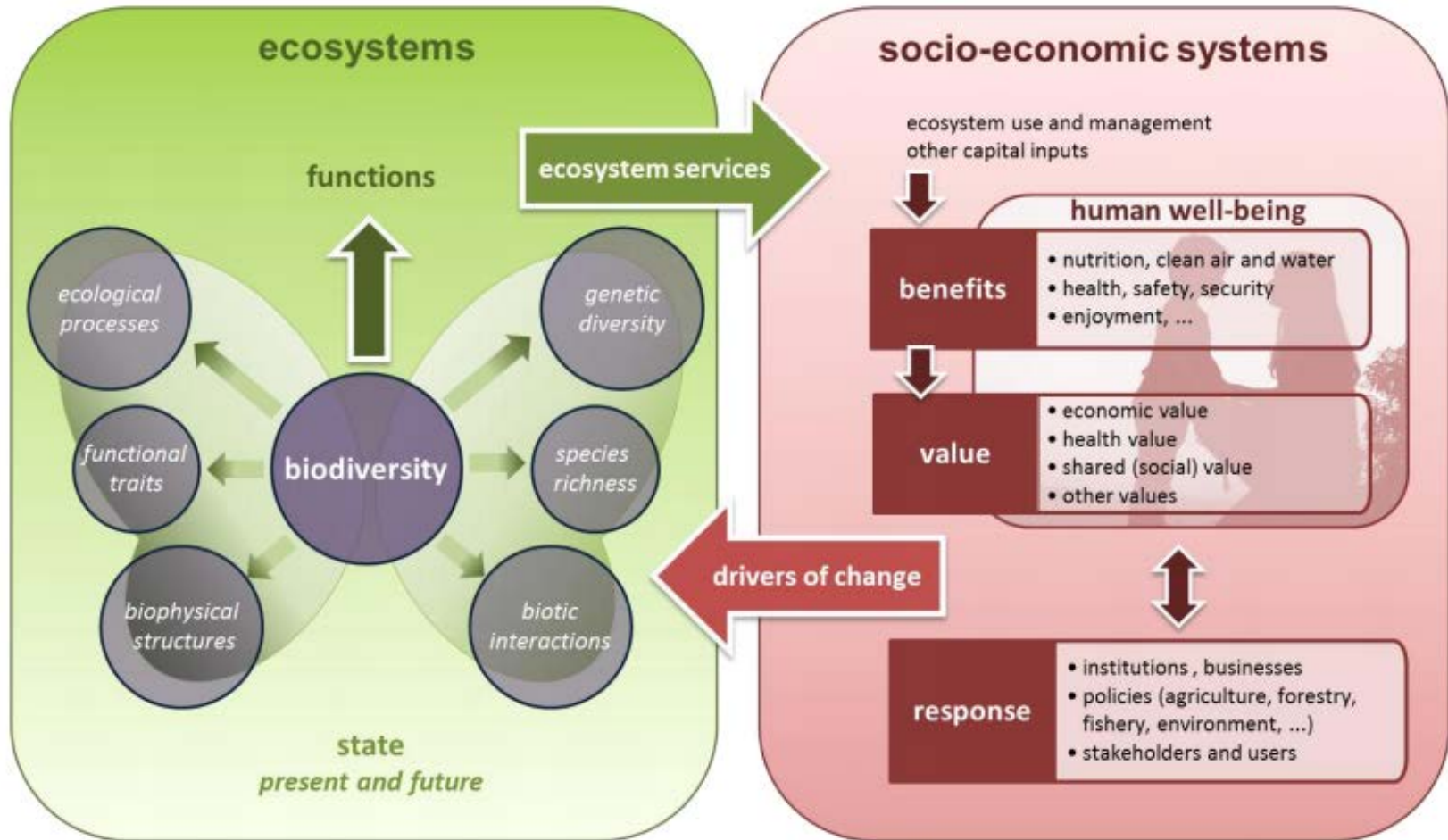
ES in practice

ES framework provides….

- an effective framing of the environment in terms of communicating with and influencing stakeholders and decision makers

- a more complete, holistic and integrated consideration of the socio-ecological system

Yet…
- EIA practitioners have not been engaged, so far
- ES definitions are still confusing is some services

Ecosystem Services Classification Systems

ES Classification systems

- Millennium Ecosystem Assessment (MA)

- The Economics of Ecosystems and Biodiversity framework (TEEB)

- Common International Classification of Ecosystem Services (CICES)

- Classifications by individual researchers

Overview of classification

ES	MA	TEEB	CICES
Provisioning	○	○	○
Regulating (& maintenance)	○	○	○
Cultural (& amenity)	○	○	○
Supporting	○	-	-
Habitat	-	○	-
Sub-groups	-	-	○

ES classification systems

ES classification systems-MA

MA distinguishes four categories of ecosystem services:

- provisioning services (i.e., goods or products obtained from ecosystems)

- regulating services (i.e., contributions to human well-being arising from an ecosystem's control of natural processes)

- cultural services (i.e. recreation, aesthetic enjoyment, etc)

- supporting services (i.e. natural processes, such as nutrient cycling and primary production that maintain the other services), which are regarded as the basis for all the other services

ES classification systems-TEEB

TEEB proposes a typology of 22 ES divided in four main categories, following mainly the MA classification:

- provisioning services

- regulating services

- habitat services

- cultural and amenity services

TEEB omits supporting services, which are seen as a subset of ecological processes. Habitat services are identified as a separate category to highlight the importance of ecosystems to provide habitat for species and gene-pool "protectors".

ES classification systems-CICES

CICES refined MA framework to reflect some of the key issues discussed in the wider research literature and is more explicitly hierarchical in structure. At the highest level there are three familiar services used in MA called 'Sections':

- provisioning

- regulating and maintenance

- cultural

CICES excludes supporting services to avoid the problem of 'double counting' if ecosystem and economic accounts are to be linked.

Below these Sections a series of 'Divisions', 'Groups' and 'Classes' are nested

Use of Ecosystem Services approach

ES, Mining, Landfills and LFM

- The use of ES approach in EIA literature is limited

- Potential uses of the ES approach are related to differential changes in ES provision:

  – during ex ante impact assessment

  – for creation of Net Positive Impacts during operation

  – for optimization of after mine closure and rehabilitation

  – during design and operation of a LFM project

Tools for introducing ES approach

- **Correspondence between 'classic' impacts and ES changes**
  - Various attempts so far
  - Many impacts do not correspond to ES provision changes
  - Many ES have not been taken into account

- **Use of technical indicators for each ES**
  - First EU approach through MAES *(mapping & assessment of ES)*
  - Still many gaps and doubts

- **Economic valuation of ES differentiation**
  - Monetization of changes
  - Connection with financial valuations (social CBA analysis)

Landfill Mining

Landfill mining project

- Indicators for assessing the condition and biodiversity of the ecosystems
  - Forest land
  - Cropland & grassland
  - Rivers & lakes
  - Wetlands
  - Transitional waters and marine inlets
  - Coasts, shelves and ocean
- Indicators for assessing ecosystems services
  - Agro-ecosystems
  - Forest-ecosystems
  - Water-ecosystems
  - Marine-ecosystems

Landfill mining projects

Indicators for assessing ecosystems services	Controlled LF	Un-Controlled LF
Cultivated crops (area / yield)	🟩	🟩
Reared animals and their outputs (livestock)		
Wild plants, algae and their outputs (wild berries)	🟢	🟢
Wild animals and there outputs (populations)	🟩	🟩
Plants and algae from in-situ aquaculture		
Animals from in-situ aquaculture (production)		
Water /nutrition (abstraction)	🟢	🟢
Biomass /materials (area, yield, timber production)	🟢	🟢
Water /materials (abstraction)	🟢	🟢
Plant-based resources (fuel wood)	🟩	🟩
Animal-based resources	🟩	🟩
Animal-based energy		
Mediation of waste, toxics and other (area, nutrients)		
Mass stabilisation and control of erosion rates (risk)	🟩	🟩
Buffering and attenuation of mass flows	🟩	🟩
Hydrological cycle & water flow maintenance	🟢	🟢
Flood protection (areas at risk)	🟢	🟢

Landfill mining projects

Indicators for assessing ecosystems services	Controlled LF	Un-Controlled LF
Storm protection	🟩	🟩
Ventilation and transpiration (biomass amounts)	🟢	🟢
Pollination and seed dispersal (potential)	🟩	🟩
Maintaining nursery populations and habitats (High Nature Value farmland)	🟢	🟢
Pest and disease control		
Weathering processes (organic farming, soil properties)	🟢	🟢
Decomposition and fixing processes (area N-fixing crops)		
Chemical condition of freshwaters (chemical status)	🟩	🟩
Chemical condition of salt waters		
Global climate regulation by reduction of greenhouse gas concentrations (carbon storage/sequestration)	🟧	🟧
Micro and regional climate regulation (forest area)		
Physical and experiential interactions (visitor statistics)	🟢	🟢
Intellectual and representative interactions		
Spiritual and/or emblematic		
Other cultural outputs (protected areas extent)	🟢	🟢

Landfill mining projects

- Overall positive picture
    - 32 categories
    - 9 positive impacts
    - 11 potentially positive (depends on land use)
- Carbon sequestration is a grey area
    - Pros: soil sequestration, energy consumption
    - Cons: circulation of organic materials, required processes
- Nuisances to humans during LFM processes not included in the assessment
- Indicators that cannot (yet) be addressed with existing data have not been included

So, how do we plan policies?

Planning policies

- Ecosystem services provision changes are useful to understand and communicate negative and positive impact assessment

- Ecosystem services provision changes cannot always be monetized (yet), and we need more research

- ES indicators provide reasonable ground for the optimization of the LFM objectives and processes

- Impacts on manmade environment should be also put into perspective within this framework

- A national plan (at the strategic level) should not fail to analyze these aspects.

Concluding remarks

- ES approach is particularly relevant at the Strategic Impact Assessment level

- To improve this situation, a more consolidated methodological framework will have to be established based more on globally standardized classifications

- Scientists and practitioners involved in LFM should become more familiar with the concept of ES because it becomes mainstream in several standards and legislations, but also because it may help in successful conflict management

Thank you for your attention…