



Ecosystem services

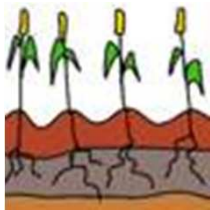
Sustainable use of the subsurface

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6 October 2011

Jahrestagung der Österreichische Bodenkundliche Gesellschaft

Benefits of soil ecosystem services to society



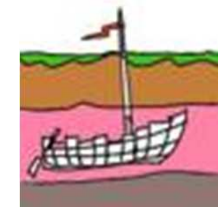
Production



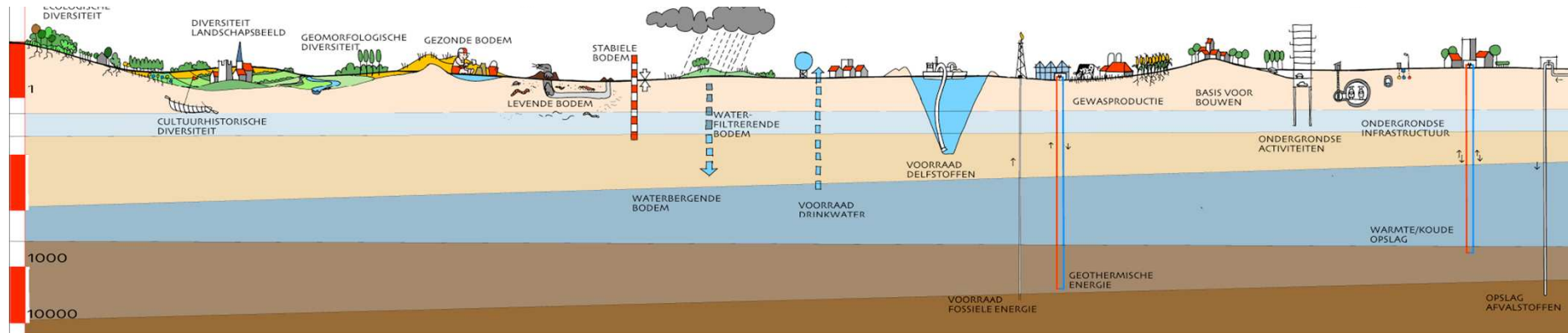
Regulation



Carrying capacity



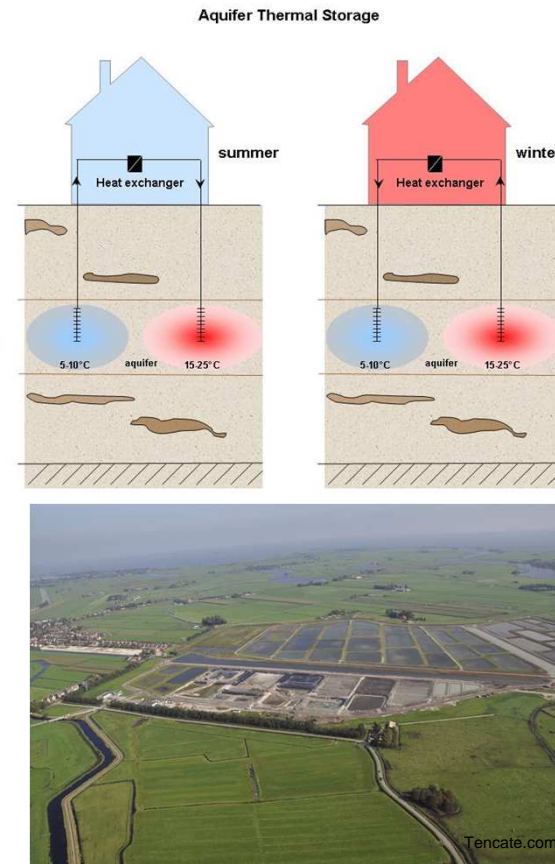
Information



Benefits of soil ecosystem services to society



Benefits of soil ecosystem services to society

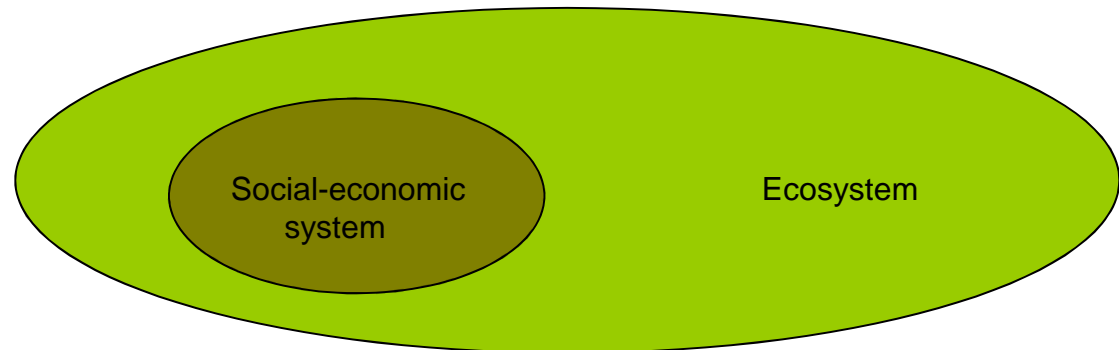


Ecosystem services concept

Antropocentric

Multi-sectoral

System approach



The soil community

From skepticism to interesting concept

<u>ConSoil 2008</u>	vs.	<u>ConSoil 2010</u>
10 delegates		100 delegates
Low response		Enthusiasm and debate

(applied) research on e.g.

Value of uncovered soil

Functional agro-biodiversity

Soil in spatial planning

Ecosystem services in EU policy

Conserving single
species

Conserving status
of communities of
species

Enhancing
connectivity

Sustaining
Ecosystem
Services

Proposed Soil Framework Directive:

*'the preservation of the **capacity of soil to perform** (...) **environmental, economic, social and cultural functions**'.*

Soil characteristics, functions, ecosystem services

SFD functions

- Biomass production, including in agriculture and forestry
- Storing, filtering and transforming nutrients, substances and water
- Biodiversity pool, such as habitats, species and genes
- Physical and cultural environment for humans and human activities
- Source of raw materials
- Acting as carbon pool
- Archive of geological and archeological heritage



Ecosystem service

Biological degradation groundwater contaminants



Relevant soil characteristics

Redox conditions
Presence specific microorganisms
Availability of nutrients
Temperature

Biodiversity and ecosystem services

Major questions are:

- Opportunities and trade-offs of (adding) a focus on ecosystem service goals for biodiversity conservation? (e.g. Chan et al., 2006; Goldman et al., 2008)
- Opportunities for human well-being of expanding a conservation plan based on conservation of biodiversity, with goals for ecosystem services protection? (e.g. Chan et al., 2006)
- How does biodiversity (conservation policy) influence ecosystem services delivery?
(e.g. Naidoo et al., 2008; Nelson et al., 2009; Rey Benayas et al., 2009; Isbell, 2011; Hooper et al., 2005)

Application possibilities

Awareness and support

Broaden scope

Beaumont et al., 2007, Beukering et al. (2008)

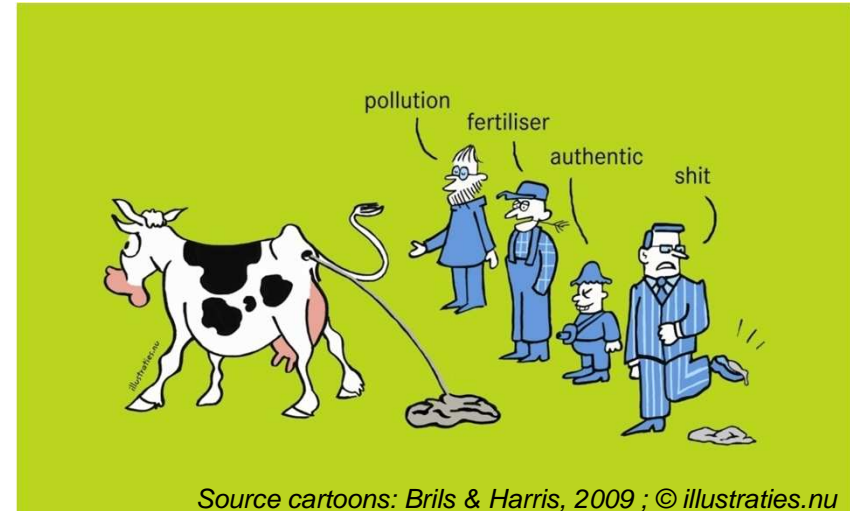
Communication, participation

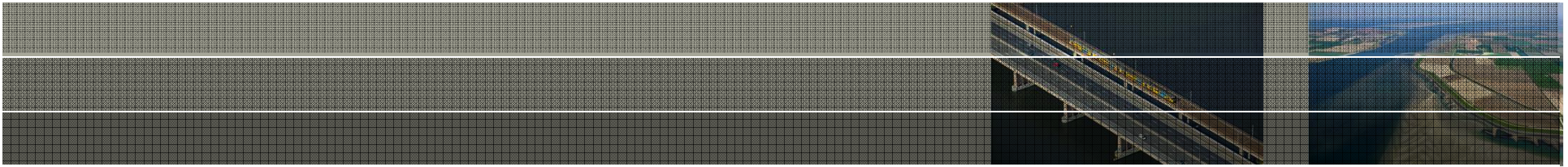
TCB, 2003; Slootweg and Beukering, 2008, Van der Meulen et al, 2010, 2011

Soil management goals

PES, balancing investments and benefits

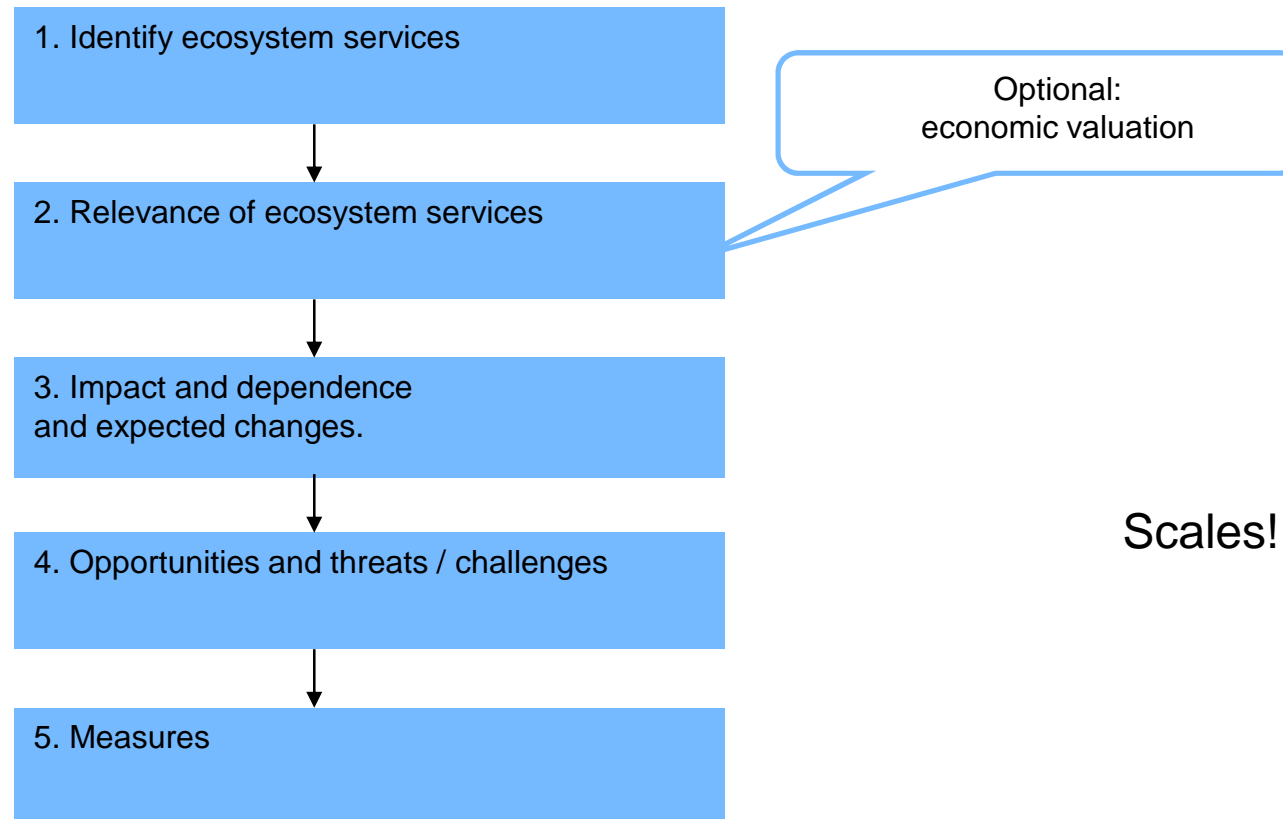
Wunder (2005), Greiber (2009), Engel et al. (2008)





Application of the concept

Framework for analyses



Framework for analyses of ecosystem services; based on Ranganathan et al., 2008 and Beukering et al. (2008), Daily, 2000

Communication

List of ecosystem services

Food production (crops, fish aquaculture)

Biofuel crops

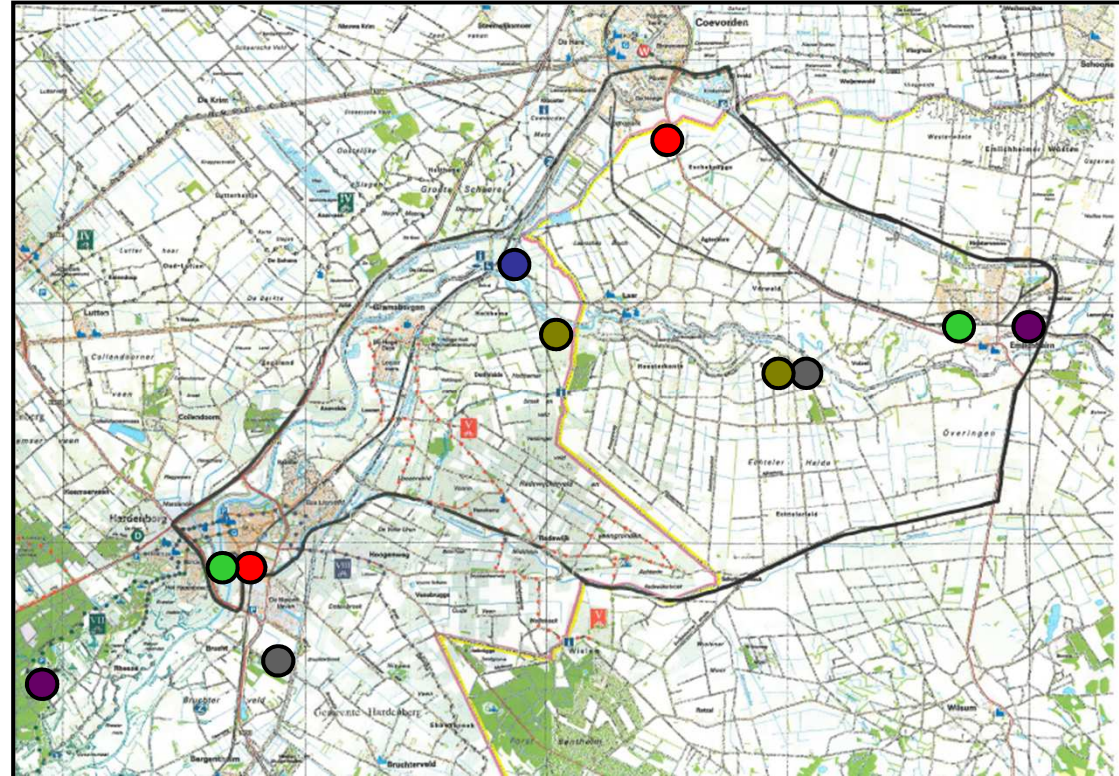
Irrigation water

Recreational service

...

...

...



Local water management

Business / industry

Nature protection

Agriculture

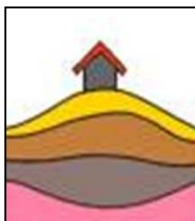
Tourism / leisure

Inhabitants

Deltares

Identification of ecosystem services

Opportunities for development – case study



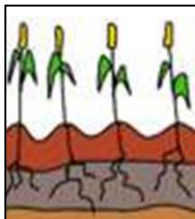
Carrying capacity for buildings



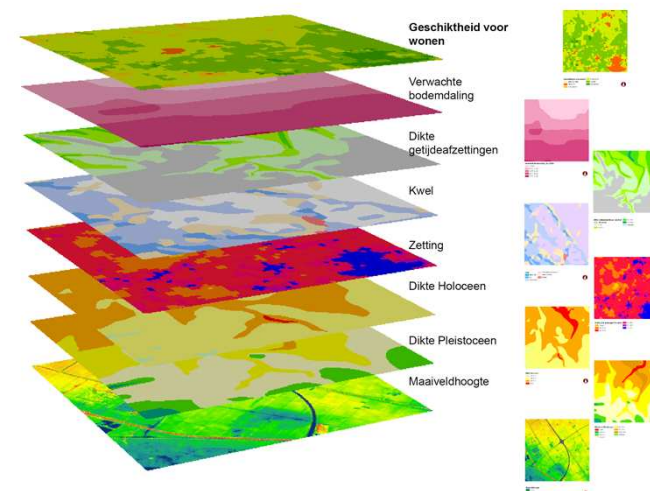
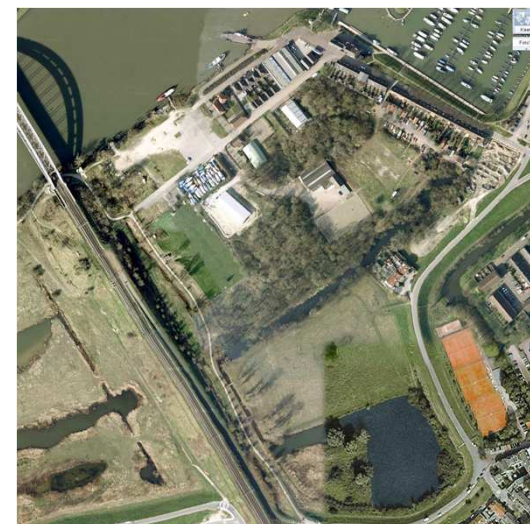
Landscape value



Unpolluted soil



Substrate for flora and fauna

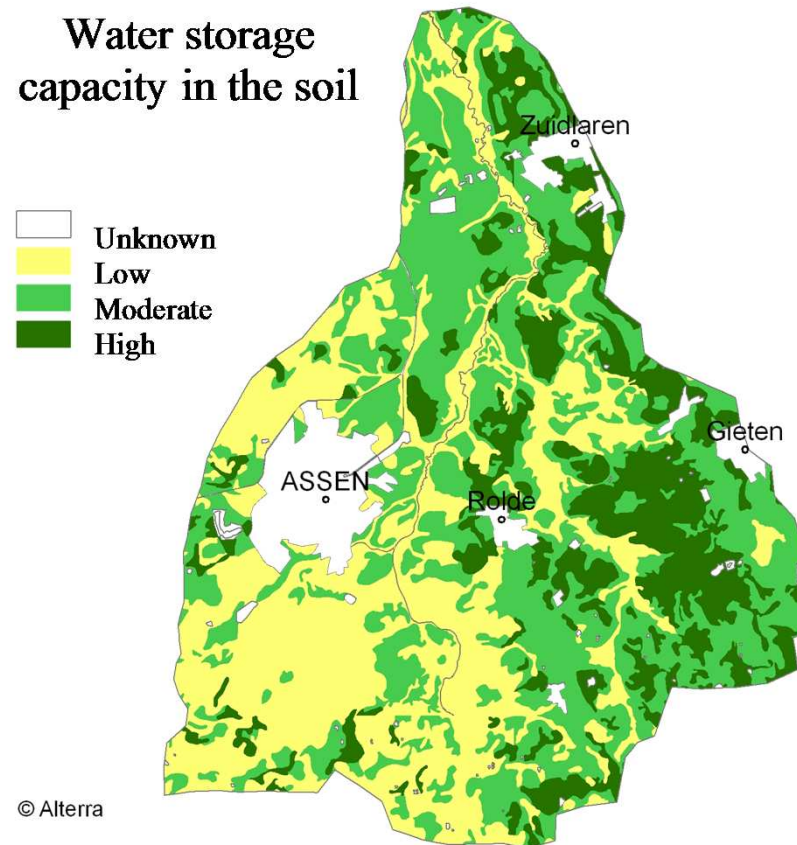
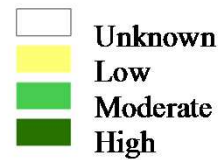


Quantification of ecosystem services

Ecosystem service (ES)	Examples of units for quantification of the ES
Food production	Hectares Tons €
Biofuel crops	Productivity of crop production or potential energy production
Water storage	Classes ¹ : low /medium / high storage capacity; infiltration rate and maximum capacity
Natural attenuation of groundwater contamination	Classes ² : potential for natural attenuation
Pest and disease control in agriculture	Classes
Aquifer Thermal Energy Storage	Suitability classes; (Giga)Joules/m ² /year or kWh/m ² /year
Drinking water	Capacity m ³
Climate regulation	Sequestration rate Kg/ha/yr
Geoheritage and archeology	Change on archeological findings or valuable geoheritage sites (map)

Mapping ecosystem services

Water storage capacity in the soil



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Value of ecosystem services

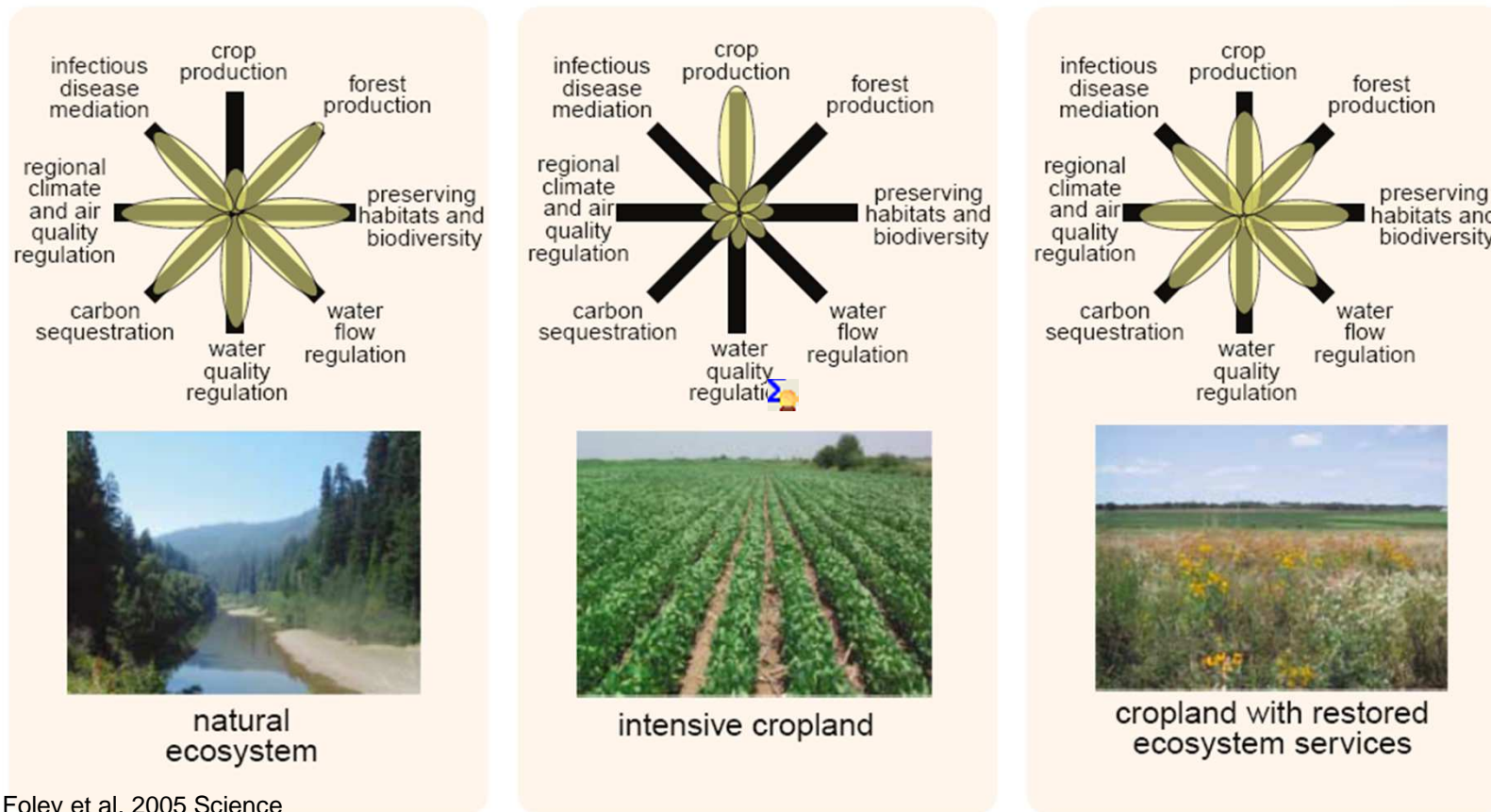
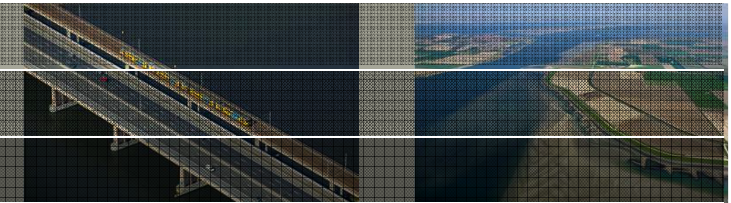
Different levels of valuation of ecosystem services

Stakeholder valuation

Societal value of ecosystem services

Economic valuation

Developing ambitions



Foley et al. 2005 Science

RBB (referentie biologische bodemkwaliteit: Rutgers *et al.*, 2007; Smeding *et al.*, 2008

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Conclusion

Potential:

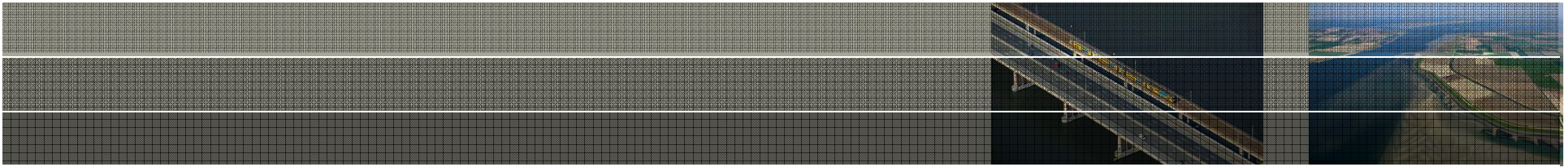
Integral solutions for sustainable development

- Using stakeholder knowledge
- Awareness and support
- Balancing investments and benefits

*Skepticism is decreasing but practical value
should be tested and demonstrated*

Specify application possibilities and added value in specific situations

Work in progress



Thank you

