



SUSTAINABLE REMEDIATION 2011
STATE OF THE PRACTICE
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**Integrating the soil function concept and multi-criteria
analysis for sustainable remediation of contaminated land**

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GOAL

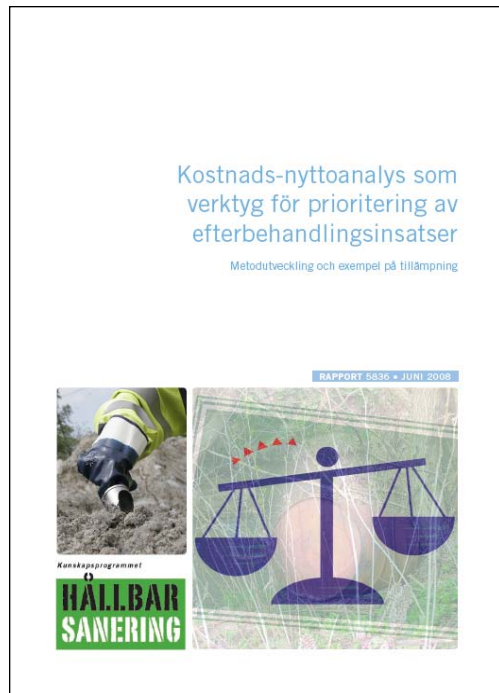
To integrate **Multi Criteria Analysis** and the **Soil Function Concept** to assess the sustainability of different remediation solutions.

What? Why? How?



Points of Departure:

1. The prototype of multi criteria analysis (MCA) for sustainability appraisal of remediation alternatives (Rosén et al. 2009).



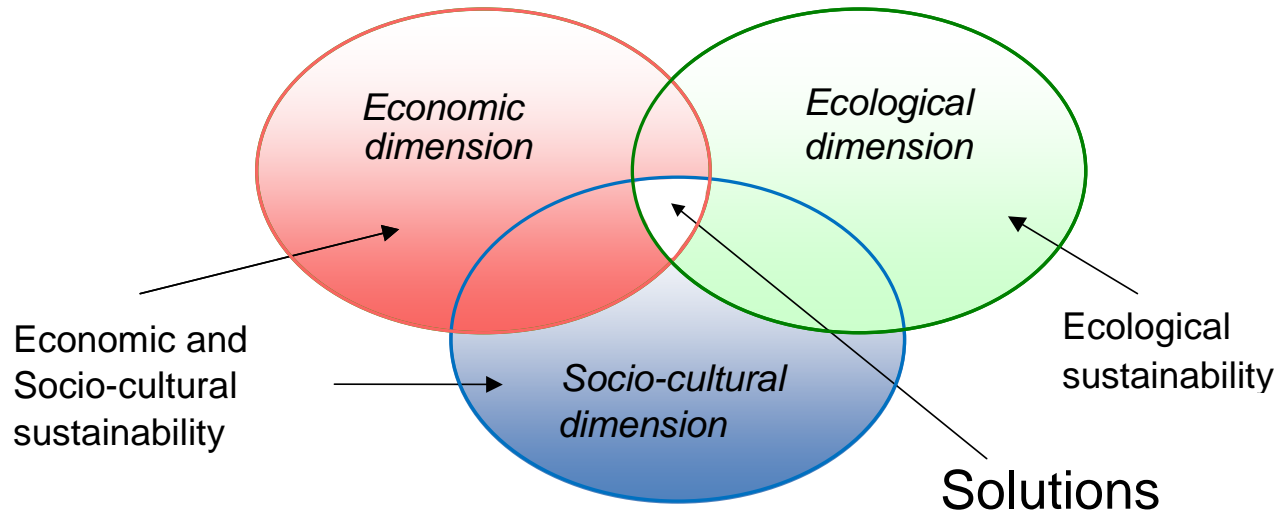
2. The soil Function Concept introduced by proposed EU-Directive on soil protection (COM 2006).

What is MCA?

- To assess the degree to which a project fulfills a set of performance criteria.
- These criteria are typically evaluated for each identified decision option, including a baseline alternative.
- Sometimes, qualitative estimations are made for each criterion.
- Sometimes, scores and weights are assigned to each criterion to facilitate comparison between alternatives.



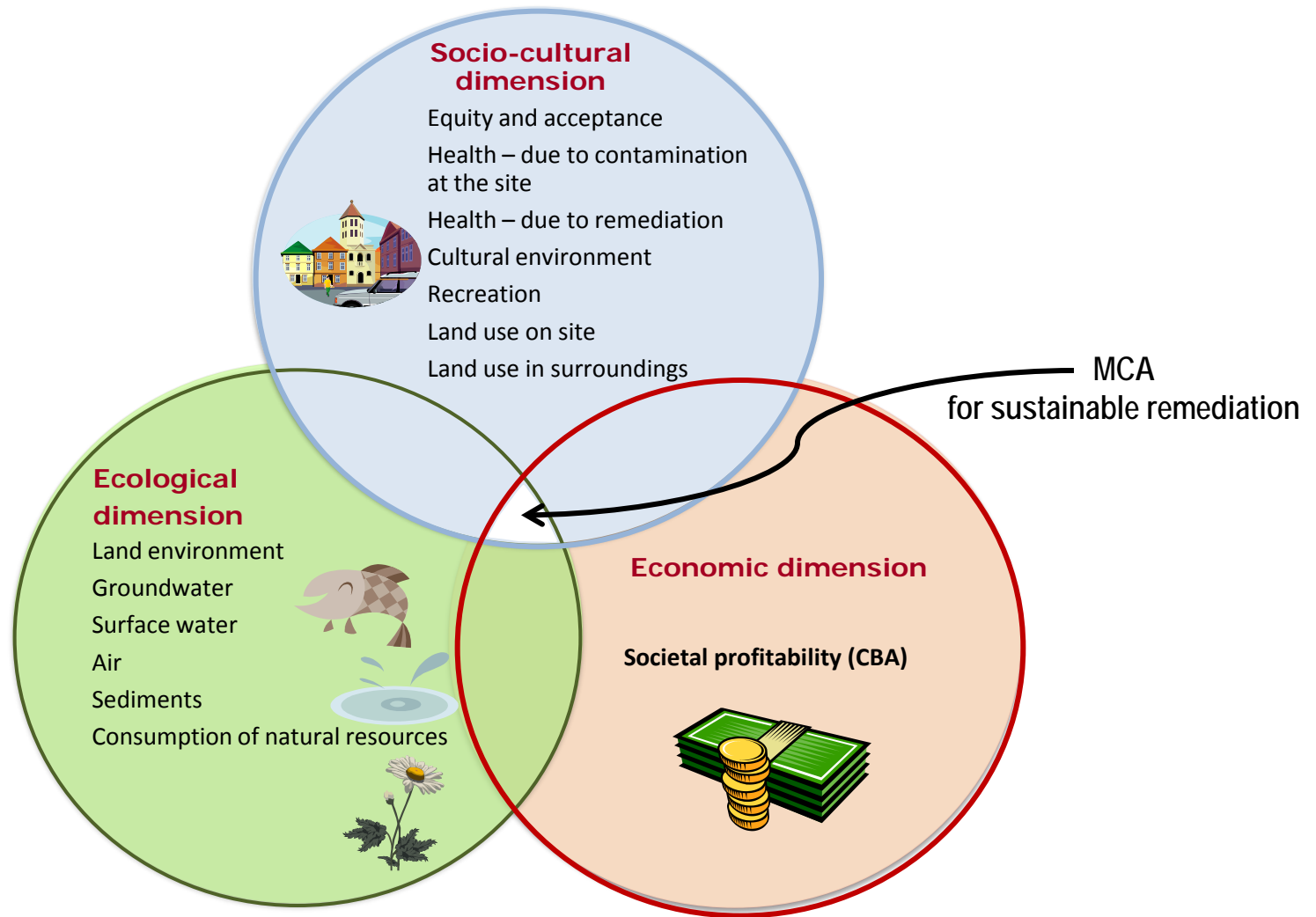
Why MCA?



After Söderqvist et al (2004) and Brundtland Commission (1987)

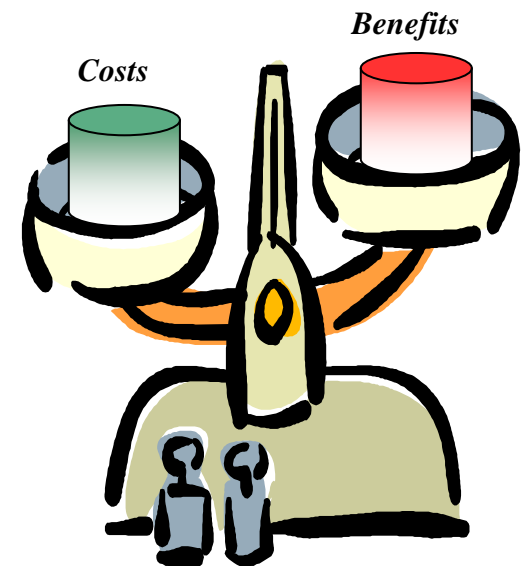
- To capture multiple criteria of three sustainability pillars.
- To evaluate available remediation alternatives in a structured, step-wise way.
- To prioritize between remedial options and to choose the most sustainable one.

Criteria in the MCA model (*Rosén et al., 2009*)



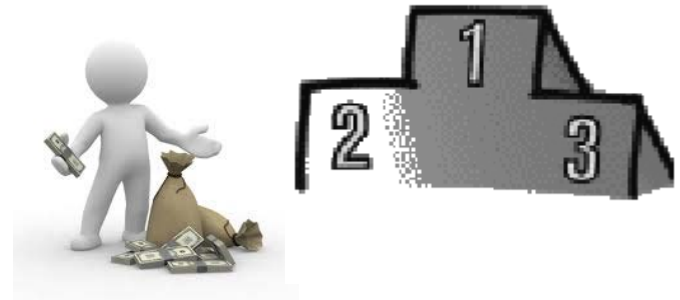
Economic dimension- Cost-benefit analysis (CBA)

- **Purpose:** to estimate *changes* in public welfare.
- Performed on the societal level.
- **Basic criterion:** Is the sum of all benefits for all companies and individuals larger than the sum of all costs for all companies and individuals?
- Analysis of distributional effects necessary.



Why CBA?

- In the interest of society to perform efficient measures
- Limited resources
 - We need to prioritize



- A common language is a key for efficient solution when several interested parties involved into decision-making

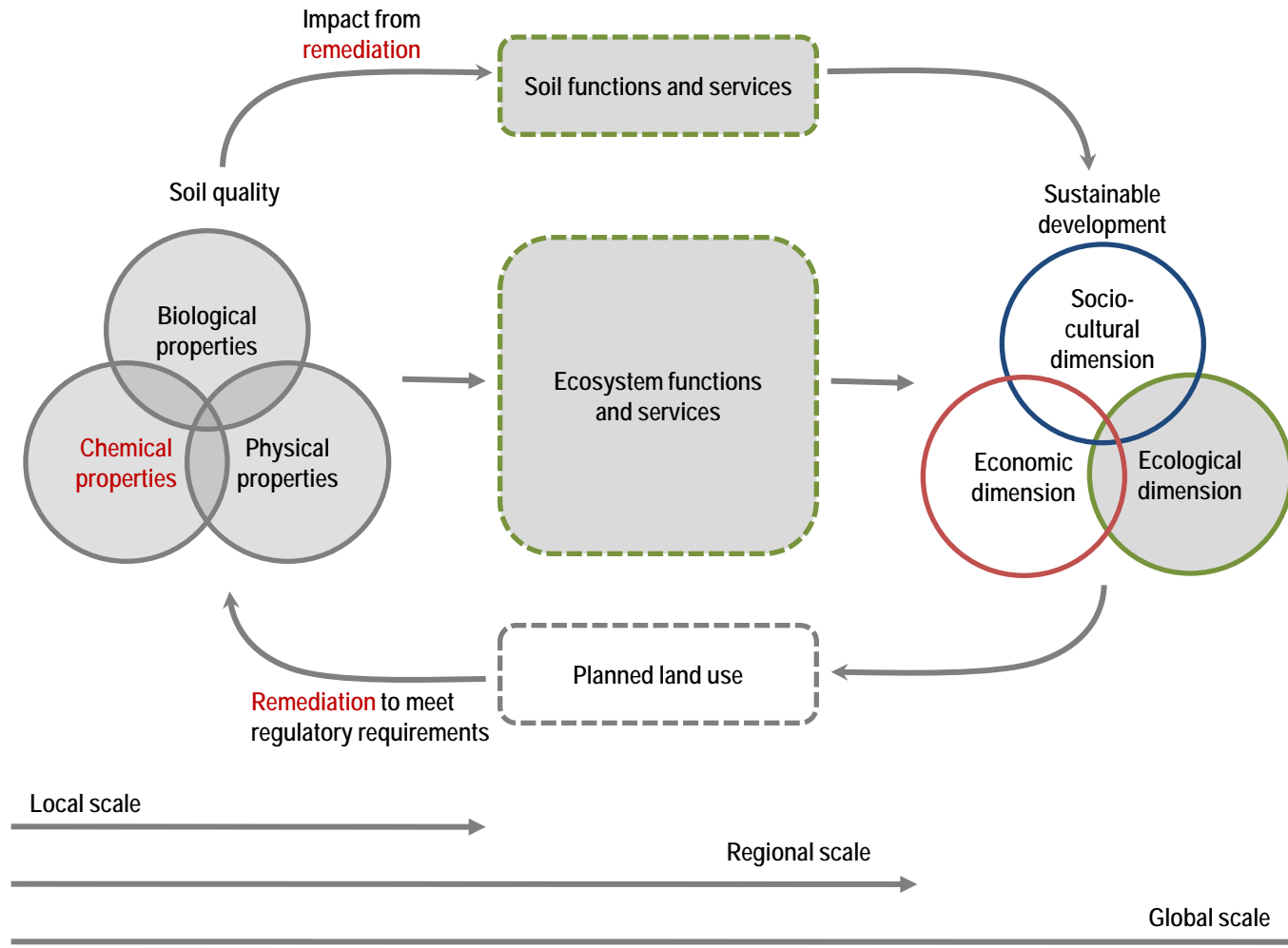
What is the Soil Function Concept about?

Soil function can be defined as a capacity of soil to fulfill a particular “requirement” assigned to it by nature or/and humankind.

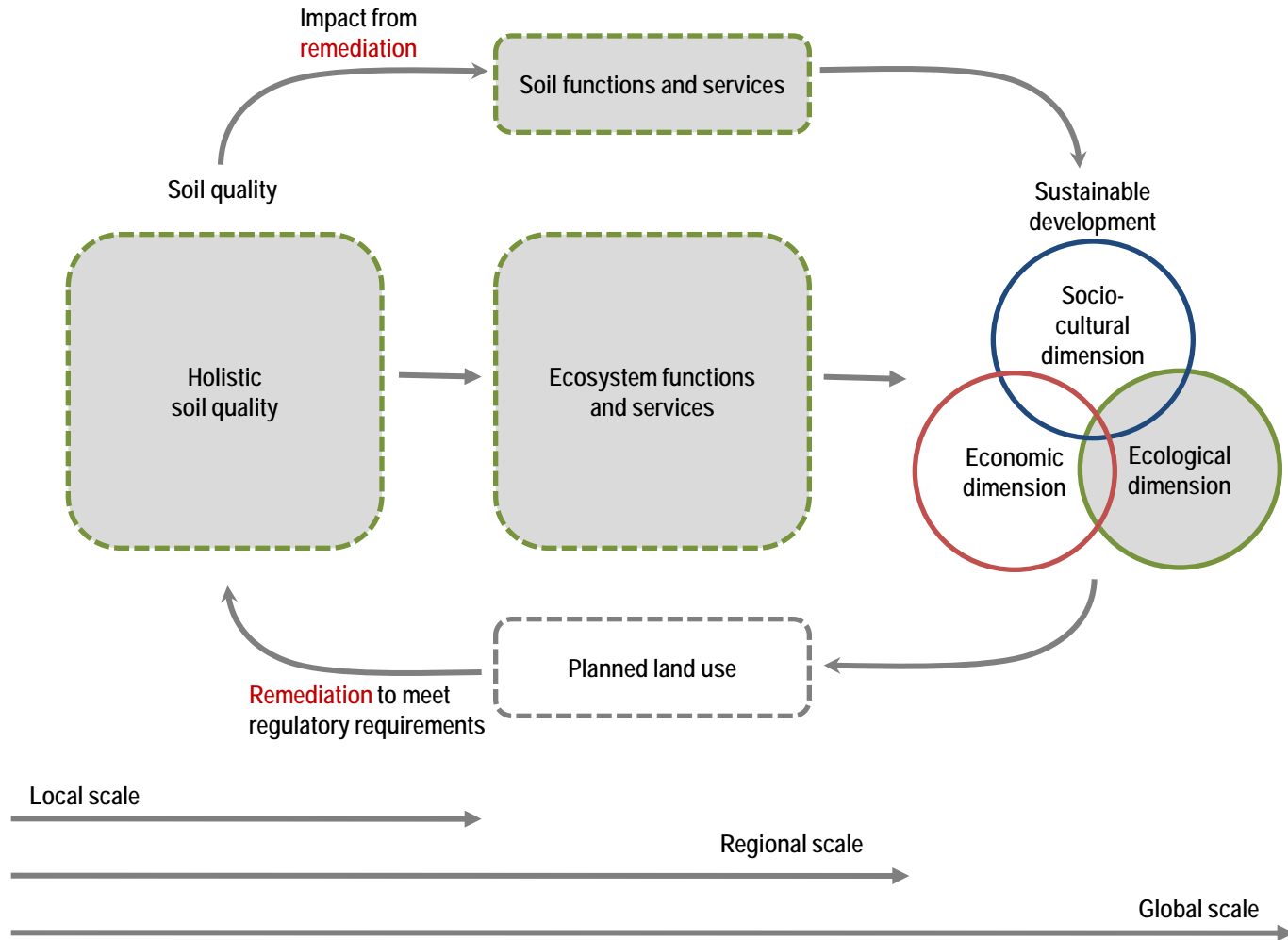
The proposed EU-Directive on soil protection (COM, 2006) lists the following soil functions and services:

- (a) biomass production, including in agriculture and forestry;
- (b) storing, filtering and transforming nutrients, substances and water;
- (c) biodiversity pool, such as habitats, species and genes;
- (d) physical and cultural environment for humans and human activities;
- (e) source of raw materials;
- (f) acting as carbon pool;
- (g) archive of geological and archeological heritage.

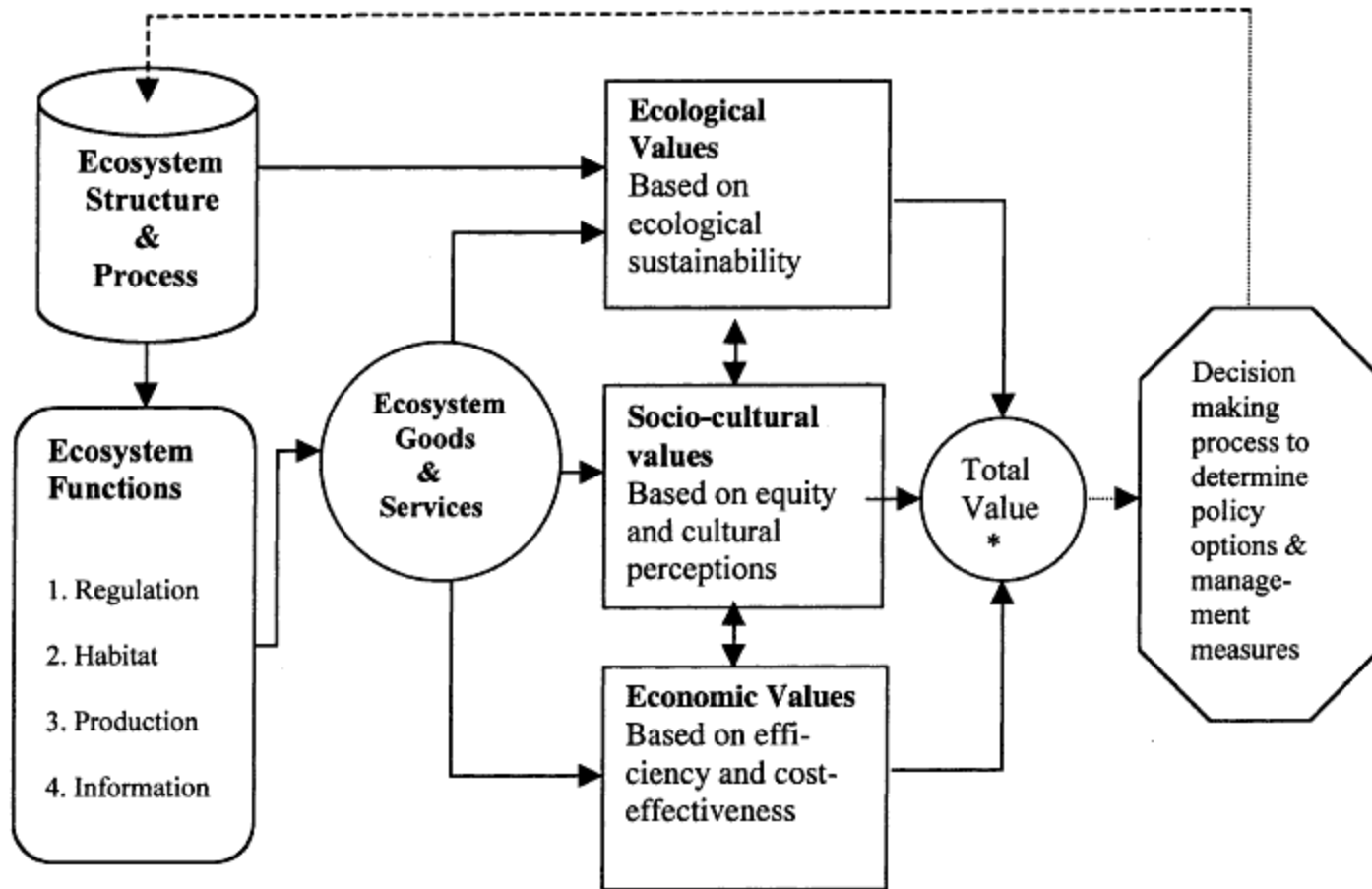
SOIL QUALITY, SOIL FUNCTIONS & SUSTAINABILITY: How do the concepts match remediation?



Directive on soil protection poses a holistic view on soil management...



Ecological Economics



Framework for integrated assessment and valuation of ecosystem functions, goods and services (de Groot et al, 2002)

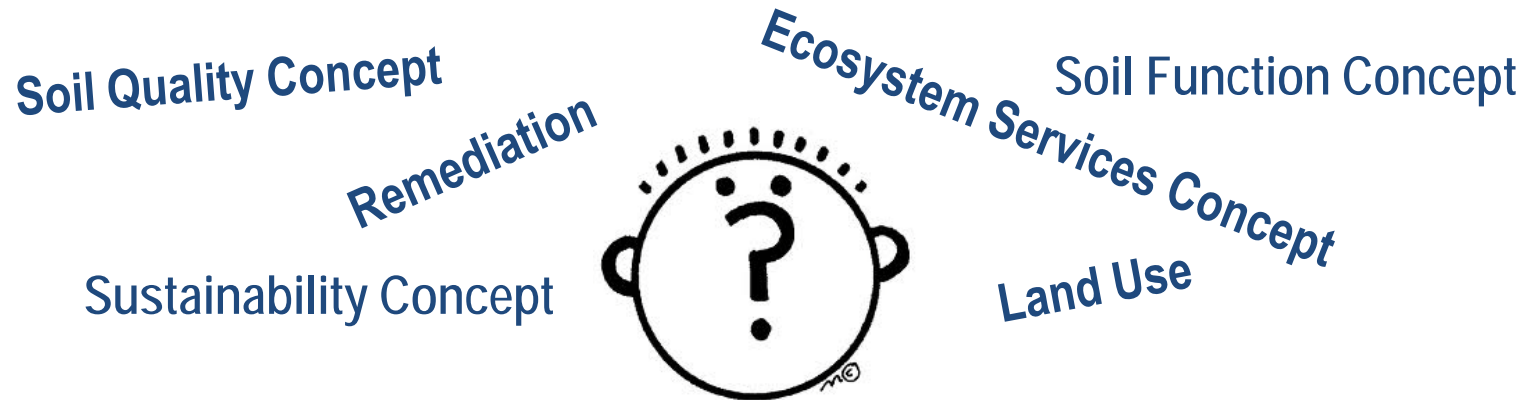
ECOSYSTEM FUNCTIONS & SERVICES

Ecosystem functions defined as “[a] capacity of natural processes and components to provide goods and services that satisfy human needs” (de Groot, 1992).

- Ecosystem functions result in **ecosystem services** once they are *delivered* to and *utilized* by a society (Costanza et al., 1987).
- It’s a service once people *profit* of function (de Groot et. al, 2002).
- Ecosystem services *include ecosystem organization* or structure as well as *process and/or functions* if they are consumed or utilized by humanity either directly or indirectly (Fisher et al., 2009).

One-to-one matches between functions and services are seldom, as a **single ecosystem service** may result of **several ecosystem functions** and vice versa (Costanza et al., 1987; MEA, 2003).

How to handle this chaos?



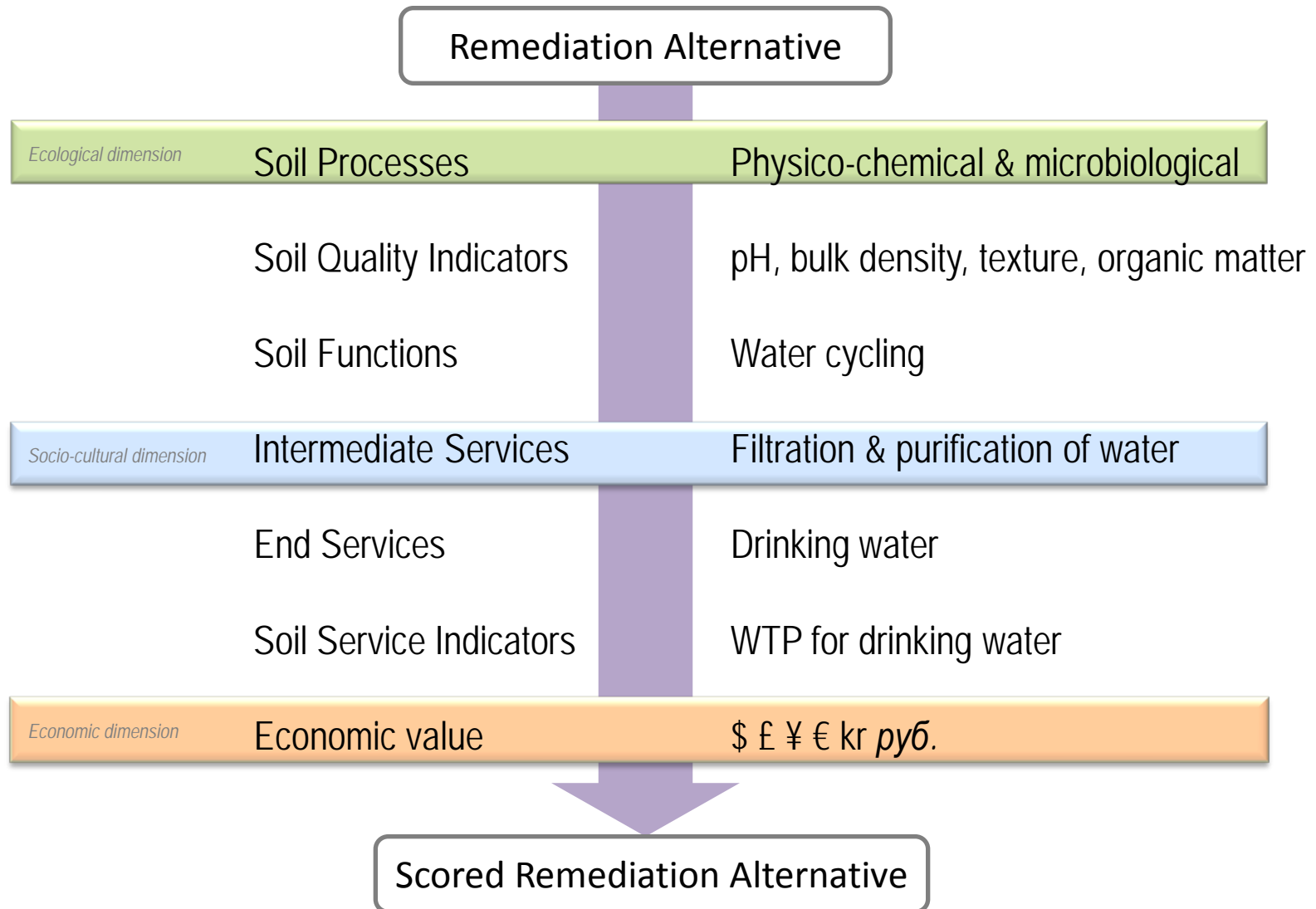
STEP 1: Simplify/ Structure

STEP 2: Specify/ Cluster

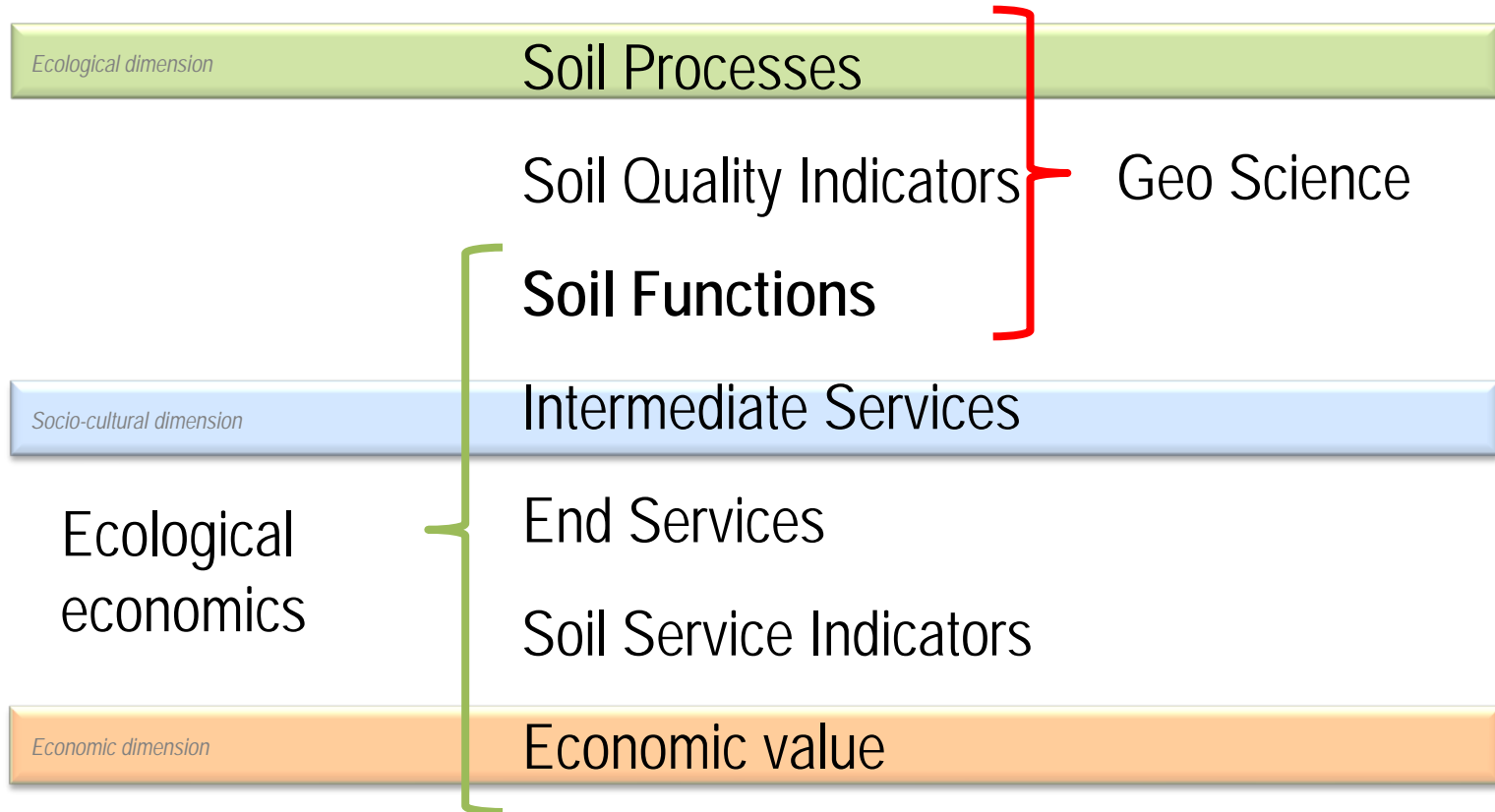
STEP 3: Categorize

STEP 4: Evaluate

Example for soil as a water source

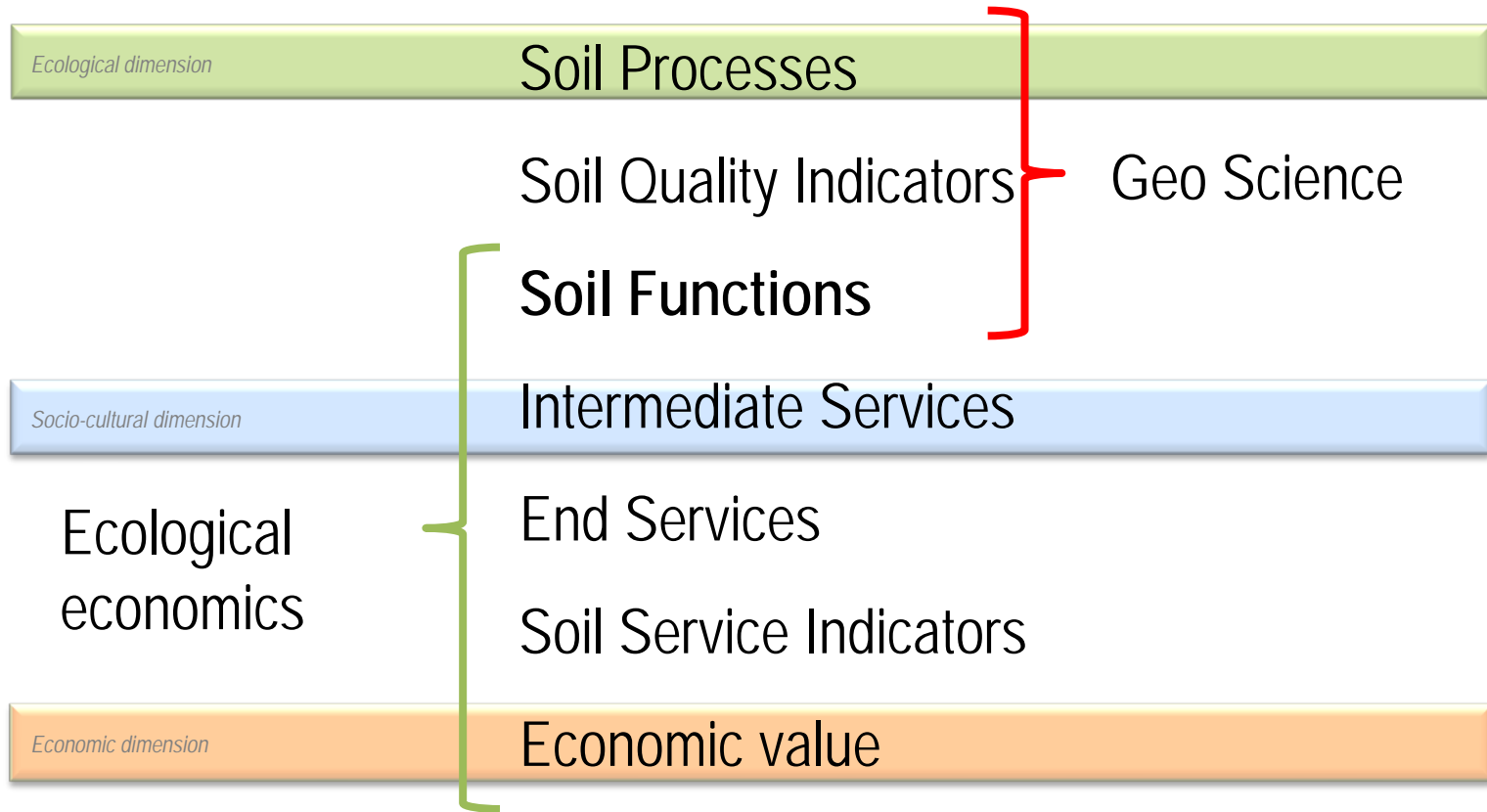


How to evaluate the *impact* of remedial action?



Missing part of the chain “Soil quality – Human well-being” ...

Expert judgment elicitation...



... for evaluation of changes in soil functions after remediation

Challenges

- **Scale** (boundaries of assessment)
- **Biochemical cycles** (Water, Nitrogen, Carbon, Oxygen, Phosphorus)
- **Causal links between quality indicators and functions**
- **Impact of remediation techniques on soil quality indicators**
- **Risk of double accounting**



Integration of MCA & Soil Functions for Sustainable Remediation

Possible?

Practical?

Viable?

Thank you for your attention!



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