

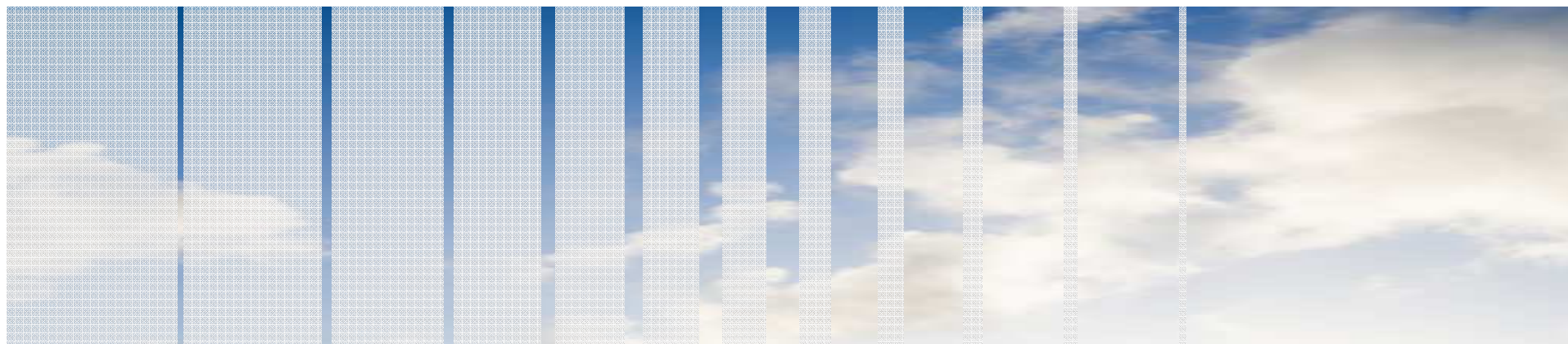


# PBL Netherlands Environmental Assessment Agency

## The ecosystem services concept in policy support

Some experiences from the Netherlands

Rob Alkemade



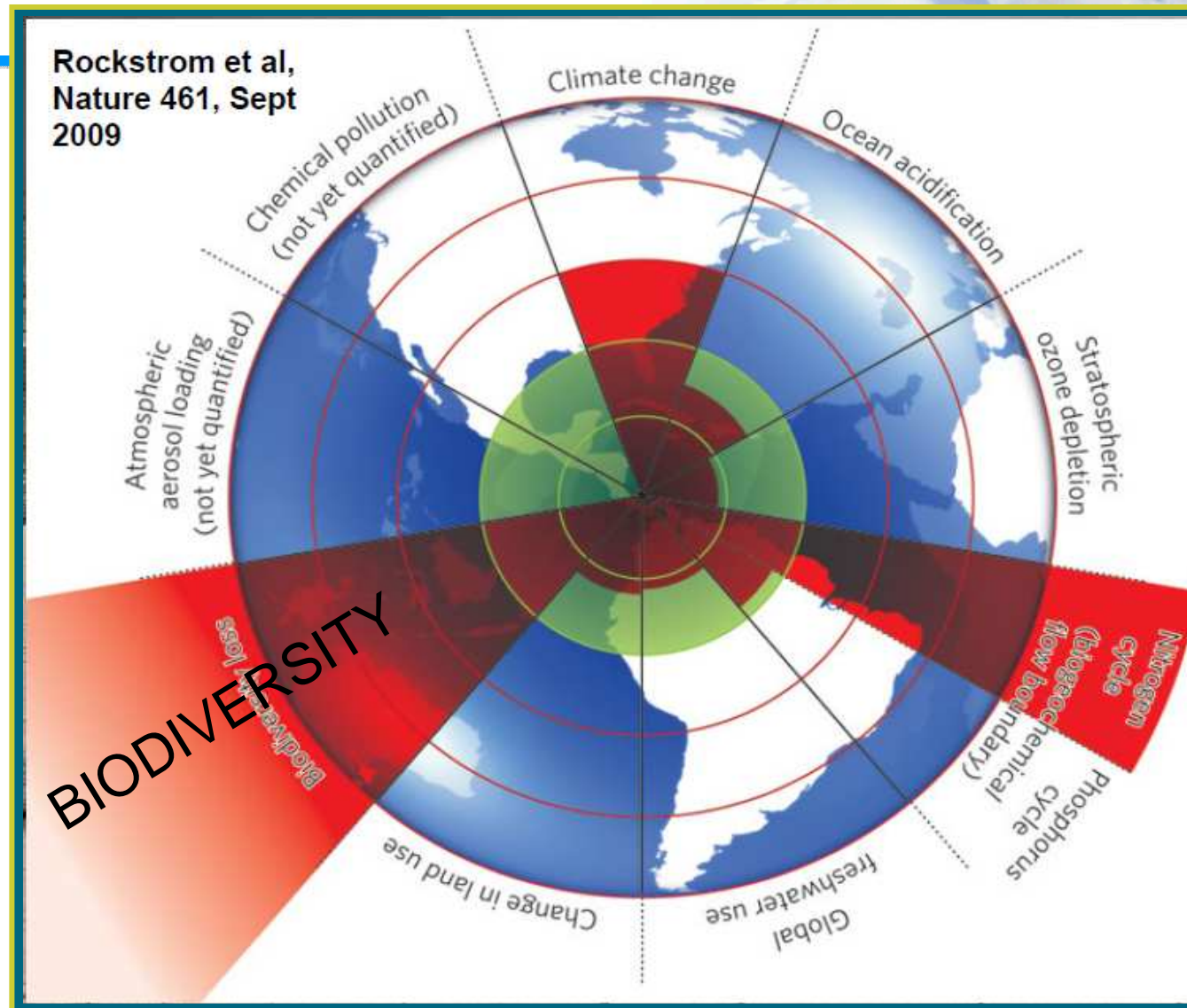
# Overview

2

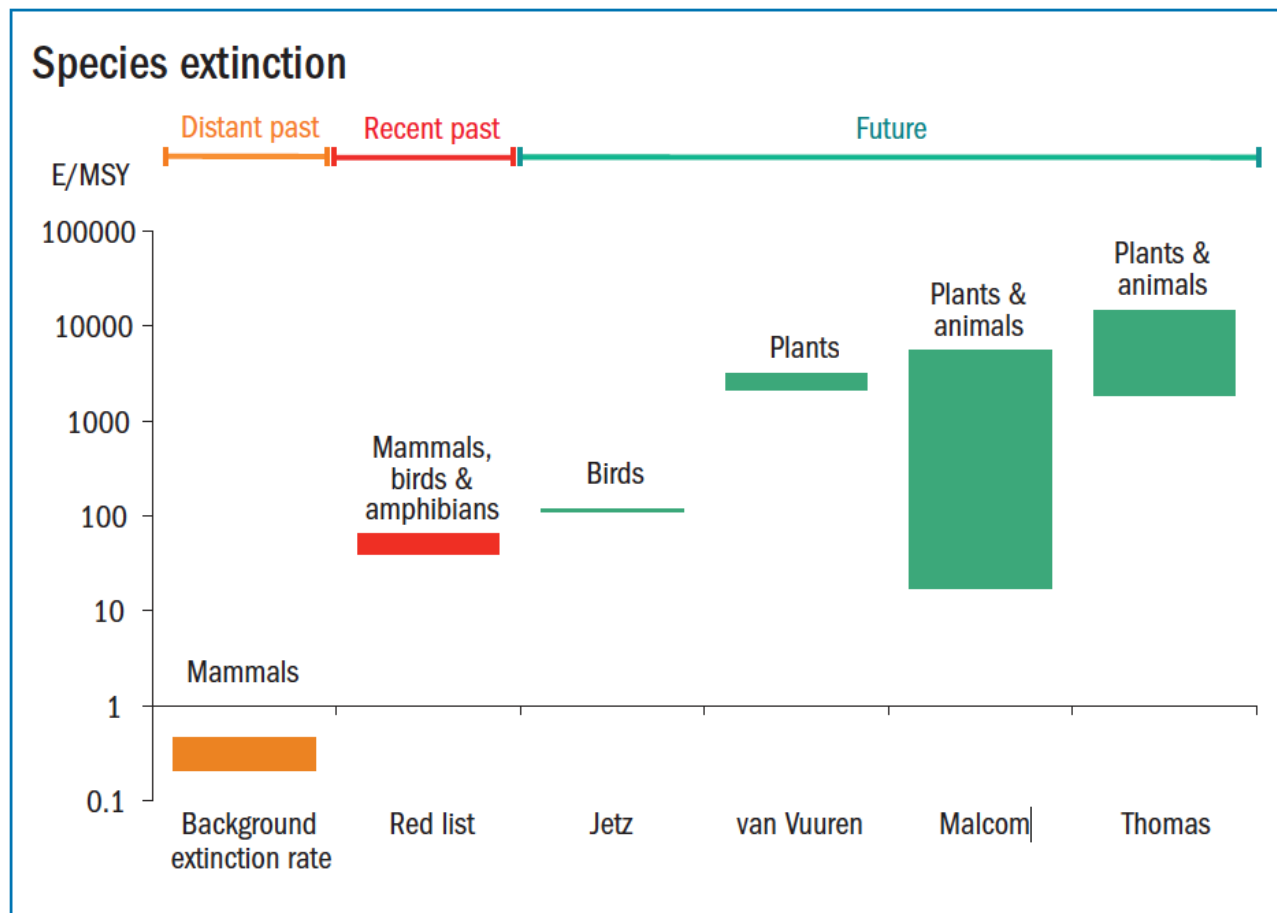
- Biodiversity and ecosystem services
- Classification, Indicators, quantification and modelling
- Economic significance of ecosystem services
- Ecosystem services in policy making

# BOUNDARIES: A safe operating space for humanity

3

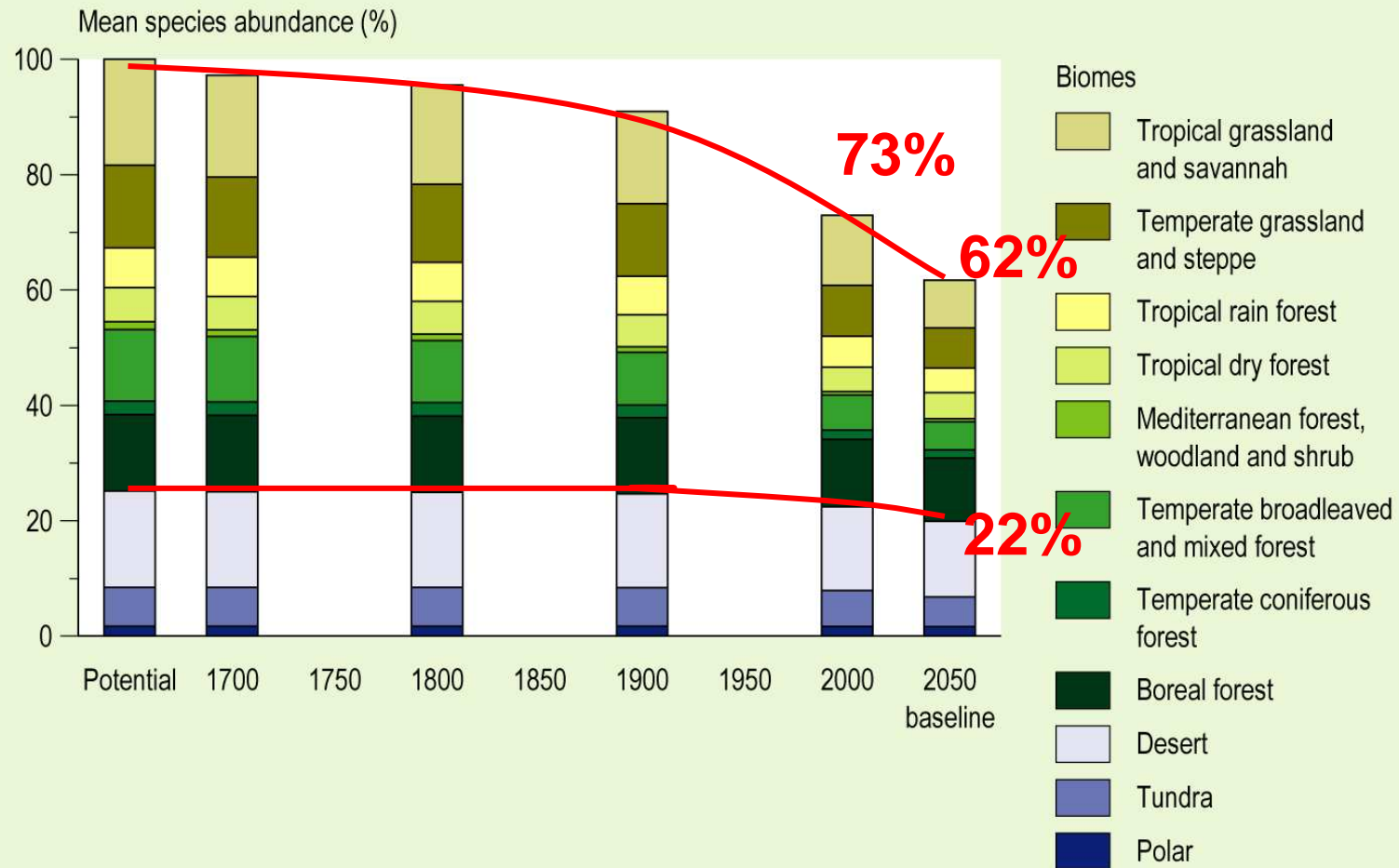


## SPECIES EXTINCTIONS





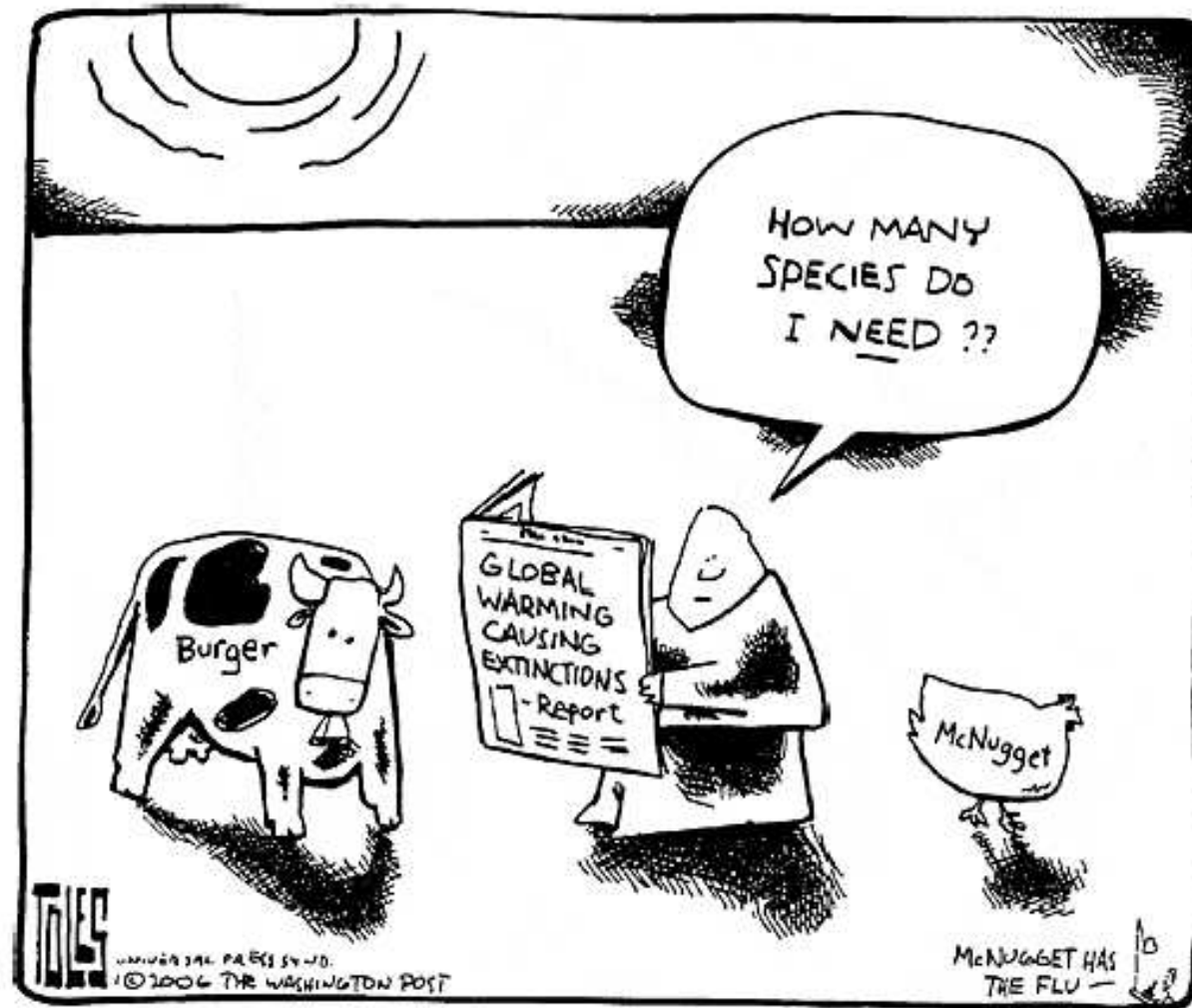
## Historic and future development of global biodiversity



Ten Brink et al., 2007

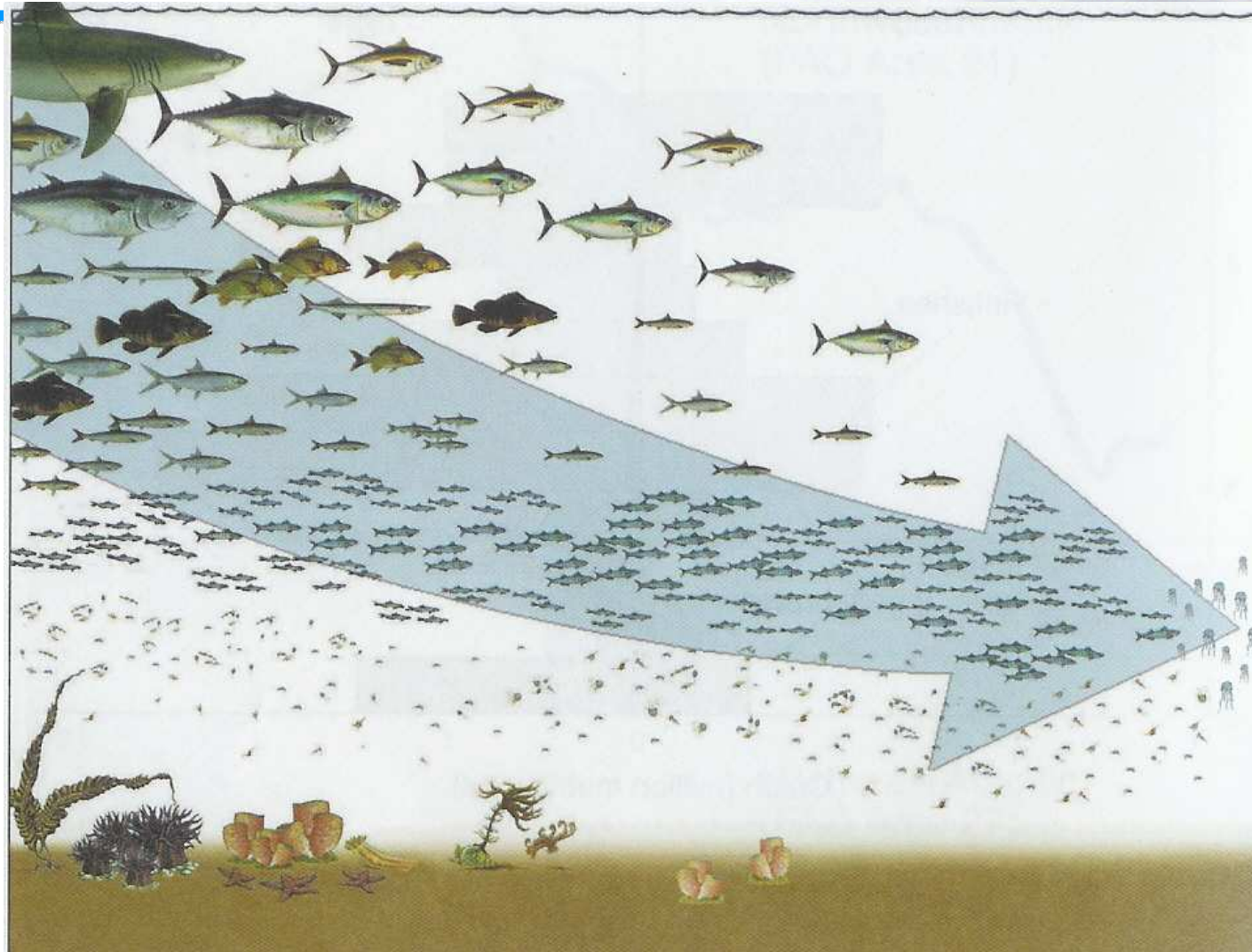
# What good is biodiversity anyway?

6



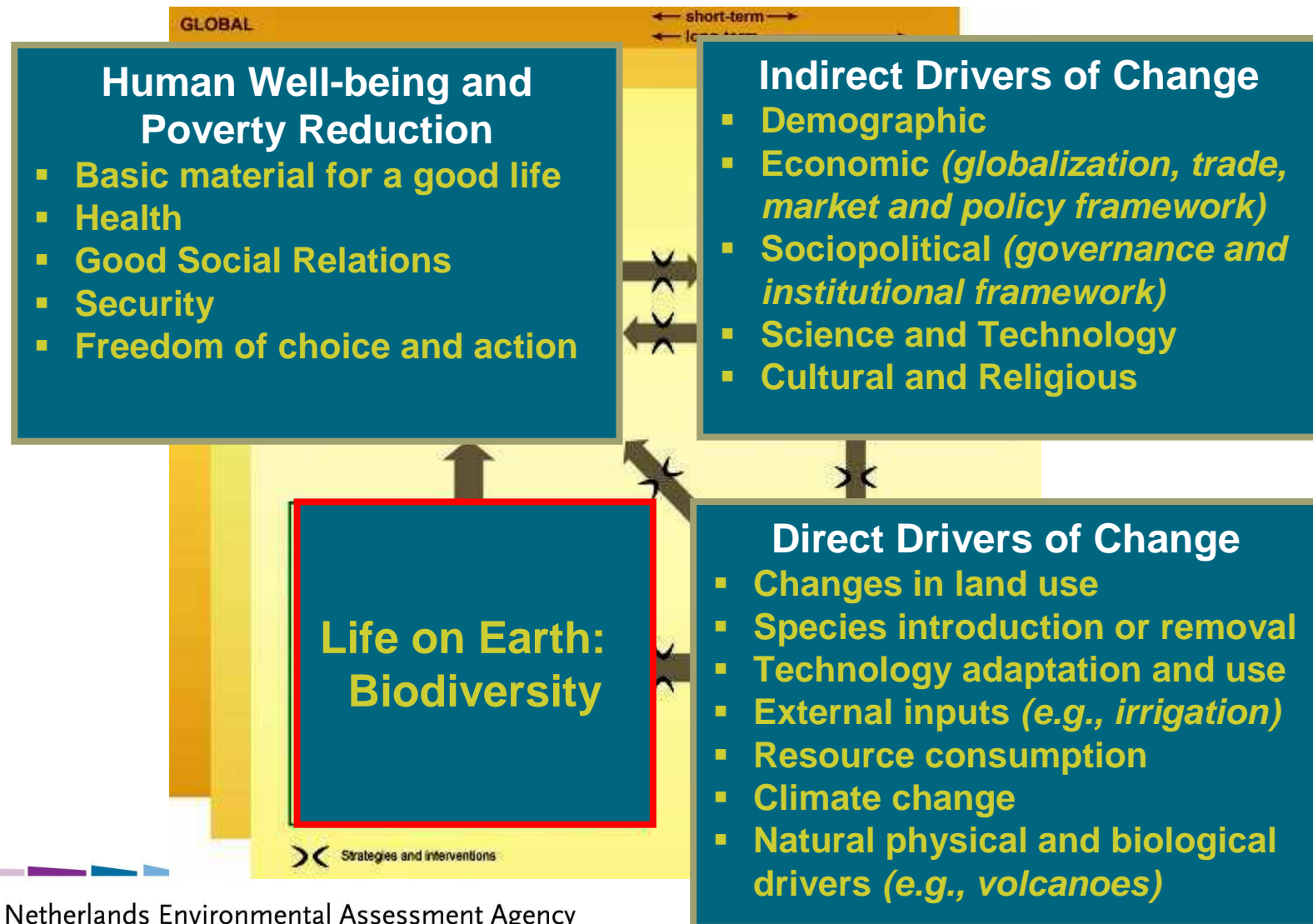
# Man's Impacts on Marine Ecosystems

7



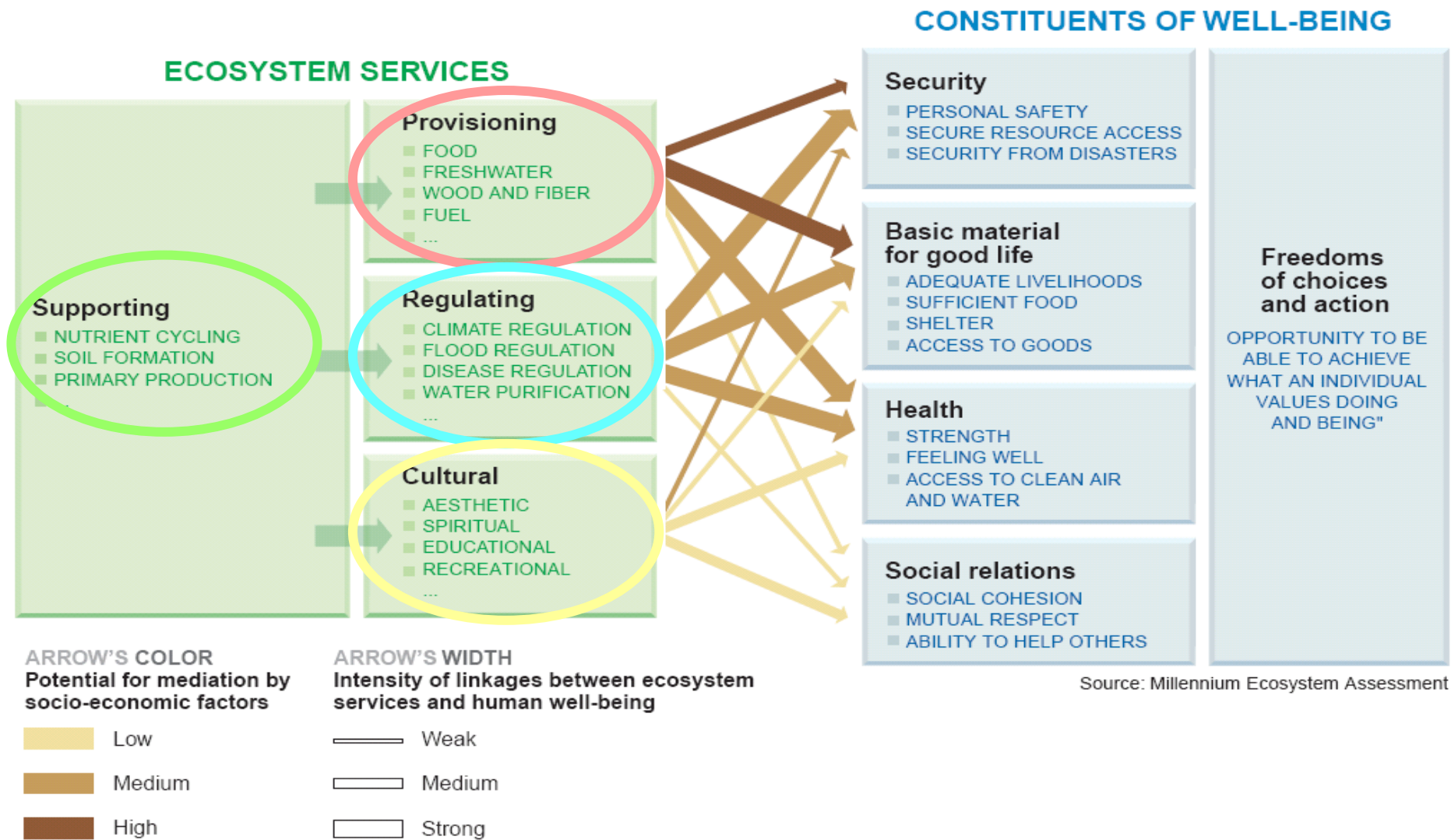
# Millennium Ecosystem Assessment

8



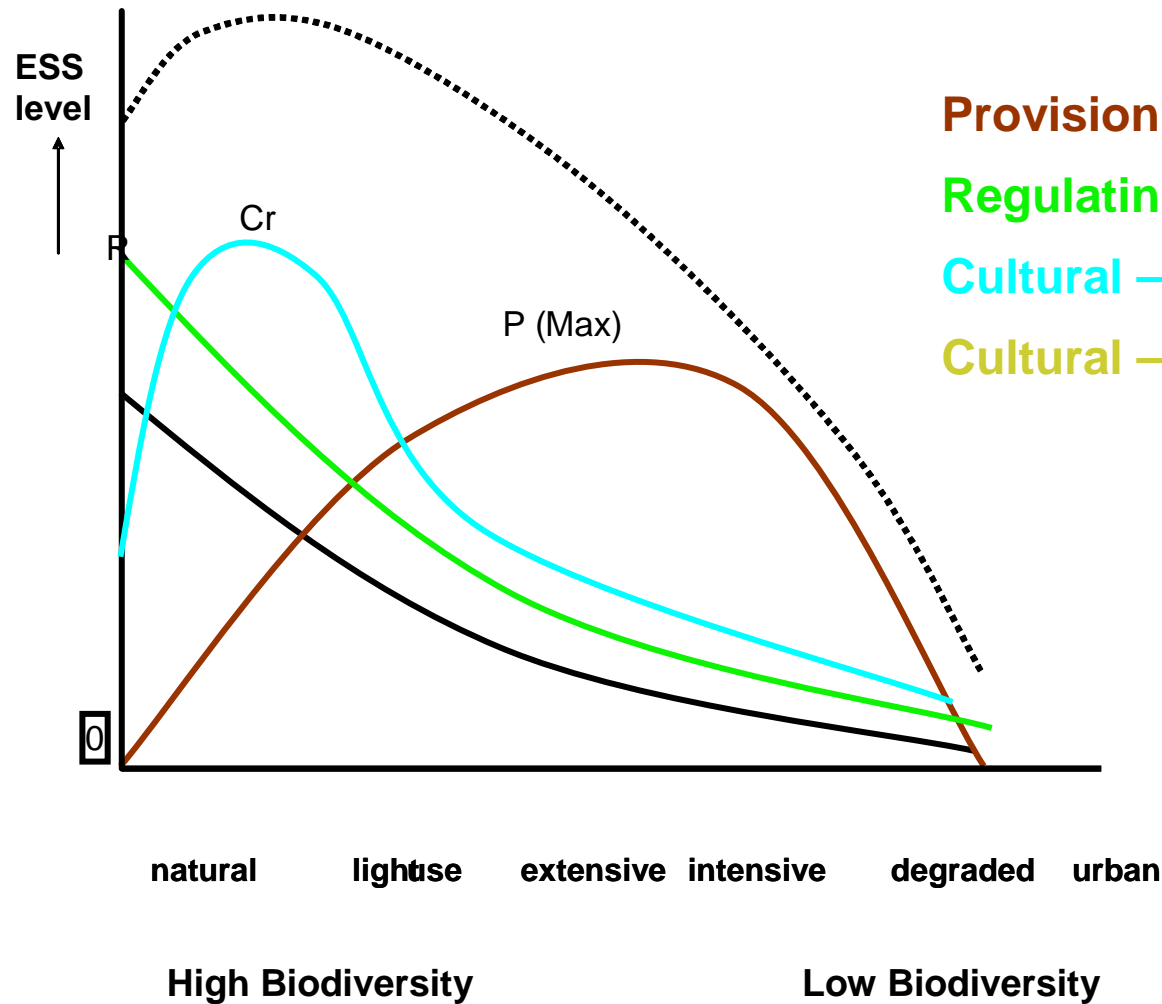


# Millennium Ecosystem Assessment 2005



# Biodiversity & Ecosystem Services

10



**Provisioning services (P):**

**Regulating services (R):**

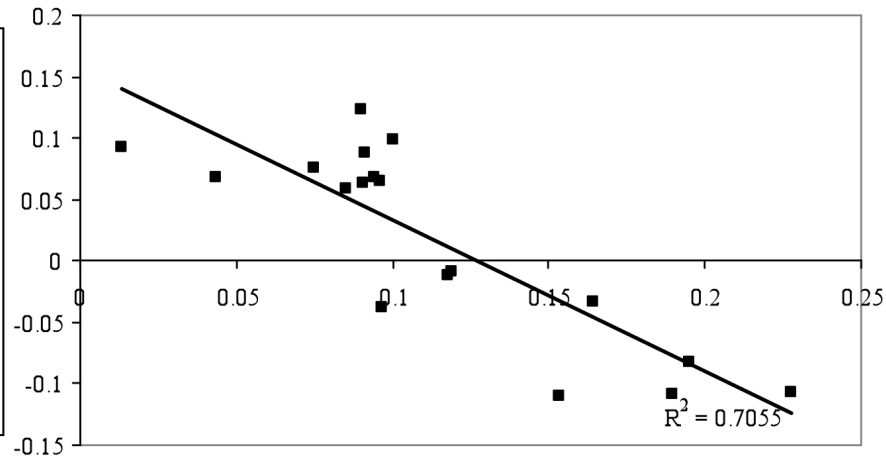
**Cultural – recreation services (Cr):**

**Cultural – Information services (Ci):**

# LINKS BETWEEN BIODIVERSITY & ECOSYSTEM SERVICES

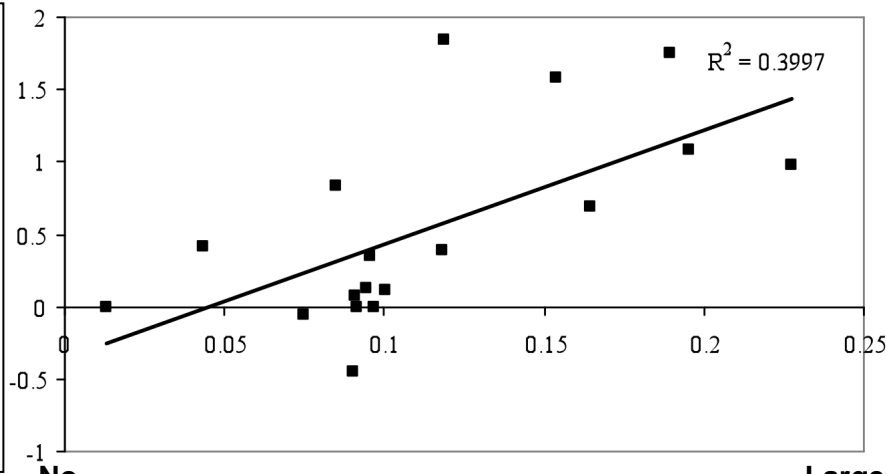
Regulating Service

Change in C Storage  
(2000-2050)



Provisioning Service

Change in Agricultural  
Productivity (2000-2050)



No  
Change

Decline in Species Abundance  
(2000-2050)

Large  
Decline

PBL Ne

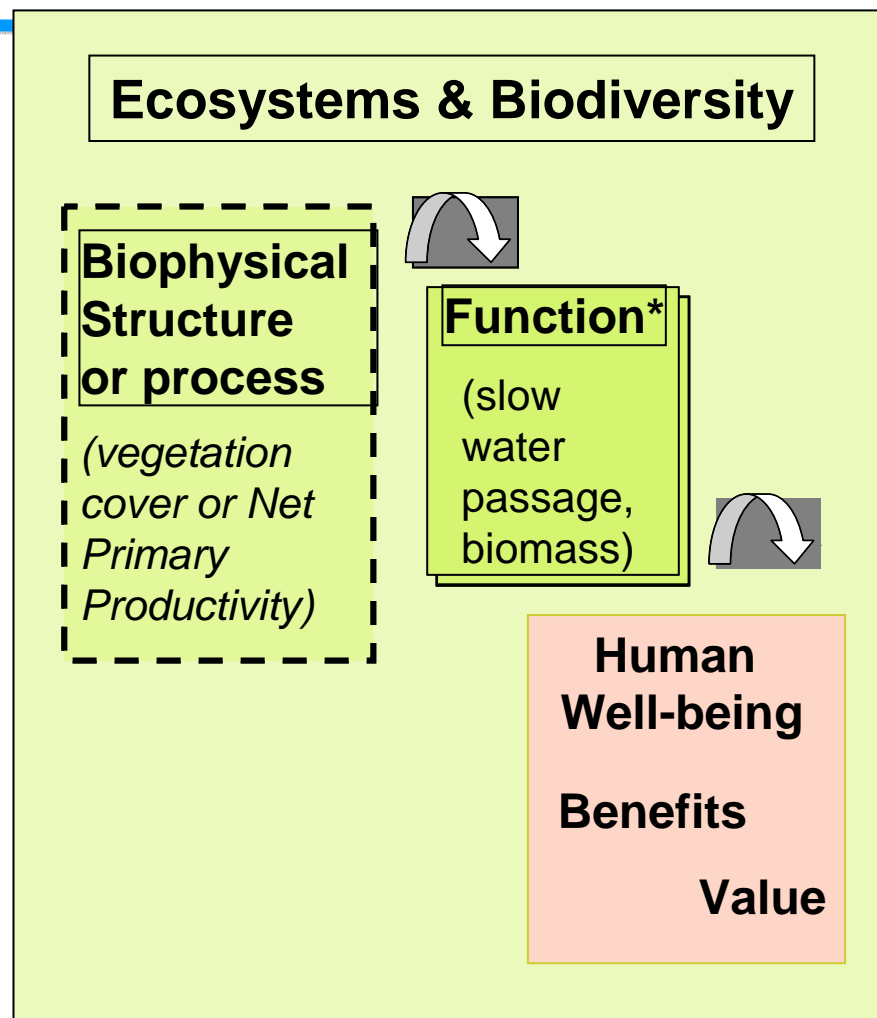
A growing number of studies indicate that:

- Provisioning services and biodiversity conservation are often at odds
- Win-win situations occur much more often when considering regulating services and biodiversity.

*Figure: New analysis of 18 terrestrial regions using the GBOBIO3 and IMAGE Models (GBO3: Leadley et al. 2010)*

# 10.000 years ago ....

12

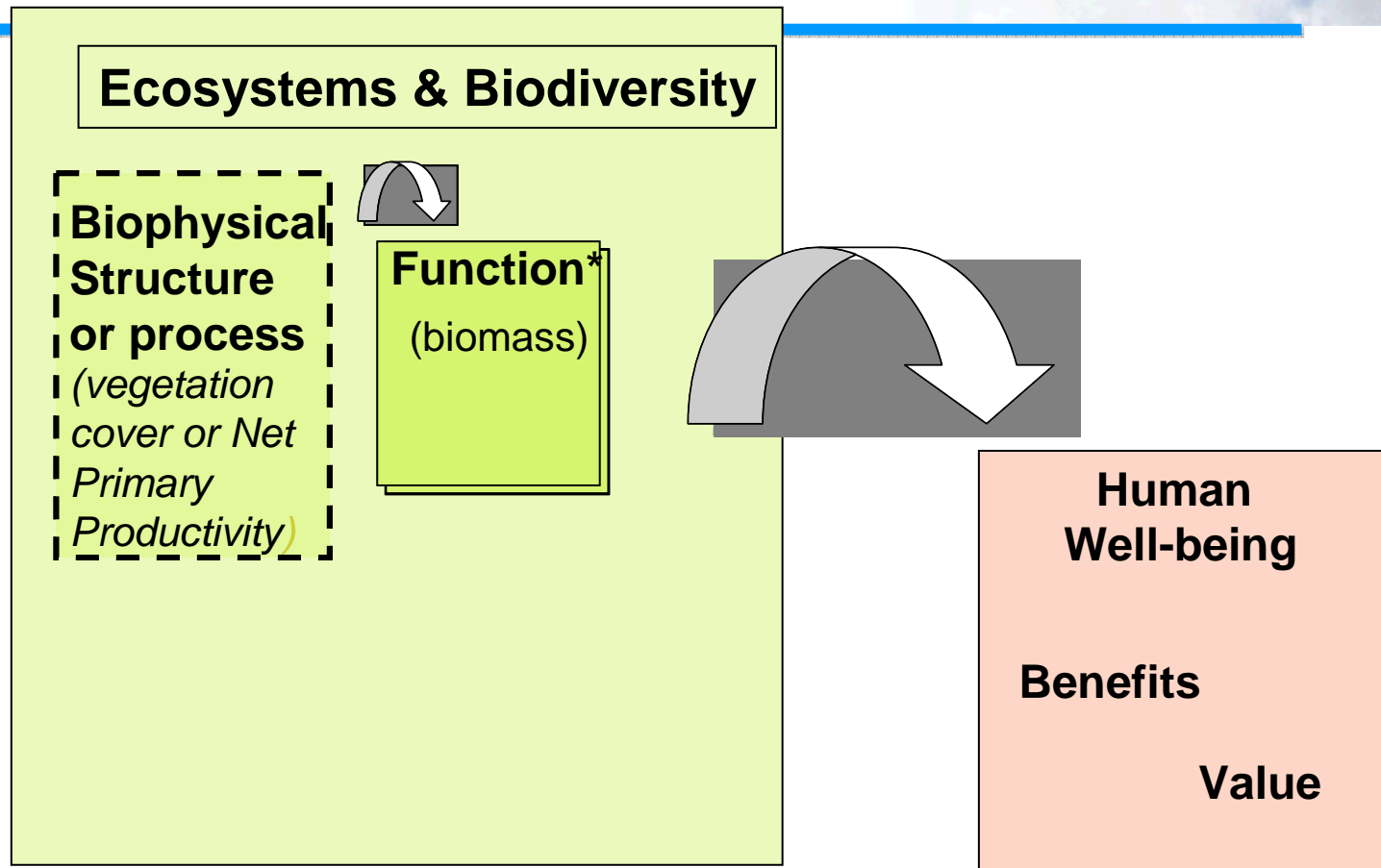


Adapted from Haines-Young & Potschin, 2009



6.000 years ago ....

13



Adapted from Haines-Young & Potschin, 2009

# The Present ....

## Ecosystems & Biodiversity

**Biophysical  
Structure  
or process**

(vegetation  
cover or Net  
Primary  
Productivity)

**Function\***

(slow  
water  
passage,  
biomass)

**Service**

( flood-  
protection,  
timber

## Human Well-being

**Benefits**

(contribution  
to health,  
safety)

**(econ) Value**

(appreciation,  
willingness to  
pay

**Pressures**

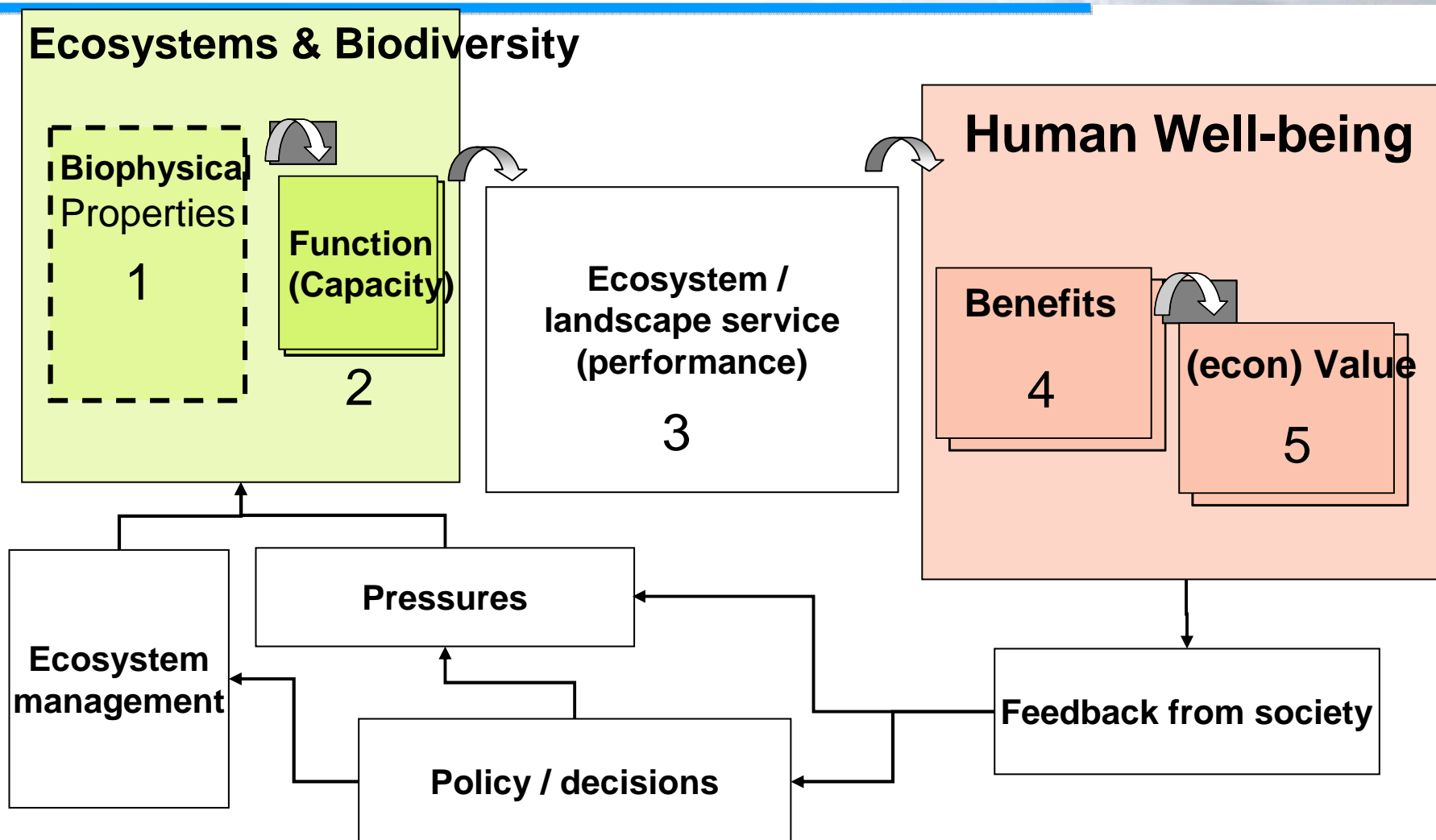
**Ecosystem Services are the  
contributions of ecosystems  
to human wellbeing**

14

Adapted from Haines-Young & Potschin, 2009

# TEEB framework

15



From: van Oudenhoven & Petz (in prep.)  
Adapted from Haines-Young & Potschin, 2009

# Indicators at different levels

16

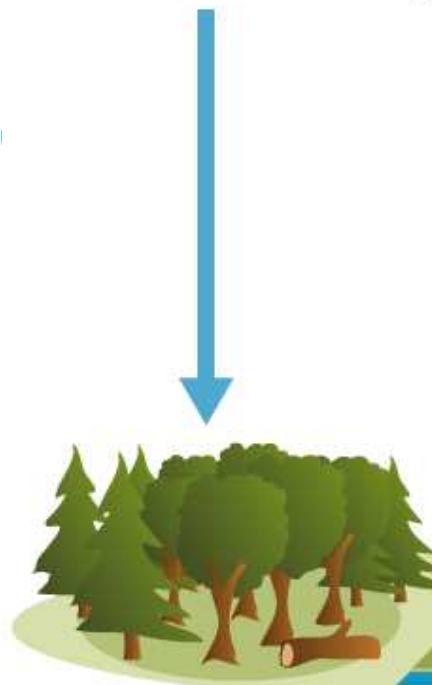
<b><i>Ecosystem Service</i></b>	<b><i>Carbon sequestration</i></b>	<b><i>Biological control</i></b>
<b><i>1.Ecosystem Properties</i></b>	Land cover (vegetation type)	Coverage of green elements (tree-lines, hedgerows, ditches)
<b><i>2. Landscape / Ecosystem Function (Capacity )</i></b>	Potential carbon sequestration (tC / ha / yr)	Distance between elements and arable land
<b><i>3. Landscape / Ecosystem Service (Performance)</i></b>	Net carbon sequestered (uptake, decay) (tC/ha/yr)	Arable land that actually benefits
<b><i>4. Benefit</i></b>	Climate change reduction	Avoided pesticide use
<b><i>5. Economic value</i></b>	Subsidies / carbon trade	Lower costs



Koolstofvastlegging bos

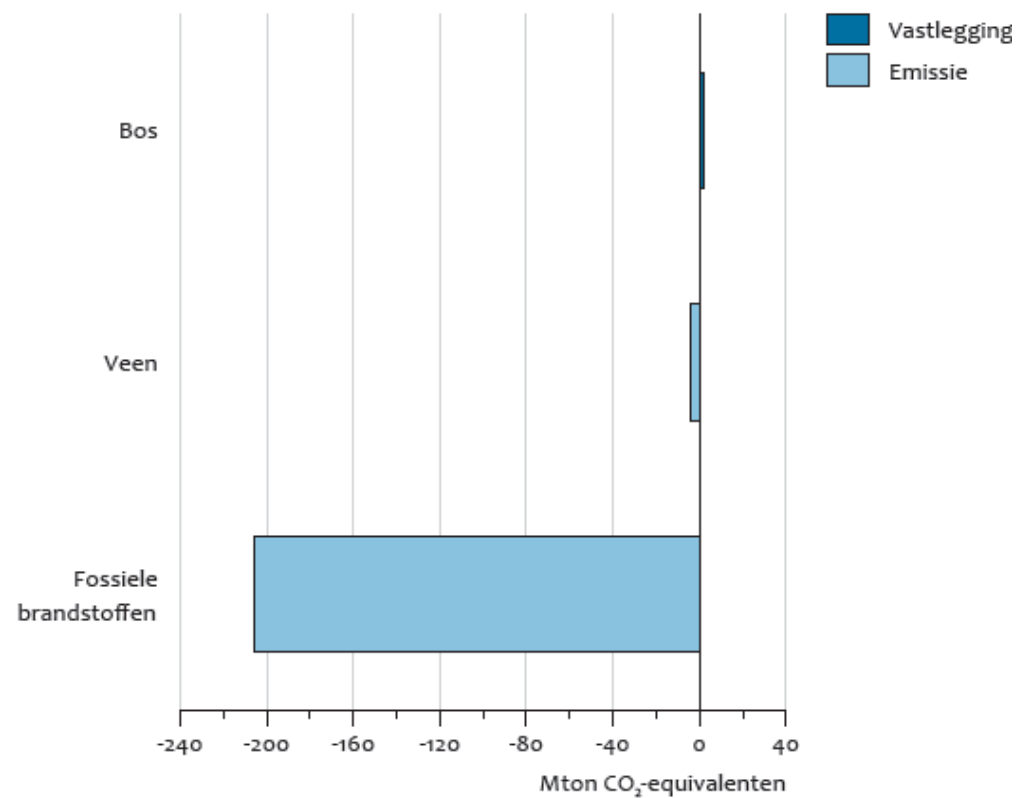
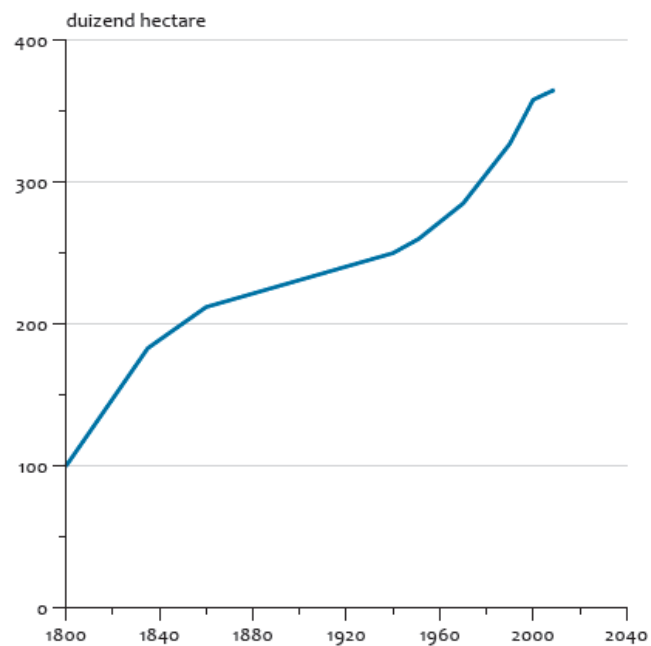
CO<sub>2</sub>-emissie  
veengronden

CO<sub>2</sub>-emissie fossiele brandstoffen



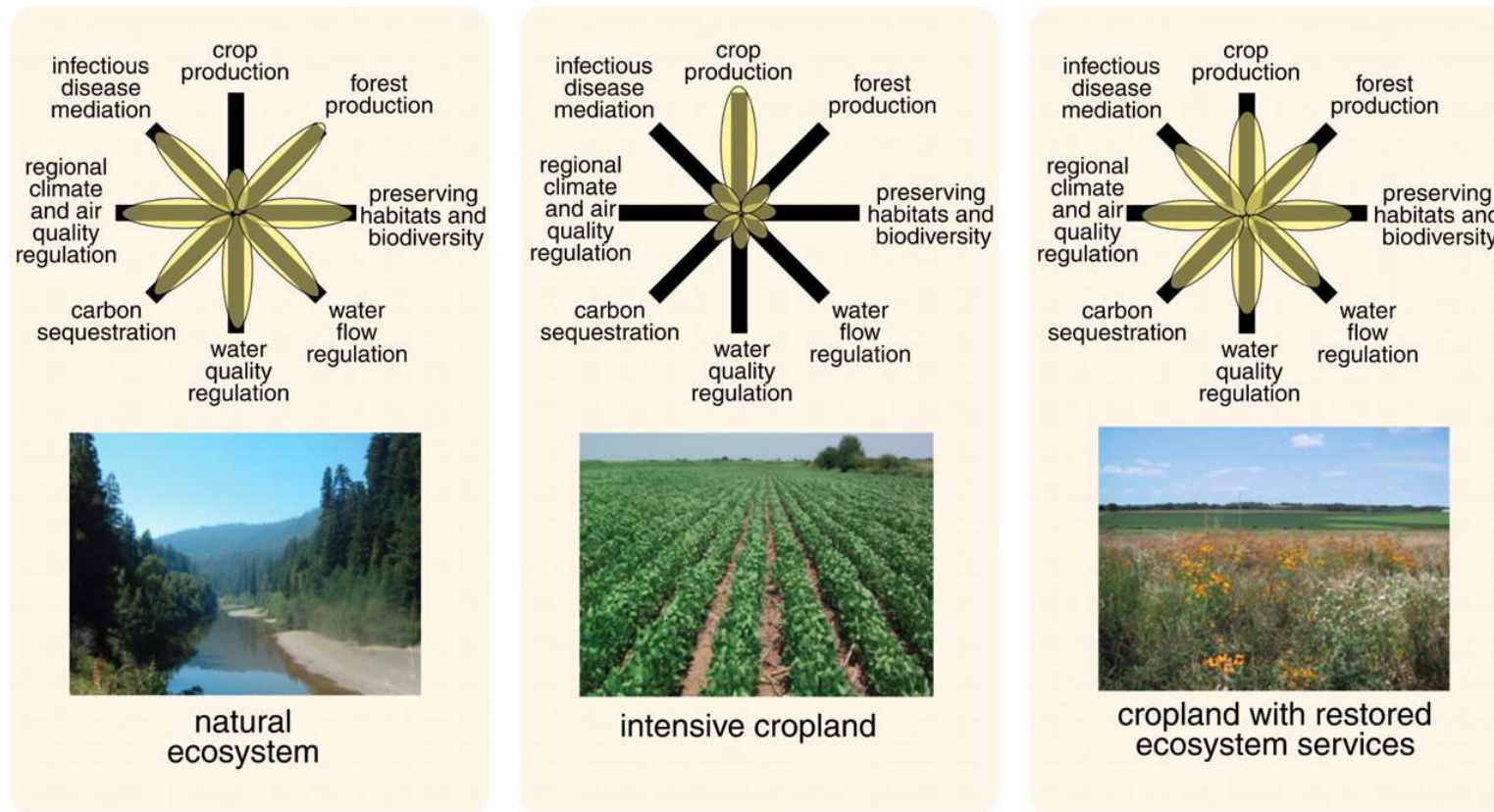
### Koolstofvastlegging en CO<sub>2</sub>-emissie, 2008

De hoeveelheid CO<sub>2</sub> die  
... id nu  
vast-  
e van  
stoot  
ssen.



# Management and ecosystem services

18



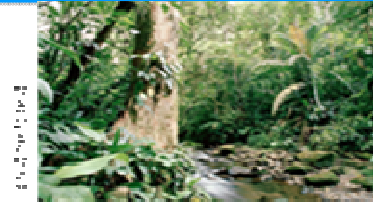
# Biodiversity and management systems

19

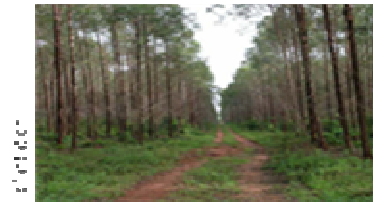
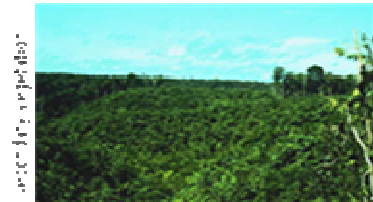
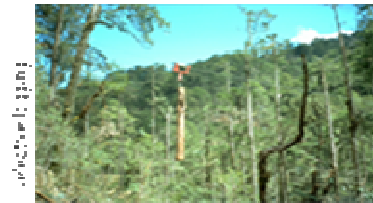
## Forest

## Grassland

Pristine forest



Extensive use



Plantation

Degraded land

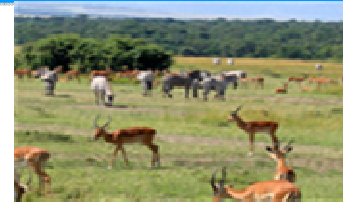


100%

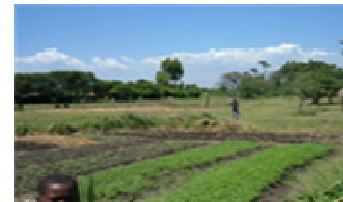
Mean abundance of original species

0%

Original Savannah



Extensive use

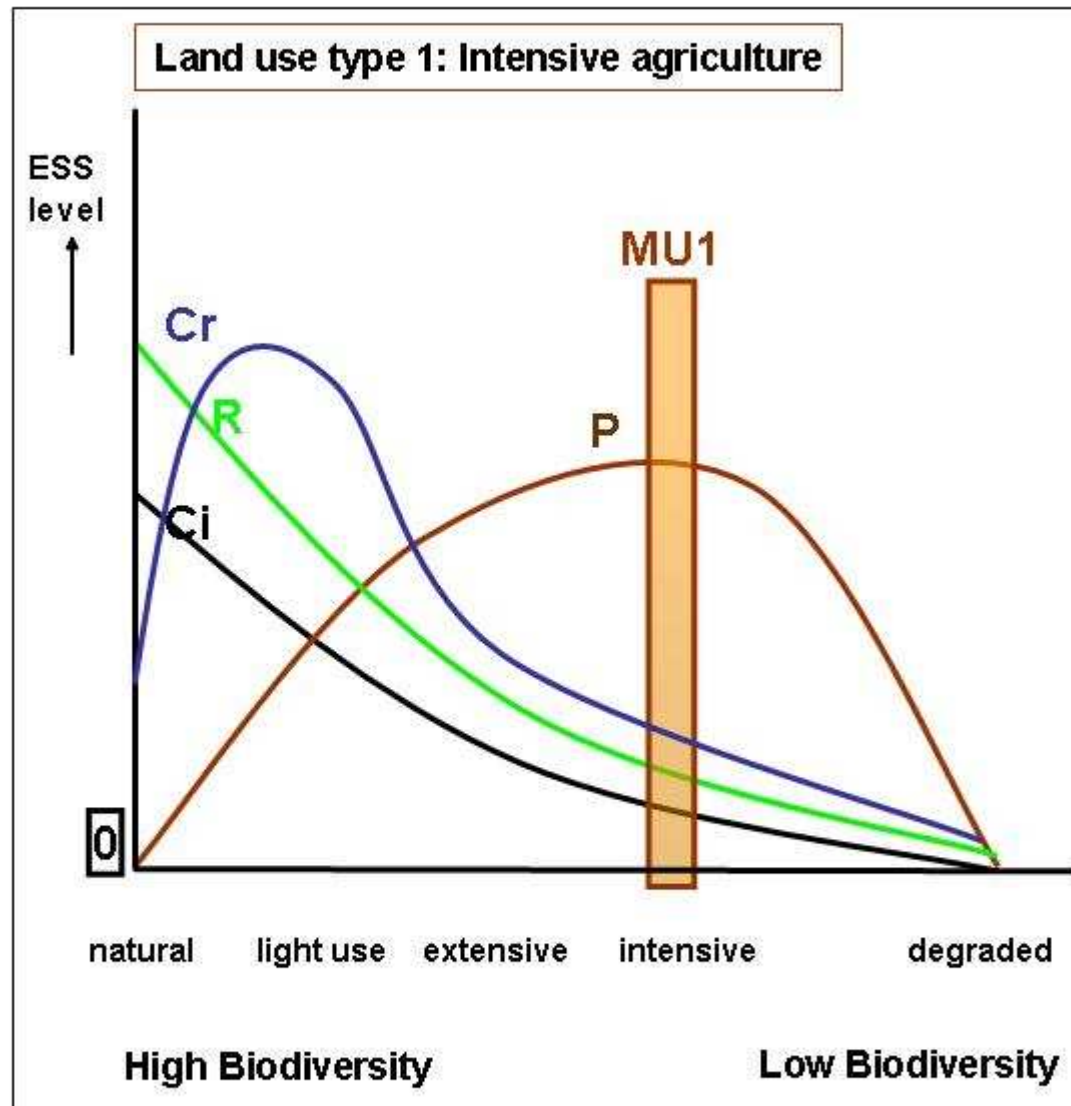


Subsistence agriculture

Intensive agriculture



## MULTIPLE ECOSYSTEM SERVICES WITH DIFFERENT LAND USE



**P = Provisioning services**  
**R = Regulating services**  
**Cr = Cultural (recreation) services**  
**Ci = Cultural (information) services**

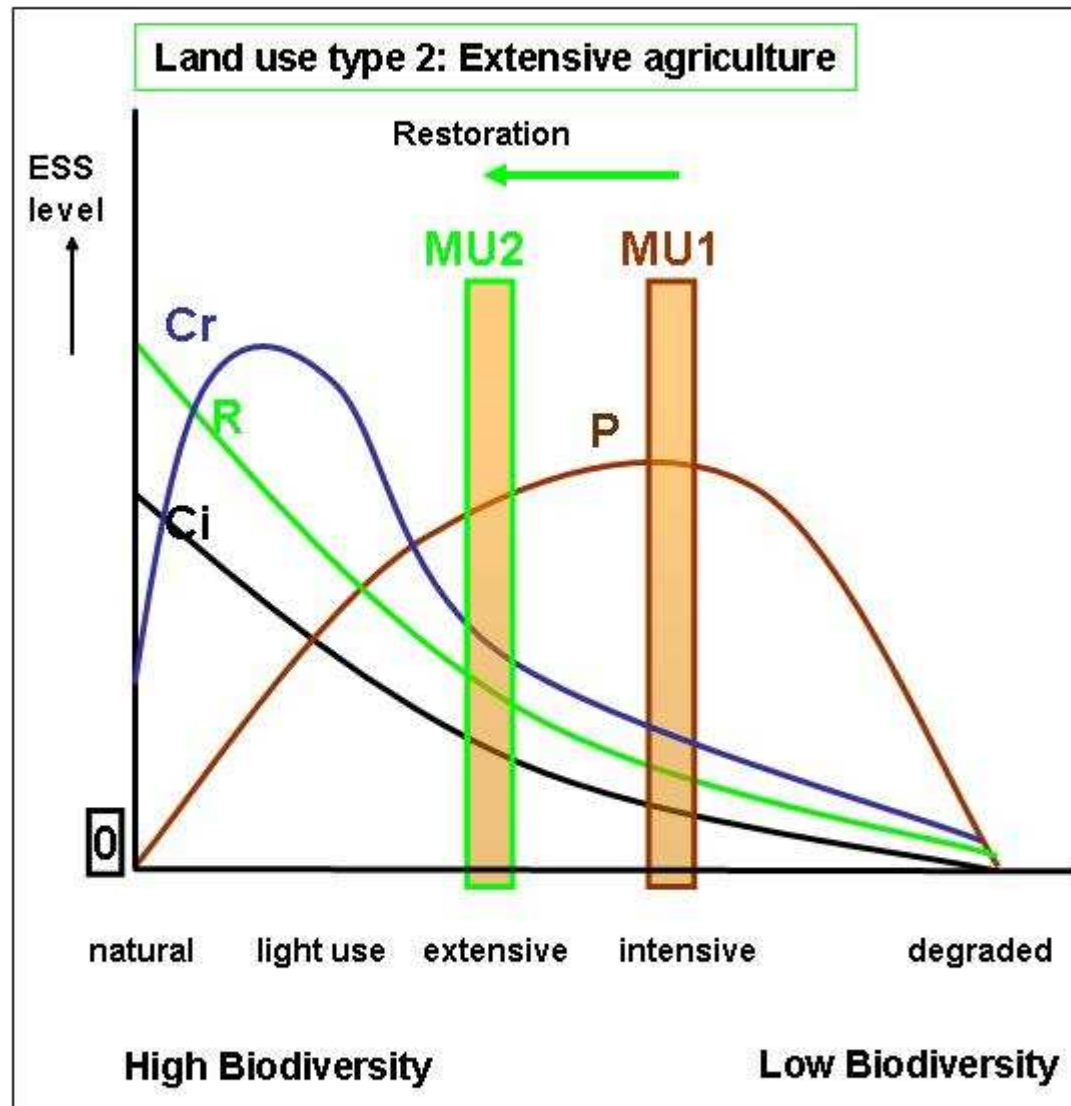
 MU = Multiple Services per Land Use type

ESS = Ecosystem Services

Braat, 2010  
(Developed from: Braat & Ten Brink, 2008)



## MULTIPLE ECOSYSTEM SERVICES WITH DIFFERENT LAND USE



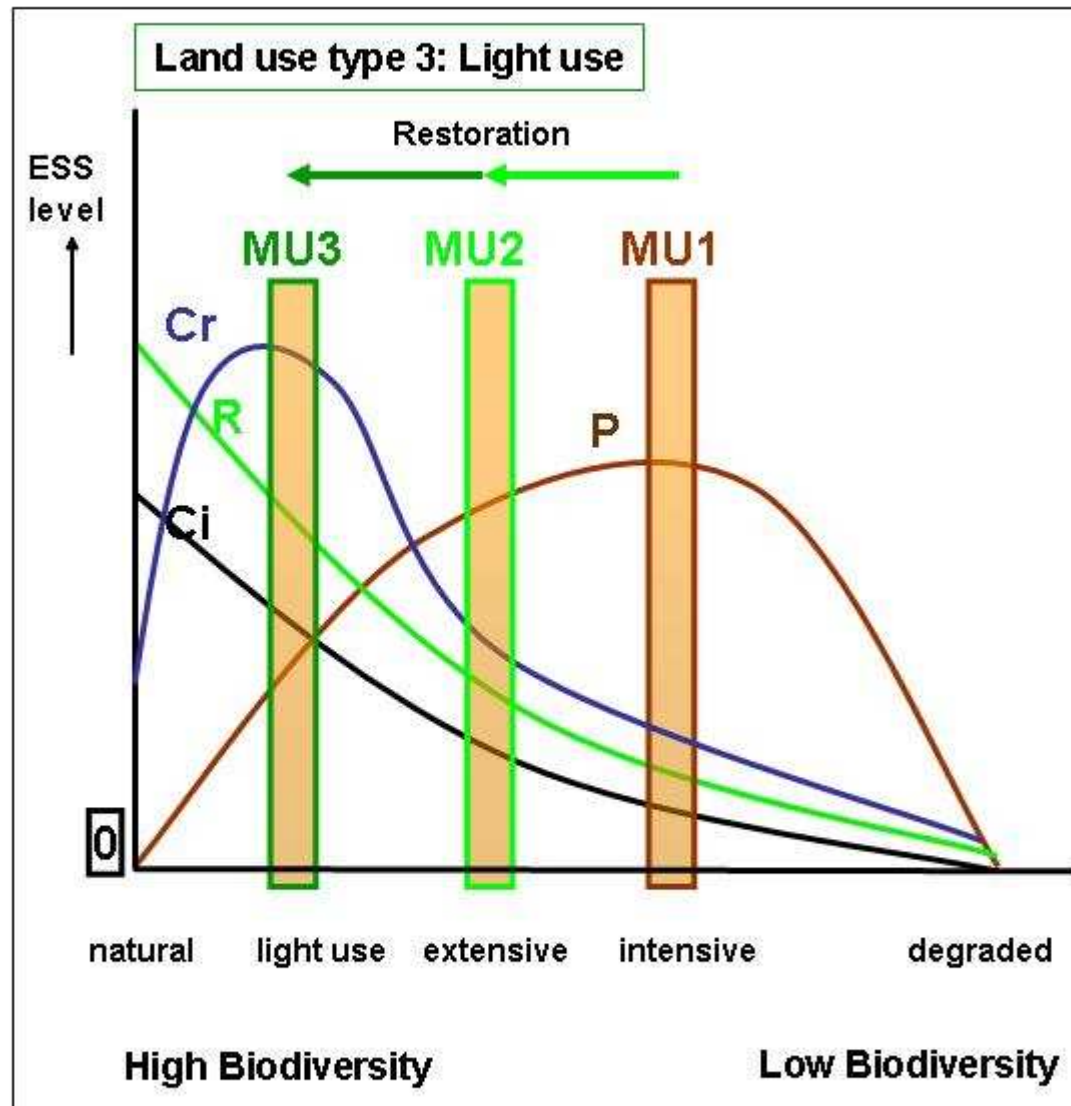
**P = Provisioning services**  
**R = Regulating services**  
**Cr = Cultural (recreation) services**  
**Ci = Cultural (information) services**

**MU = Multiple Services per Land Use type**

ESS = Ecosystem Services

Braat, 2010  
 (Developed from: Braat & Ten Brink, 2008)

## MULTIPLE ECOSYSTEM SERVICES WITH DIFFERENT LAND USE



**P = Provisioning services**

**R = Regulating services**

**Cr = Cultural (recreation) services**

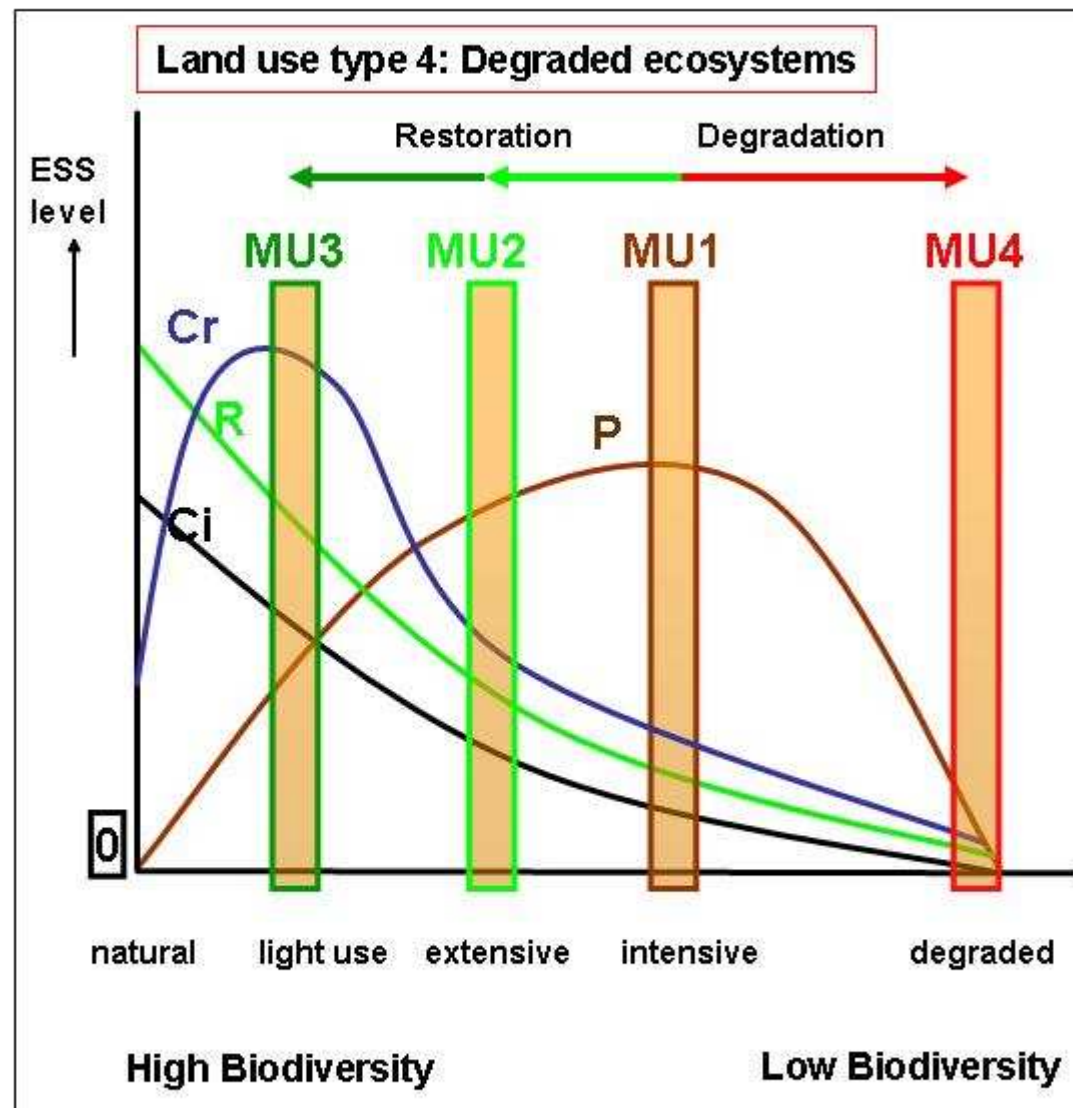
**Ci = Cultural (information) services**

**MU = Multiple Services per Land Use type**

ESS = Ecosystem Services

Braat, 2010  
(Developed from: Braat & Ten Brink, 2008)

## MULTIPLE ECOSYSTEM SERVICES WITH DIFFERENT LAND USE



**P = Provisioning services**

**R = Regulating services**

**Cr = Cultural (recreation) services**

**Ci = Cultural (information) services**



MU = Multiple Services  
per Land Use type

ESS = Ecosystem Services

Braat, 2010

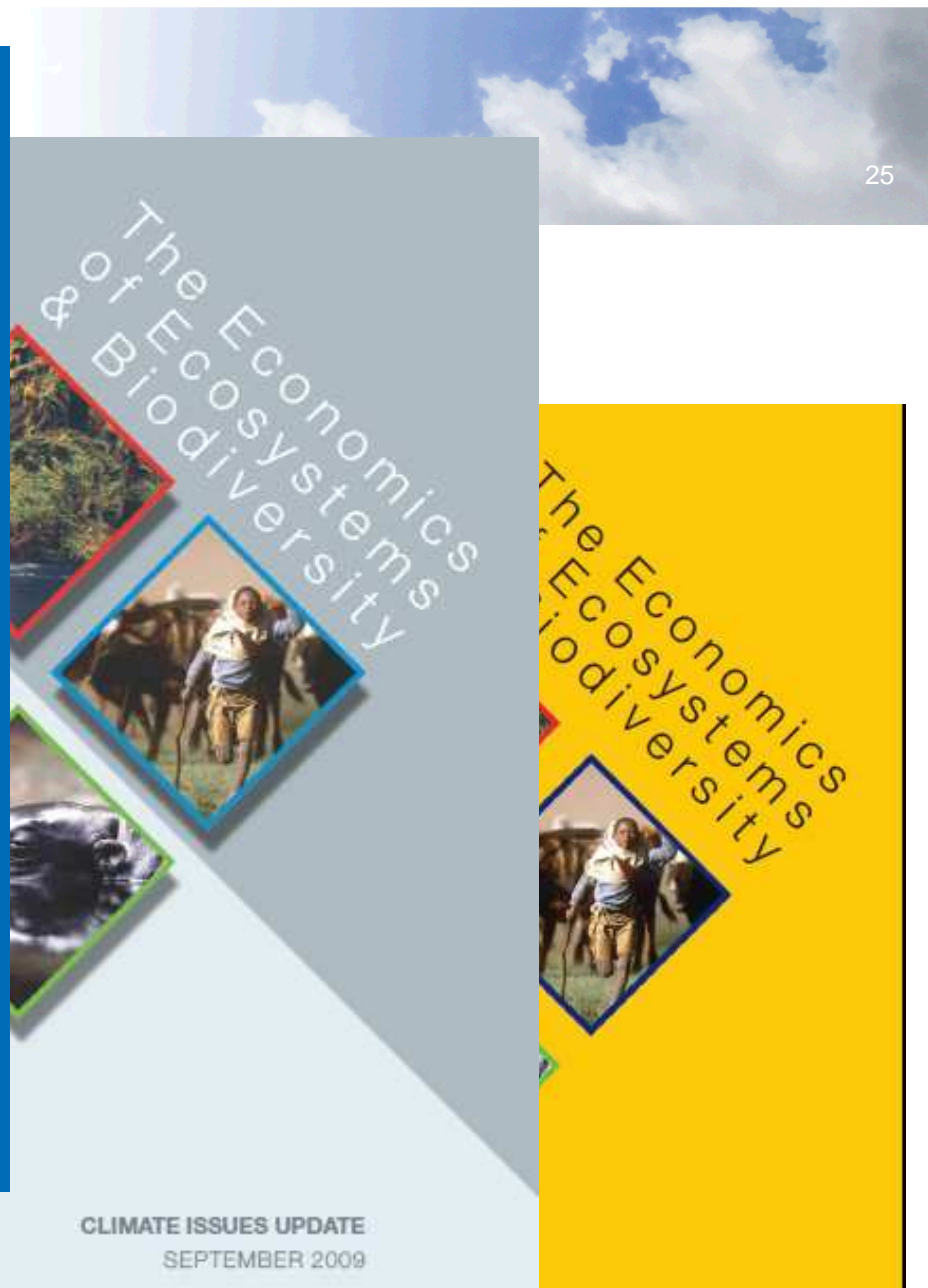
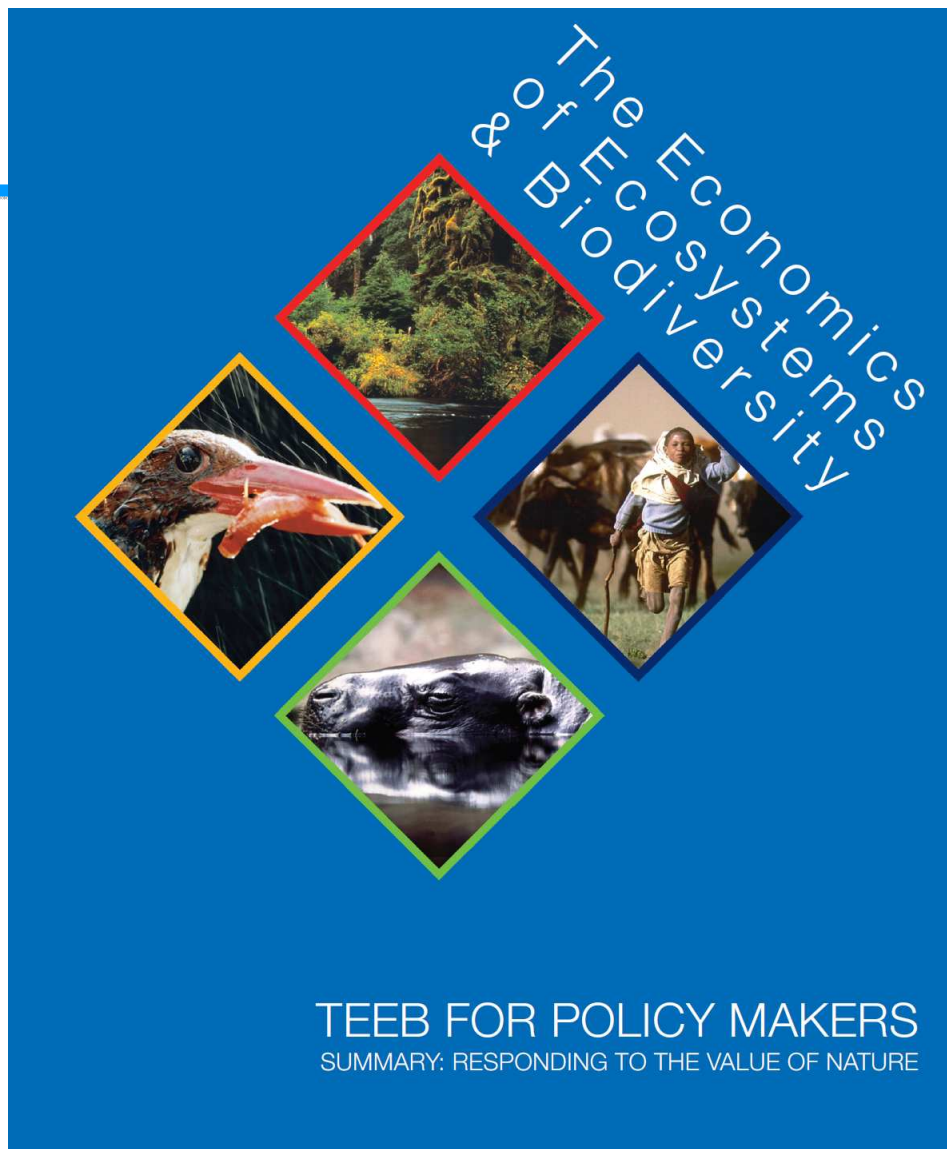
(Developed from: Braat & Ten Brink, 2008)

# Ecosystem services and economy

24

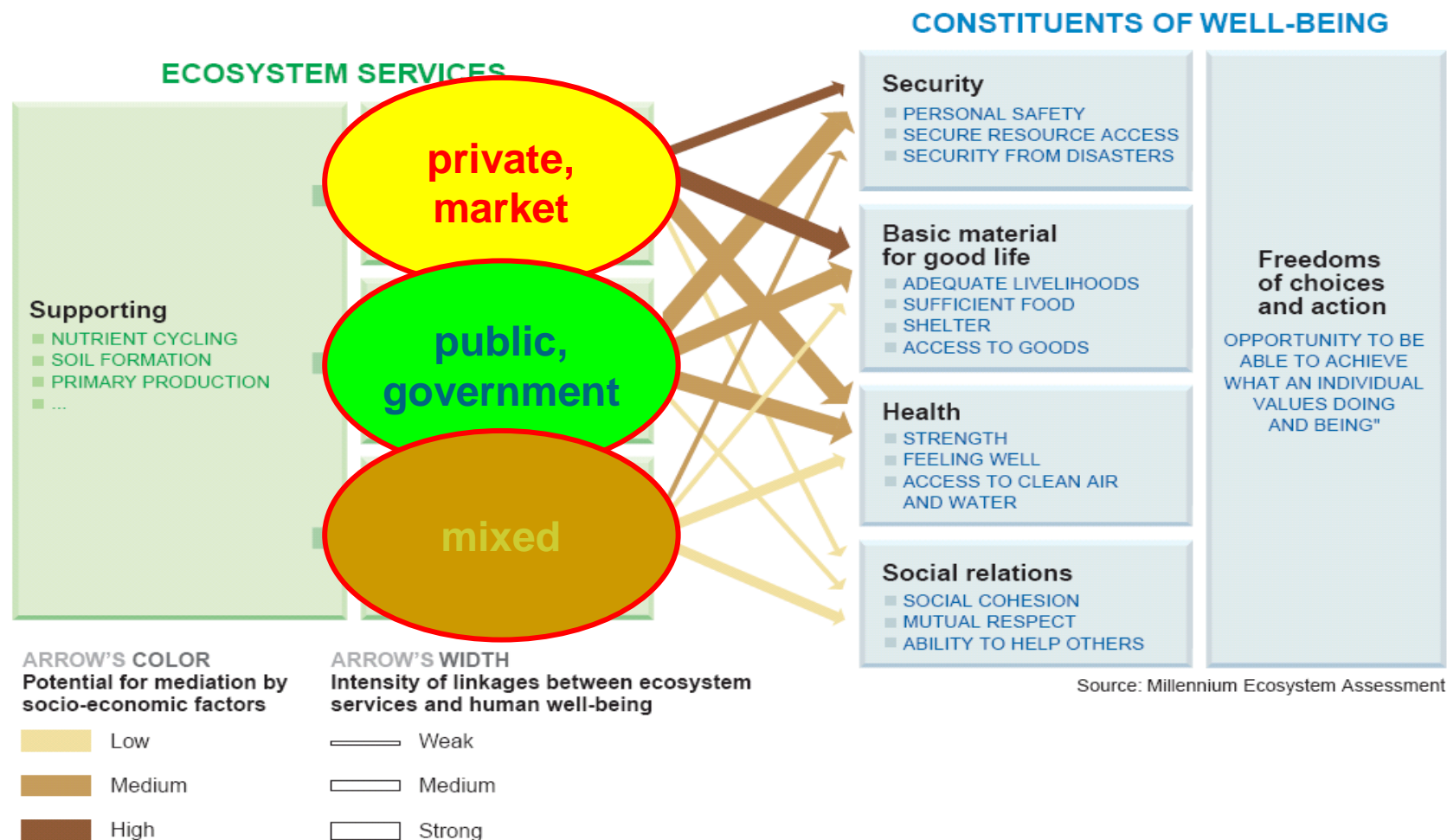
- Not all ES can be produced simultaneously
  - Management system
- ES  $\neq$  biodiversity
- Some ES are marketable
- Some are public goods
- Production of ES does not always benefit the producer





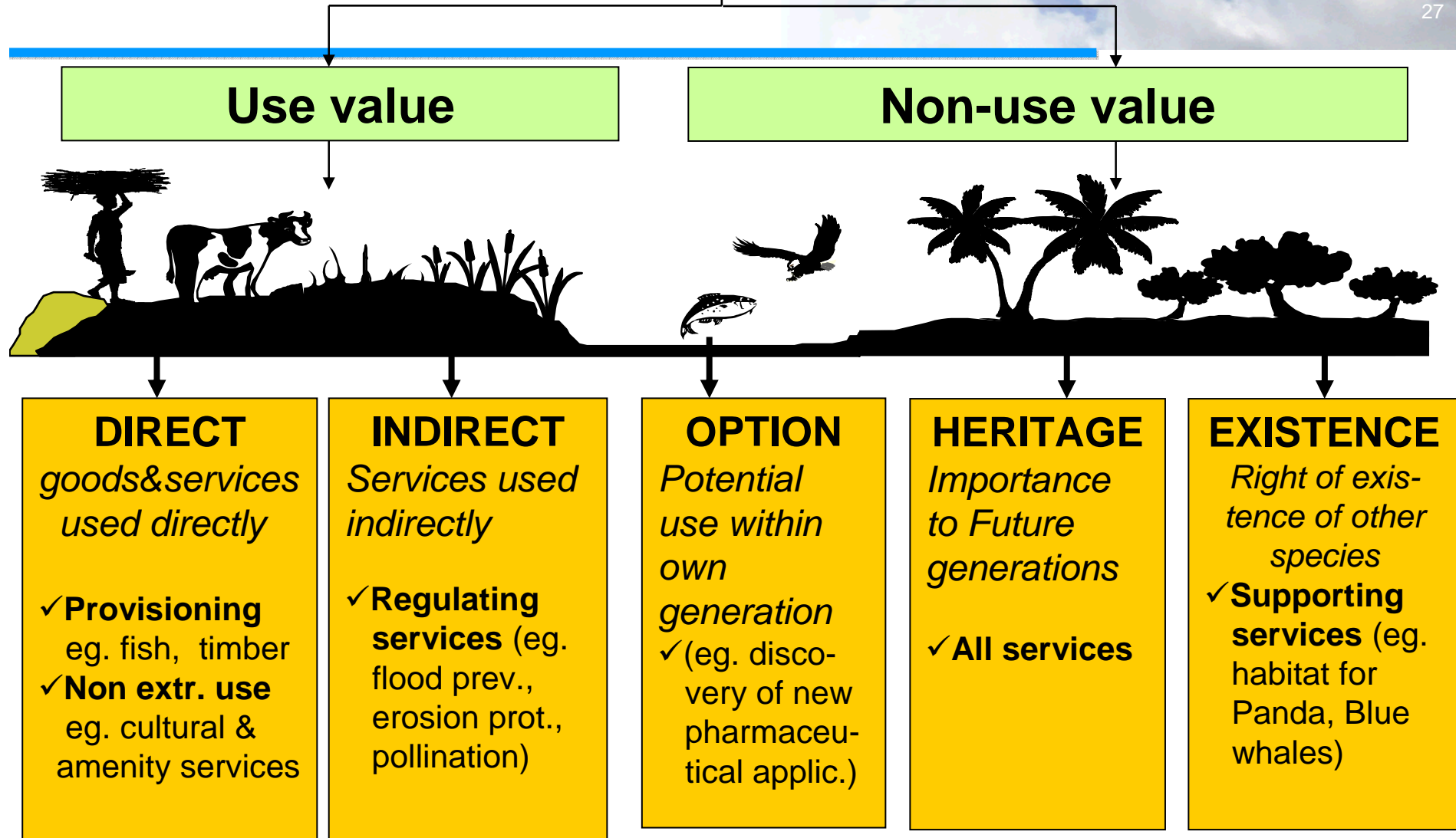


# ECOSYSTEM SERVICES to ECONOMICS



# TOTAL ECONOMIC VALUE

27



# Monetary valuation?

## 1. Market Price



Eco-tourism

Amenity  
value



## 2. Shadow price

28



Air purification

**Mitigation**

**Cost:**

2\$/minute ??



Oxygen Bar Tokyo city

## 3. Questionnaire based



**WTP** for  
protecting  
Humpback  
Whales:  
57 \$/pp/year  
(1993)



Coastal Protection

**Avoided damage**

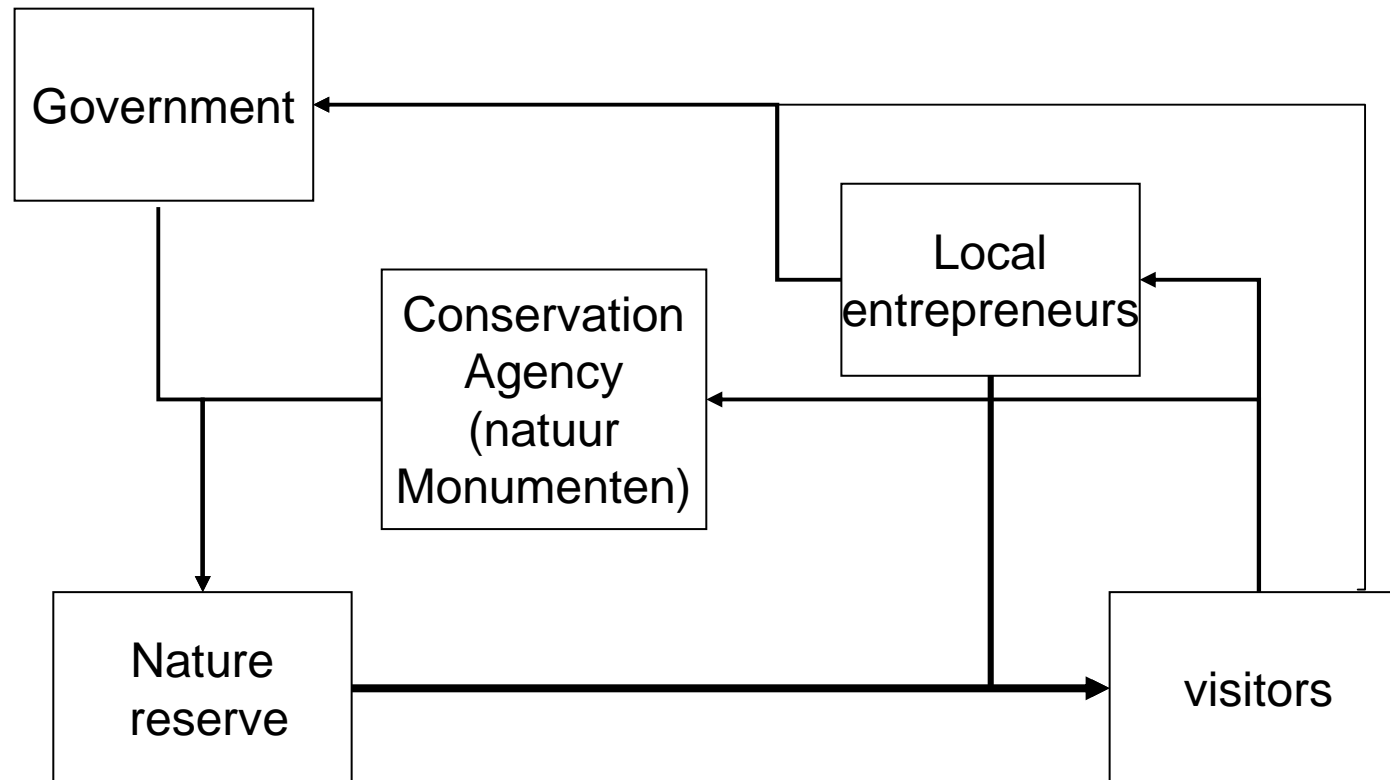
**Cost:** 36 million \$  
(Maledives-2004).

**Replacement cost**

10 million \$/km

# Example: Indirect money flow Loonse en Drunense Duinen

29



From Hilhorst & Braat, 2010



## De Loonse en Drunense Duinen (3500 ha)

30





Economic value for government:

<b>Model Van Cleef =</b>	<b>4.228.000 euro/yr</b>
<b>Model Hilhorst =</b>	<b>53.685.138 euro/yr</b>

<b>Costs per hectare:</b>	<b>142,80 euro/yr</b>
<b>Benefit per hectare:</b>	<b>15338,60euro/jaar</b>

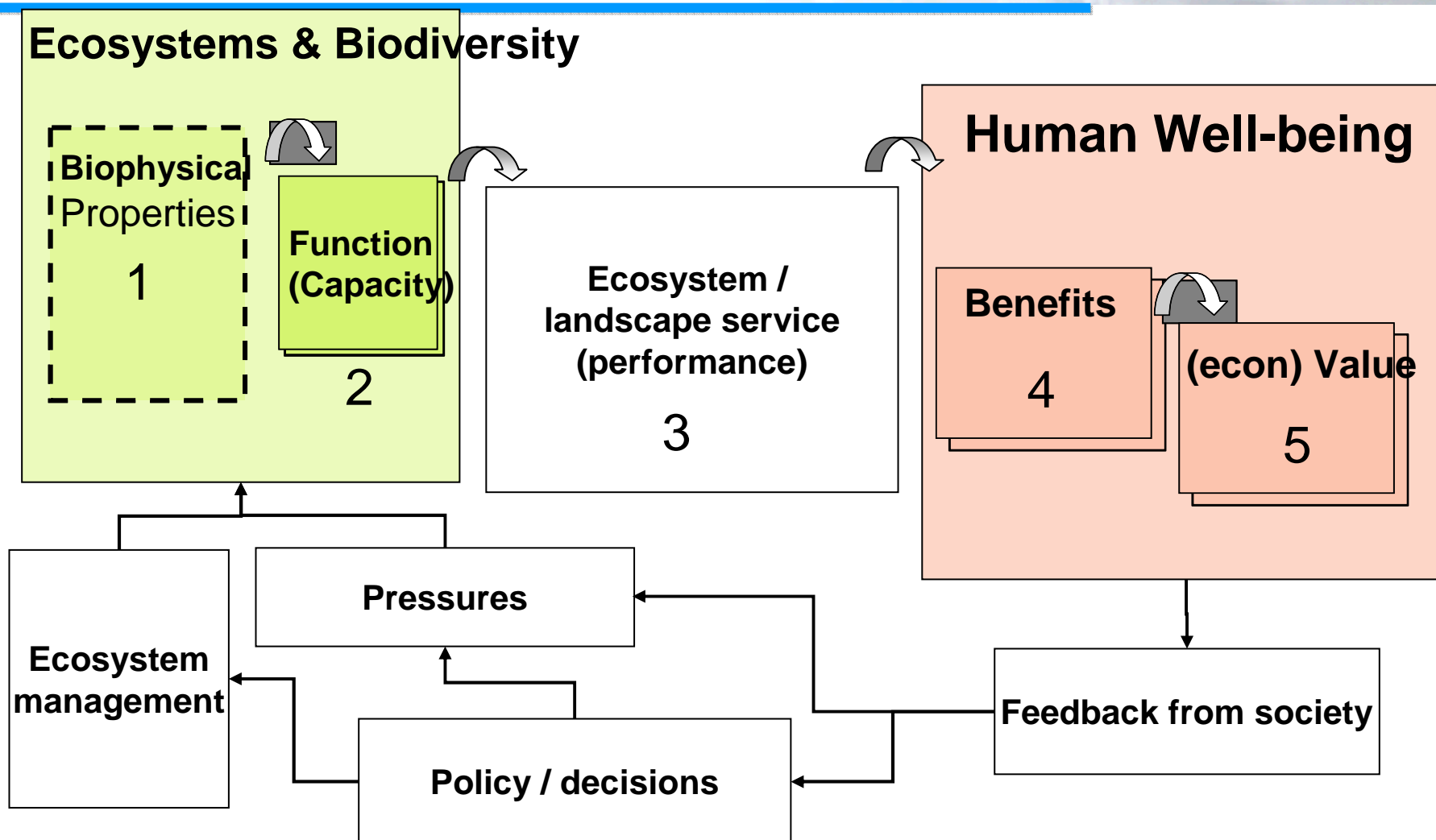
## Main services

- Recreation
- Fine dust filtering
- Real estate value
- CO<sub>2</sub> sequestration
- Water purification

Bron: Stageverslag "A new model to evaluate the monetary value of ecosystems", Anne Hilhorst, 2010

# Ecosystem services and policy

32



From: van Oudenhoven & Petz (in prep.)  
Adapted from Haines-Young & Potschin, 2009

# Ecosystem services and policy

33

## VISION EU (draft)

- By 2050, European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided (European Council, March 2010)

## HEADLINE TARGET (draft)

- Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss

# Dutch government goals:

34

- Resilient and healthy ecosystems outside protected areas, so that capacity to deliver services can be remained
- Strategy:
  - Knowledge and awareness on the role of ecosystems in the economy
  - projects to show added value of ecosystem services
- No targets, no measures (except for soils)

# Sustainable soil policy

35

- Target at healthy multi-usable soils
- Soil ecosystem services: sustainable use of soils:
  - No restriction to future use (TCB, 2003).
- Soil management restrictions or recommendations to prevent the loss of ecosystem services
- SPADE: Agro biodiversity and sustainable soil management: advise farmers ([www.spade.nl](http://www.spade.nl))

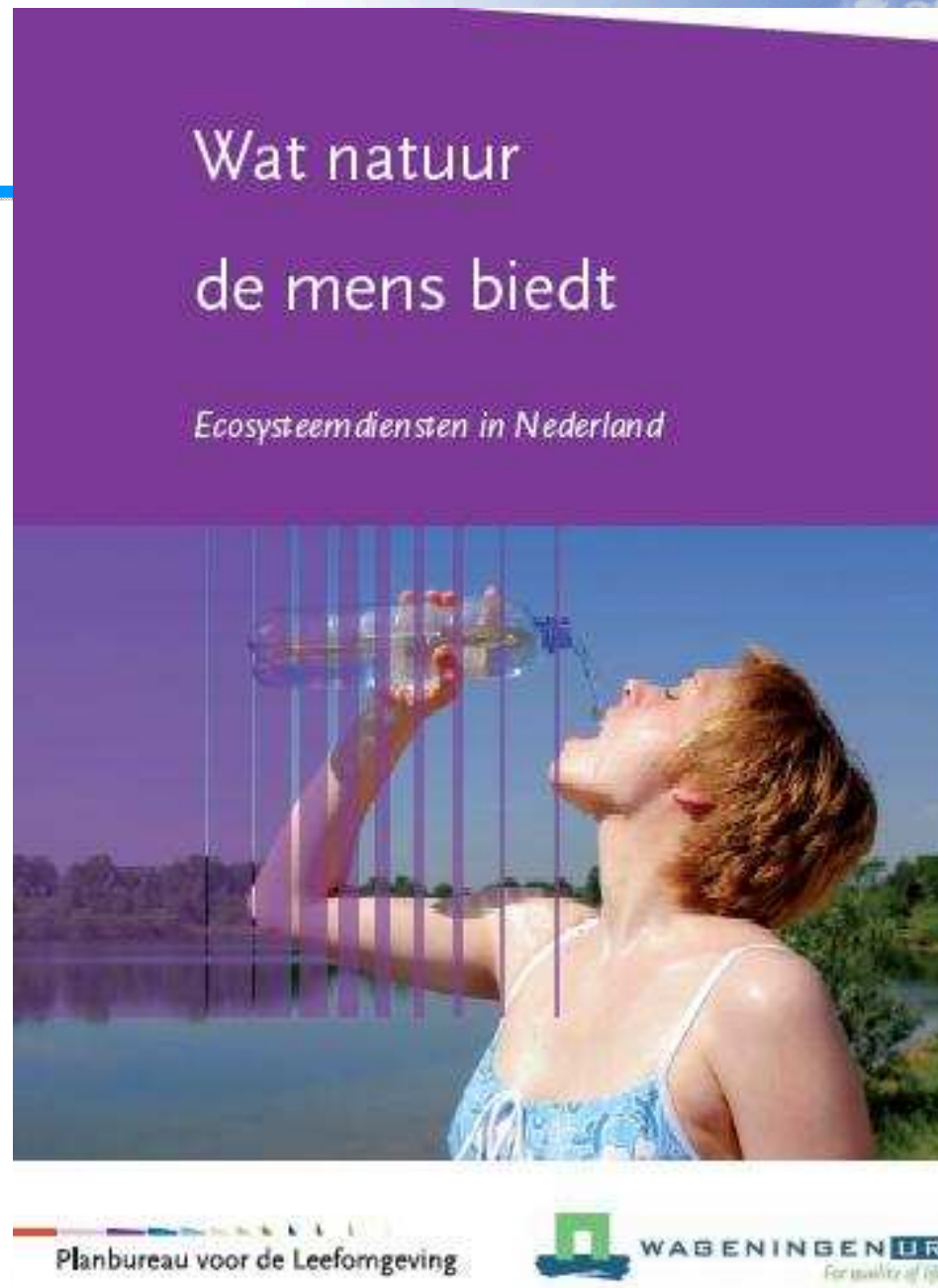


# Policy support

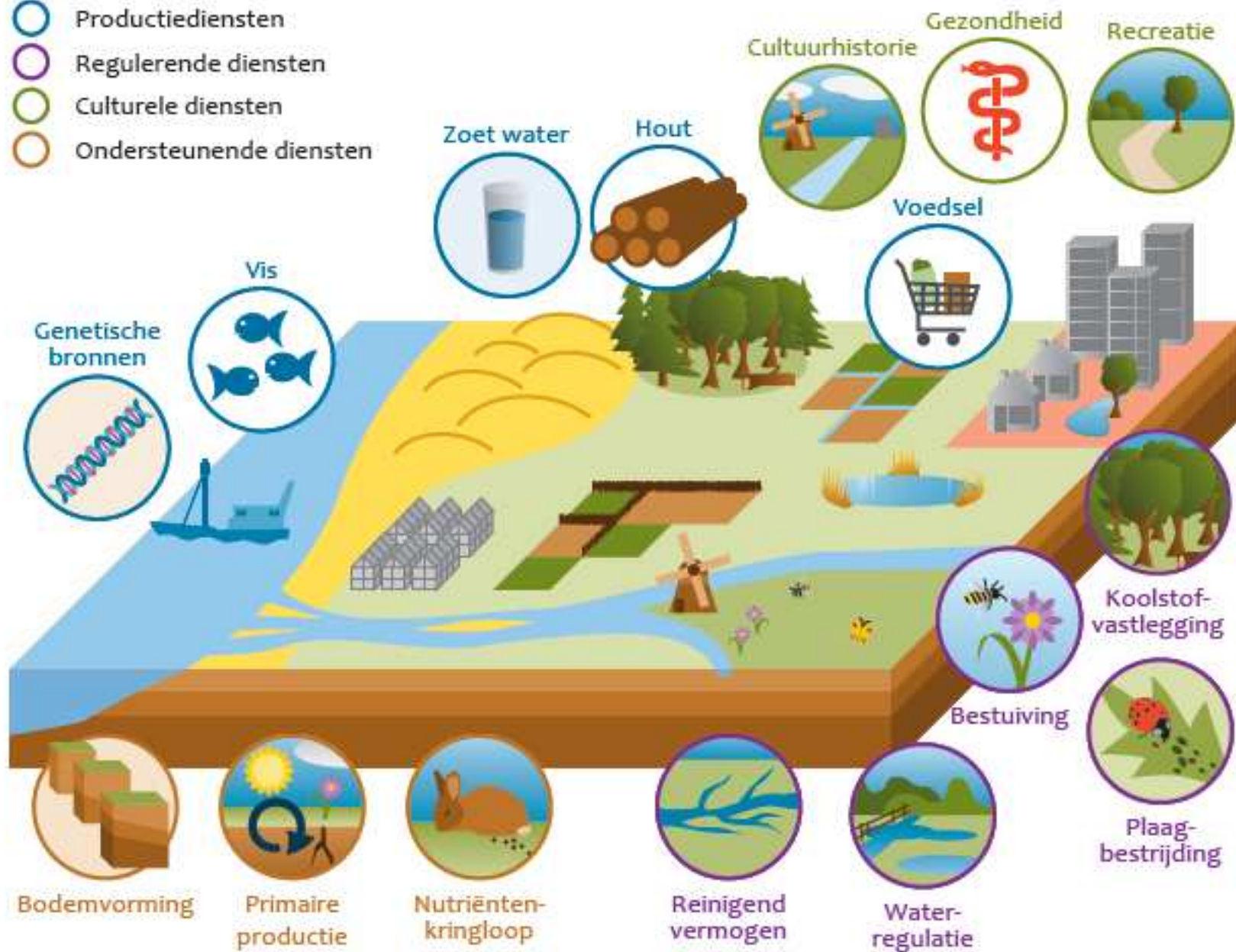
36

- Dutch environmental and agriculture ‘ministries’:
  - MA – Netherlands
  - TEEB – Netherlands
- Underpin environmental policies
- ‘prove the concept of ecosystem services’
- ‘avoid unsustainable situations’

## First brief example



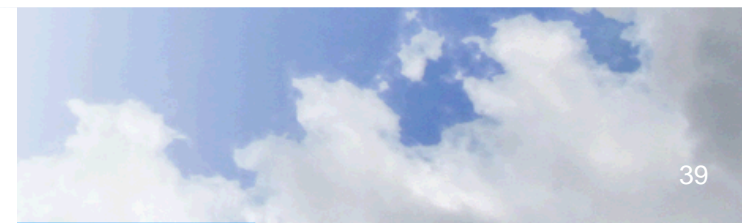
- Productiediensten
- Regulerende diensten
- Culturele diensten
- Ondersteunende diensten



Koolstofvastlegging bos

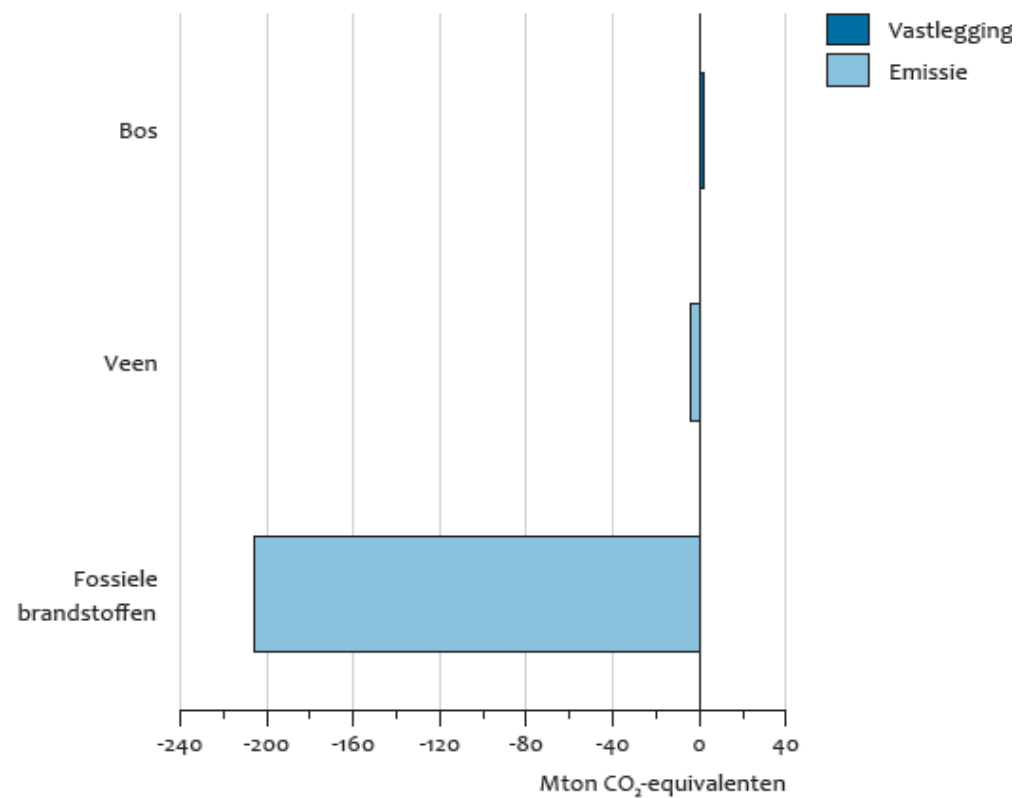
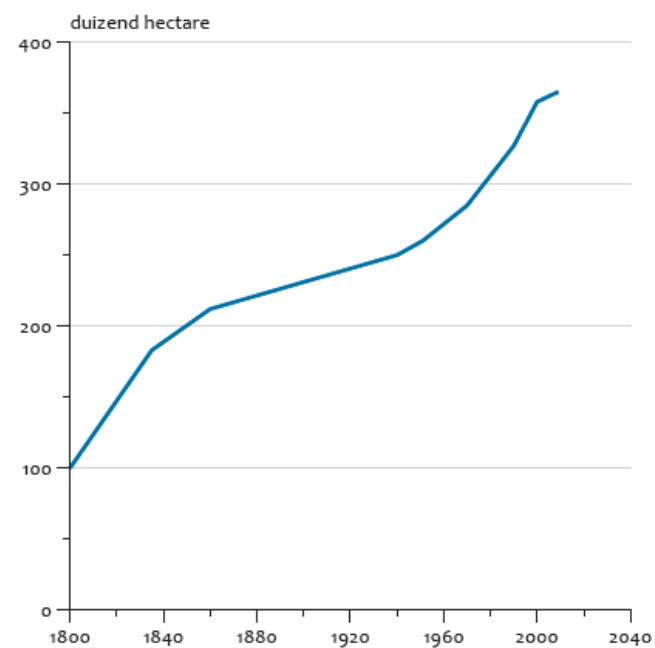
CO<sub>2</sub>-emissie  
veengronden

CO<sub>2</sub>-emissie fossiele brandstoffen



### Koolstofvastlegging en CO<sub>2</sub>-emissie, 2008

De hoeveelheid CO<sub>2</sub> die  
... id nu  
vast-  
e van  
stoot  
ssen.

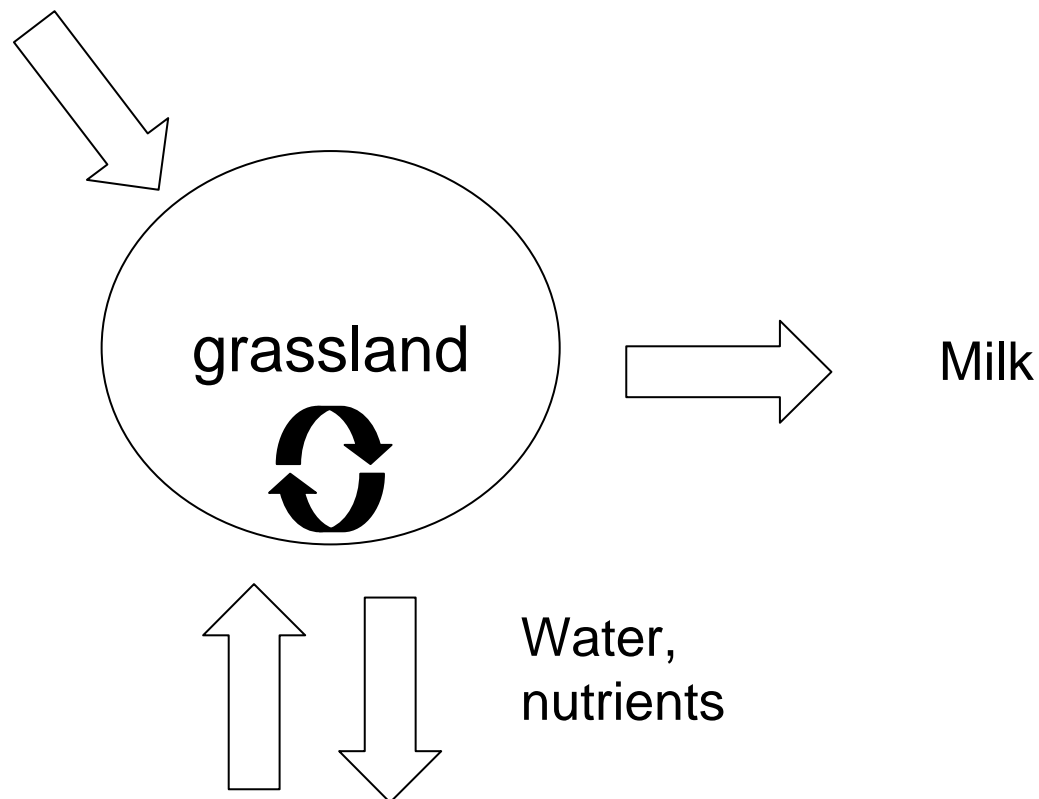


# Provisioning service

40

## ■ Milk production

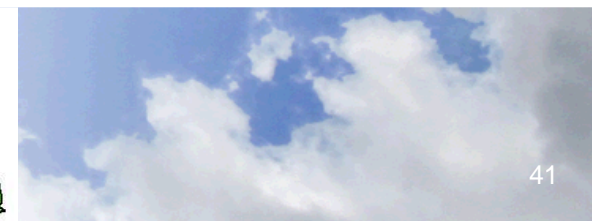
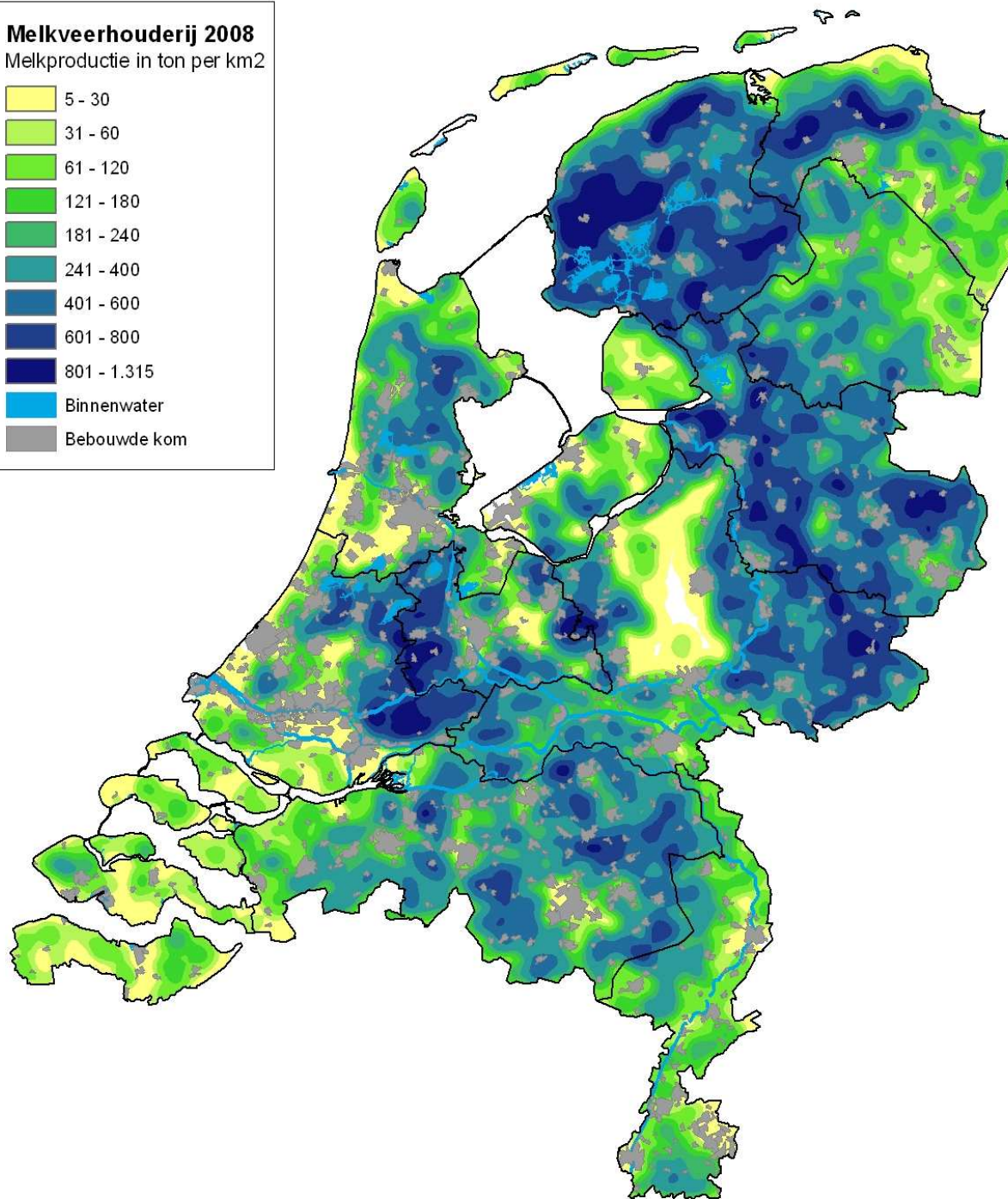
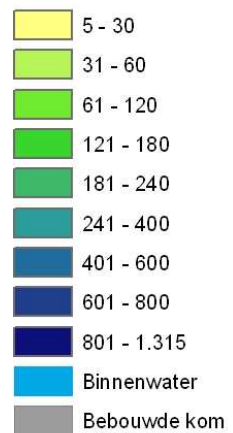
“technology”:  
•management  
•nutrients,  
•feed





### Melkveehouderij 2008

Melkproductie in ton per km<sup>2</sup>



# Main messages

42

- Services are mutually dependent
- Don't be too optimistic
- Costs and benefits attribution
- Conserving biodiversity  $\neq$  conserving EGS
- But: conservation as a precautionary

# Debate



**Bezuinigen!** En toch bouwen  
aan een mooie gemeente?

Hulp uit onverwachte hoek:  
**het natuurlijk systeem**



**BUT**

**‘The Economics of  
Eternal Bureaucracy  
(TEEB)’  
‘Ecosystem services:  
new toy for bureau-  
ecologists’**

From internet

# Conclusions

44

- Targets at European and national level are there
- Indicators are needed to support policy-making
- Indicators are needed at different levels
- Quantifications (and valuation) is needed for policies and markets
- Valuation and regulations is needed to produce optimal services
- Communication