



# Ecosystem service concept and classification systems



# Content

- **Definition of Ecosystem services**
- **Ecosystem service cascade model**
- **Interrelation between ES and biodiversity**
- **History of ES concept development**
- **Classification of ecosystem services**



# DEFINITION AND CONCEPT

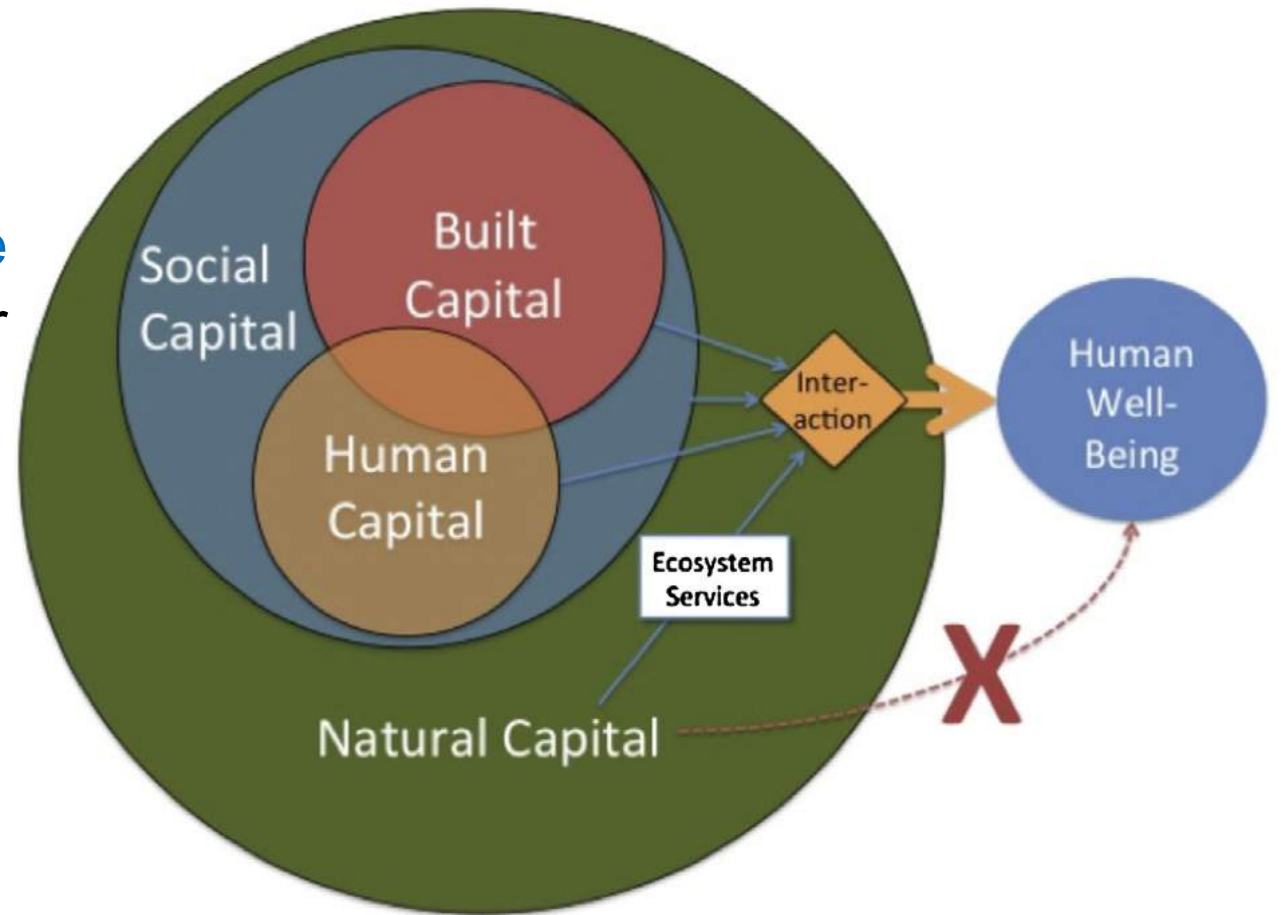


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# Definition of Ecosystem Services

Ecosystem services (ES) are **contributions of ecosystem structure and function** (in combination with other inputs) to human well-being



Burkhard, de Groot, Costanza, Seppelt, Jørgensen & Potschin, 2012. Solutions for sustaining natural capital and ecosystem services . Ecological Indicators, 21: 1 – 6

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S.J., Kubiszewski, I., Farber, S., Turner, R.K. (2014): Changes in the global value of ecosystem services. Global Environmental Change 26: 152–158.



# Categories of Ecosystem Services

## Provisioning services

*Products directly used by people*

### Food:

- Crops, wild plants, tea, honey etc.
- Reared and wild animals and their outputs

### Materials:

- Timber, hey, fibbers, herbs for medicine etc.
- Genetic material

### Energy:

- Biomass for energy

## Regulating services

*Related to the way ecosystems regulate environmental media or processes*

### Mediation of waste, toxics and other nuisances

- Filtration, accumulation

### Mediation of flows

- Erosion control and water flow maintenance

### Maintenance of nature processes

- Lifecycle and habitat maintenance;
- Water conditions, soil formation, climate control etc.

## Cultural services

*Related to the cultural or spiritual needs of people*

### Physical and intellectual interactions

- Recreation
- Educational and scientific value
- Landscape, cultural heritage

### Spiritual, symbolic interactions

- Symbols and traditions
- Existence and bequest value

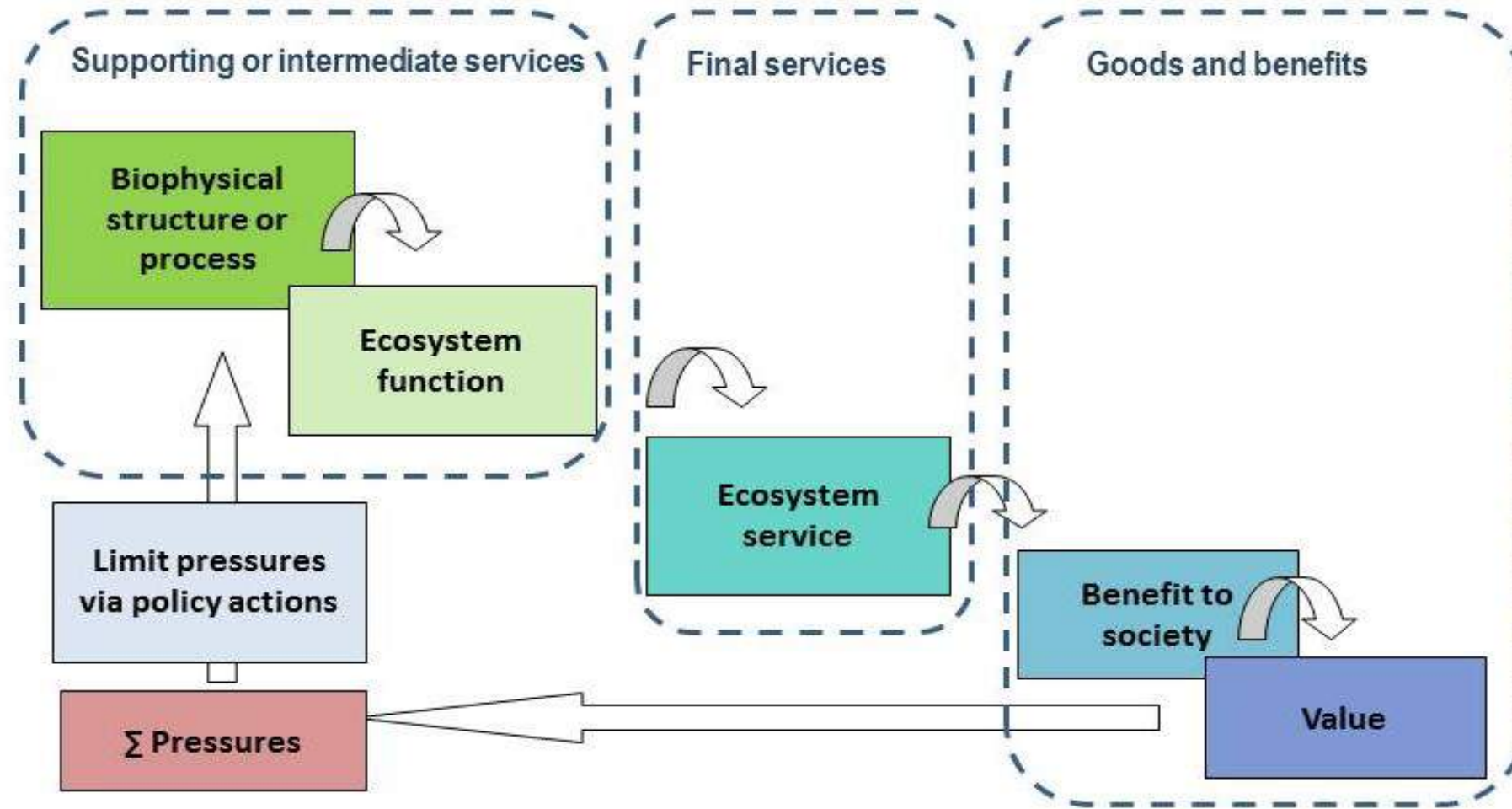


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# The ES cascade model



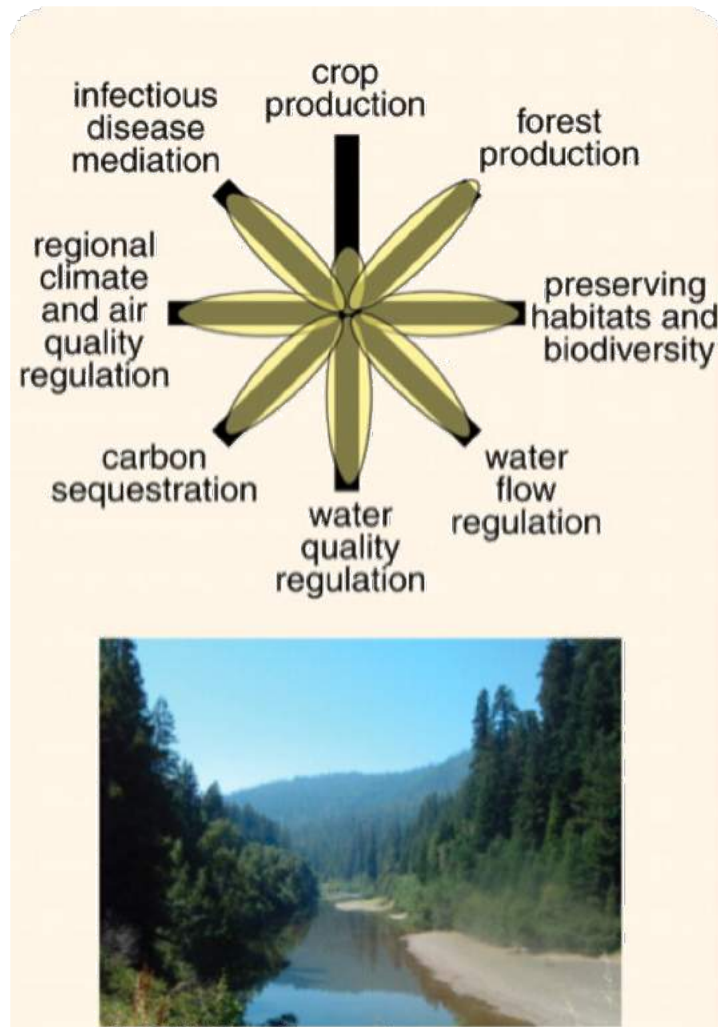
**Haines-Young, R. and M. Potschin (2010):** *The links between biodiversity, ecosystem services and human well-being.* In: Raffaelli, D.G & C.L.J. Frid (eds.): *Ecosystem Ecology: A New Synthesis.* Cambridge University Press, British Ecological Society, pp. 110-139.

# Components of the cascade model

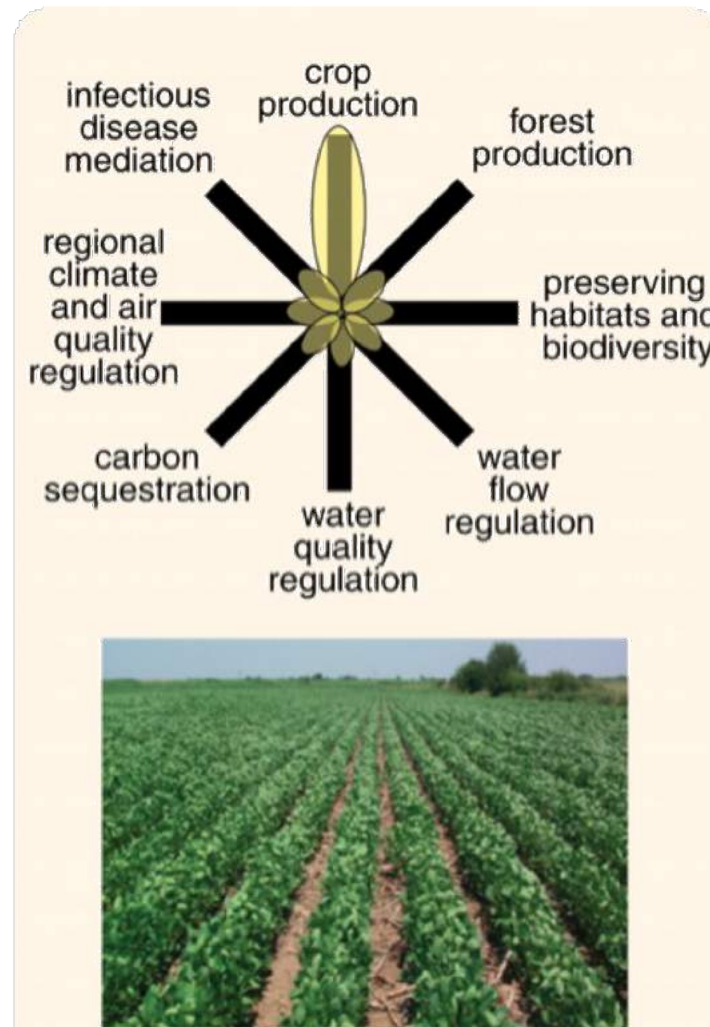
- **biophysical structure** – land cover or habitat type (e.g. woodland, wetland, grassland etc.)
- **ecosystem processes** - dynamics and interactions forming the ecological system (e.g. primary production)
- **ecosystem functions** - the characteristics or behaviours of the ecosystem that underpins its capacity to deliver an ecosystem service (e.g. ability of the woodland or grassland to generate a standing stock of biomass)
- **'final' ecosystem service** – products which can be harvested (e.g. hay, timber) or gains from ecosystem functions (e.g. flood protection, beautiful landscape etc.).
- **benefits** – contribution of ES human well-being (e.g. health, nutrition, safety, accommodation, leisure, employment, progress etc.).
- **value** – that is assigned to benefits and expressed either in monetary or in moral, aesthetic or other qualitative criteria



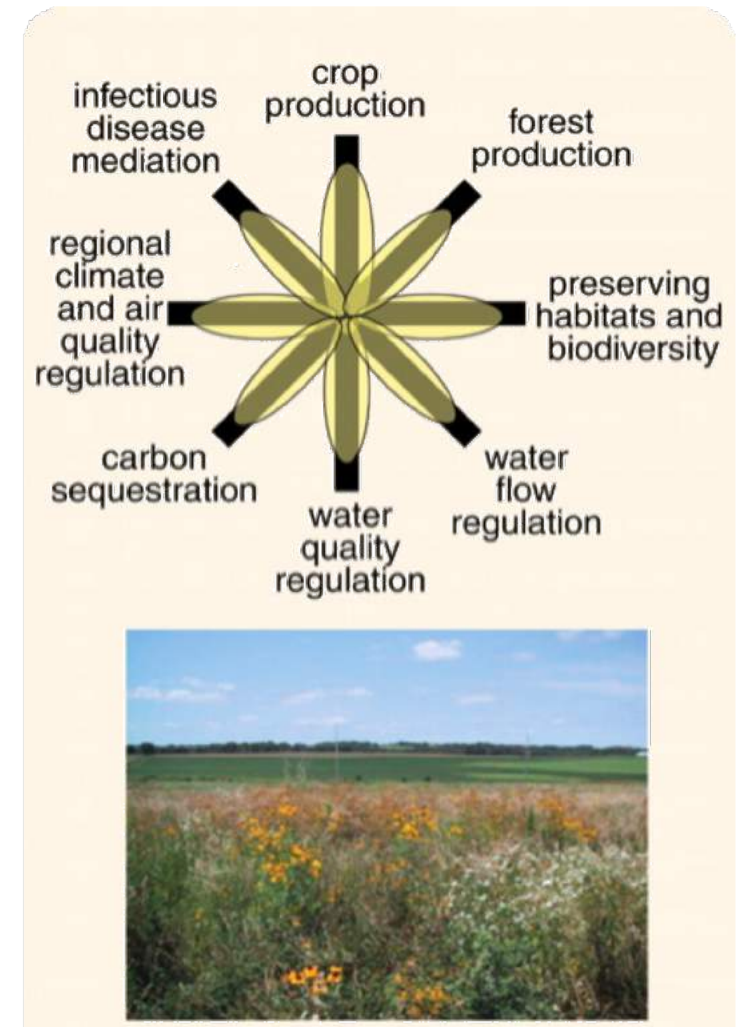
# Impact of management practice on ES supply: trade-off analysis



Unmanaged nature



Intensively managed cropland



Sustainable managed croplands



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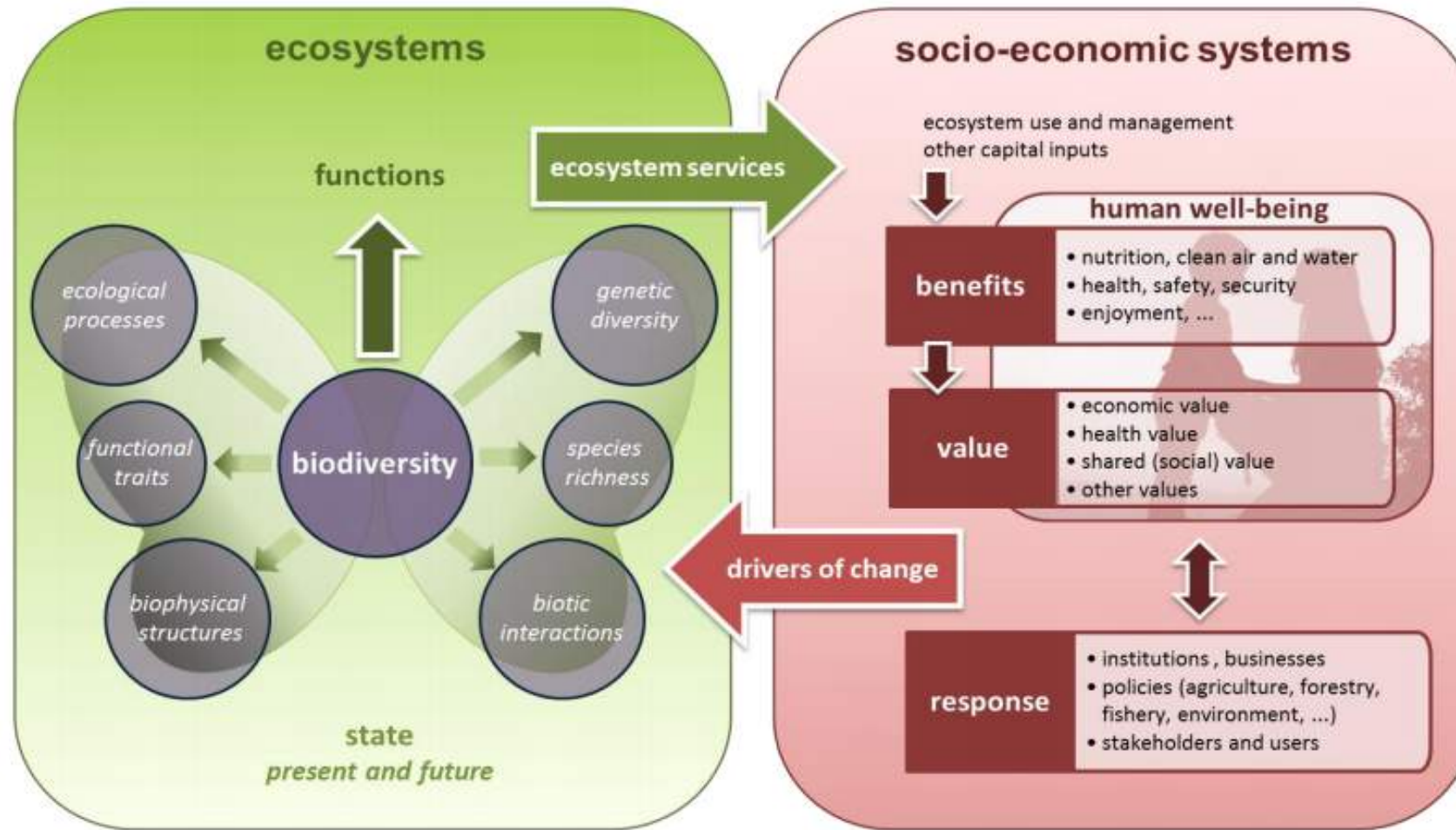
# Role of biodiversity in ES supply

## Biodiversity has essential role in ES supply:

- Mostly related to ‘**supporting or intermediate services**’ - biodiversity determines the biophysical structure and condition of ecosystem as well as different ecosystem functions
- In some cases direct relationship exists between **species diversity** and ecosystem productivity, biomass production, nutrient cycling:
  - evidence that high levels of plant species diversity increases grassland productivity
  - productivity is an ecosystem function that underpins a range of ES (e.g. biomass production, soil formation and erosion control).
- **Functional traits** - presence of particular species or species groups with particular features, that have certain function in ecosystem or its performance:
  - e.g. ability of vegetation to store nutrients might depend on presence of species with the particular feature and their abundance
- **Functional groups** - groups of species with similar functions:
  - ecosystems, where functional groups are formed by ecologically similar species with different reactions on environmental pressures, are more resistant to adverse effects



# Interrelation between biodiversity, ecosystem and socio-economic system



**Maes J. et al. (2016):** An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. *Ecosystem Services*, 17: 14–23.



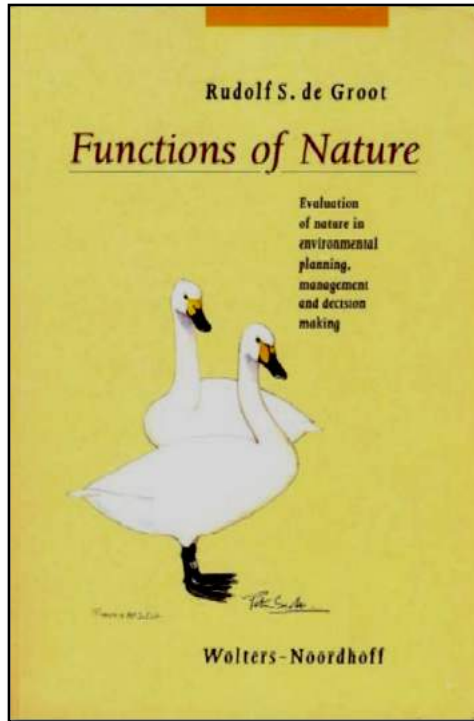
# HISTORY OF THE ES CONCEPT DEVELOPMENT AND ITS ROLE IN POLICY MAKING



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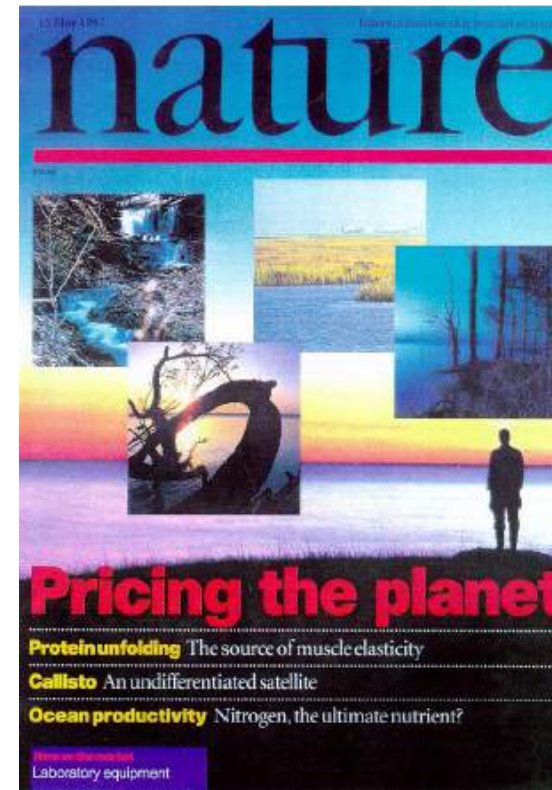
# The first most significant publications



de Groot (1992)



Daily (1997)



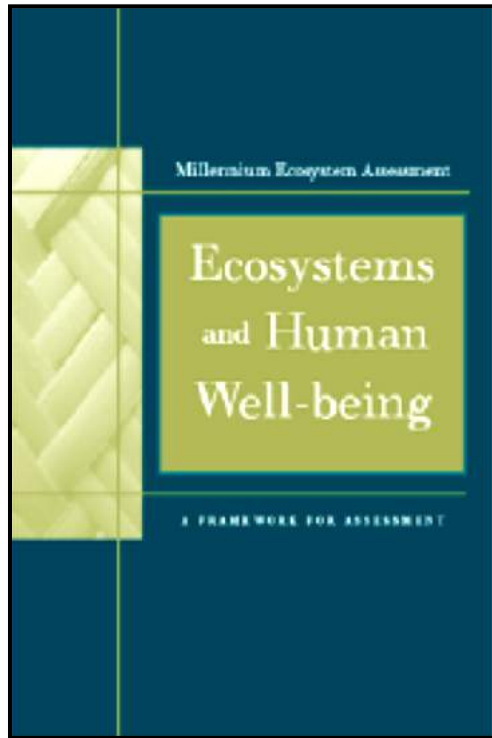
Costanza et al. (1997) The value of the world's ecosystem services and natural capital. *Nature*, 387: 253-260



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# The Millennium Ecosystem Assessment



- The study led by the United Nations , involving 1360 international experts
- Implemented from 2001 to 2005
- Assessment of human impacts on ecosystems and consequences in relation to human well-being

<http://www.millenniumassessment.org>

Concludes that 60% of all ES in the world are degraded or used unsustainably.

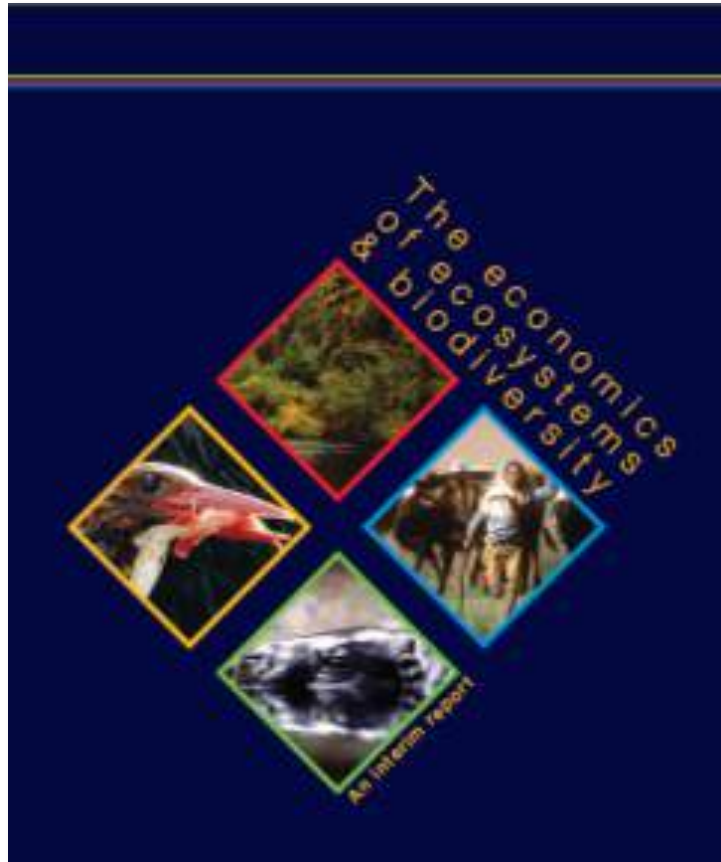
Source: Millennium Ecosystem Assessment (2003, 2005)



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# The Economics of Ecosystems and Biodiversity — TEEB



- Global initiative targeted at assessment of:
  - economic value of biodiversity
  - costs arising from biodiversity loss and ecosystem degradation
- Initiated by the European Commission and the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, responding to proposal of environment ministers from the G8+5 countries meeting in Potsdam, 2007

<http://www.teebweb.org>



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# The Economics of Ecosystems and Biodiversity — TEEB



TEEB: The Economics of Ecosystems and Biodiversity  
The Economics of Ecosystems and Biodiversity  
Ecological and Economic Foundations



TEEB: The Economics of Ecosystems and Biodiversity  
The Economics of Ecosystems and Biodiversity  
in National and International Policy Making



TEEB: The Economics of Ecosystems and Biodiversity  
The Economics of Ecosystems and Biodiversity  
in Local and Regional Policy and Management



TEEB: The Economics of Ecosystems and Biodiversity  
The Economics of Ecosystems and Biodiversity  
in Business and Enterprise

The findings of TEEB were published in several reports:

- ✓ TEEB Ecological and Economic Foundations
- ✓ TEEB in national and International Policy making
- ✓ TEEB in Local and Regional Policy
- ✓ TEEB in Business and Enterprise
- ✓ the TEEB Synthesis Report

<http://www.teebweb.org>

The TEEB initiative has been followed up by several national TEEB studies in order to demonstrate the value of ecosystems for national policy makers



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# EU Biodiversity Strategy 2020

**Target 2: By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems**

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

- By 2014 MS will map and assess the state of ecosystems and their services in their national territory
- By 2020 MS will assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level





# Working Group: Mapping and Assessment of ecosystem services - MAES

- Established by the European Commission (EC) to support implementation of the Action 5 of the EU Biodiversity Strategy 2020
- MAES working group involves experts of the EC, the member states and the research community
- Analytical framework for the MAES process involves:
  - 1) mapping of the ecosystems;
  - 2) assessment of the ecosystem condition;
  - 3) assessment of ecosystem services;
  - 4) integrated assessment



# International cooperation networks

# ESP

## Ecosystem Service Partnership:

- launched in 2008
- formed by institutional and individual members from all over the world
- aims to enhance cooperation in the field of ES by organising international conferences, trainings, data and experience exchange

<https://www.es-partnership.org/>

## Intergovernmental Science-Policy Platform on Biodiversity and ES

- established in 2012, administered by UNEP
- aims to strengthen the science-policy interface for biodiversity & ES
- works on biodiversity and ES assessments at regional and global level

<https://www.ipbes.net/>



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# Information exchange platforms



## The Biodiversity Information System for Europe:

- holds the information on completed as well as ongoing initiatives at EU and national level with regard to mapping and assessment of ecosystems and services they supply

<http://biodiversity.europa.eu/>



## OPPLA is an open platform:

- a new knowledge marketplace, where the latest thinking on ES, natural capital and nature-based solutions is brought together
- provides online database on ES assessment case studies, publications, projects that can be filtered by scale, ecosystem type, applied methods, etc.

<https://oppla.eu/about>



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# Leading international projects



## Operationalisation of natural capital and ecosystem services:

- aims to translate the concepts of Natural Capital (NC) and ES into operational frameworks providing tested, practical and tailored solutions for integrating ES into land, water and urban management and decision-making.

<http://www.openness-project.eu/>



## OPERAs is a European research project:

- produces, refines and integrates ES science into policy and practice.
- provides stakeholders with user-friendly tools and instruments to enable them to apply ES science and knowledge in their work

<http://operas-project.eu/>



## Enhancing ecoSystem sERvices mApping for poLicy and Decision mAking

- aims to deliver a flexible methodology that provides building blocks for ES mapping and assessment
- to share experience through an active process of knowledge co-creation that will enable EU member states to achieve the aims of Action 5, biodiversity Strategy 2020



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# EC CLASSIFICATION SYSTEMS



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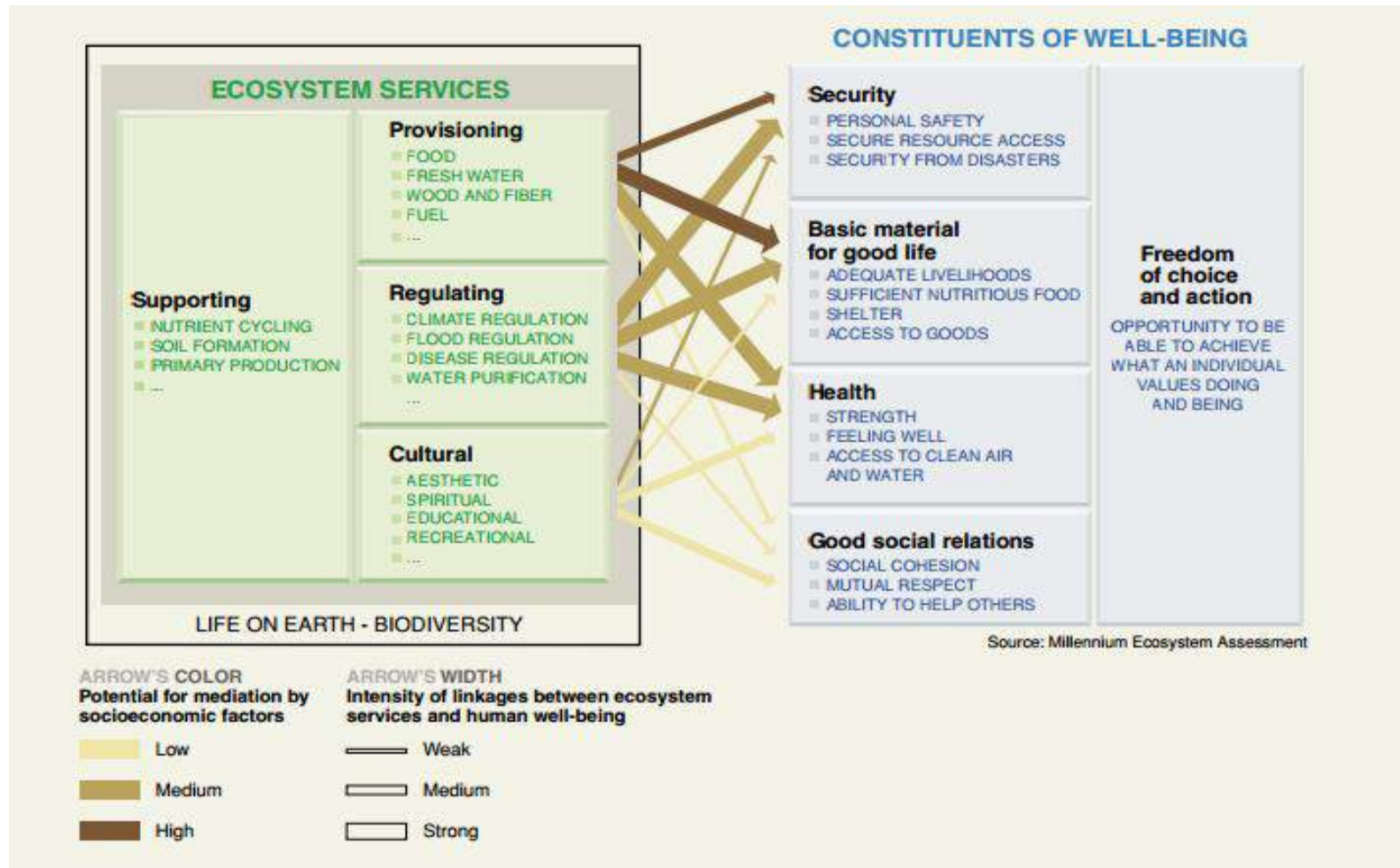
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## Variety of approaches to classify ecosystem services using different criteria:

- spatial character and scale
- service flow – cascade model
- service beneficiary (private vs public)
- type of benefit ('use' vs 'non-use')
- does the use of a service by one individual or group affects the use by others ('rival' vs 'non-rival')
- describing the variety of benefits to humans



# The Millennium Ecosystem Assessment Classification of ES



- Includes four ES categories:
  - Supporting services;
  - Provisioning services;
  - Regulating services;
  - Cultural services
- Demonstrates the links between ecosystem services and human well-being

# TEEB classification:

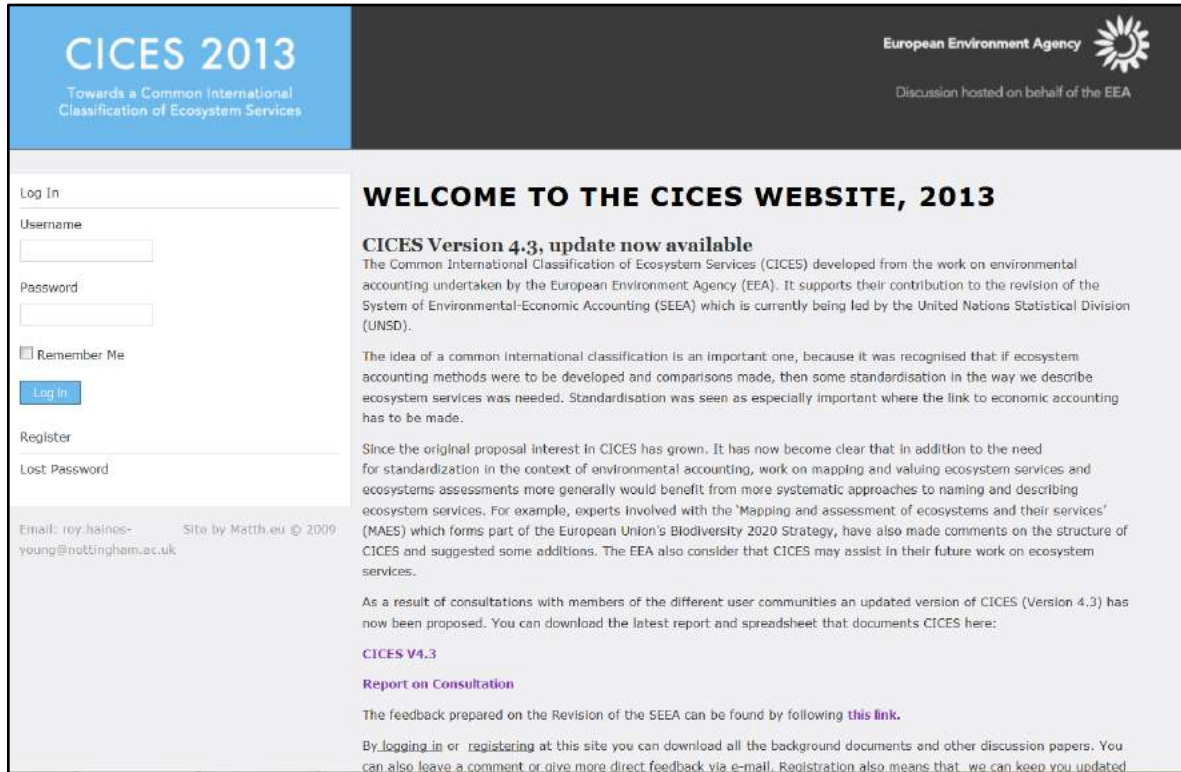
Based on similar approach as used Millennium Ecosystem Assessment:

- Provisioning services
- Regulating services
- Cultural services
- Habitat or supporting services (*habitats for species and maintenance of genetic diversity*)





# The Common International Classification of Ecosystem Services - CICES



**CICES 2013**  
Towards a Common International Classification of Ecosystem Services

European Environment Agency  
Discussion hosted on behalf of the EEA

**WELCOME TO THE CICES WEBSITE, 2013**

**CICES Version 4.3, update now available**  
The Common International Classification of Ecosystem Services (CICES) developed from the work on environmental accounting undertaken by the European Environment Agency (EEA). It supports their contribution to the revision of the System of Environmental-Economic Accounting (SEEA) which is currently being led by the United Nations Statistical Division (UNSD).

The idea of a common international classification is an important one, because it was recognised that if ecosystem accounting methods were to be developed and comparisons made, then some standardisation in the way we describe ecosystem services was needed. Standardisation was seen as especially important where the link to economic accounting has to be made.

Since the original proposal interest in CICES has grown, it has now become clear that in addition to the need for standardization in the context of environmental accounting, work on mapping and valuing ecosystem services and ecosystems assessments more generally would benefit from more systematic approaches to naming and describing ecosystem services. For example, experts involved with the 'Mapping and assessment of ecosystems and their services' (MAES) which forms part of the European Union's Biodiversity 2020 Strategy, have also made comments on the structure of CICES and suggested some additions. The EEA also consider that CICES may assist in their future work on ecosystem services.

As a result of consultations with members of the different user communities an updated version of CICES (Version 4.3) has now been proposed. You can download the latest report and spreadsheet that documents CICES here:

[CICES V4.3](#)

[Report on Consultation](#)

The feedback prepared on the Revision of the SEEA can be found by following [this link](#).

By [logging in](#) or [registering](#) at this site you can download all the background documents and other discussion papers. You can also leave a comment or give more direct feedback via e-mail. Registration also means that we can keep you updated.

Email: roy.haines-young@nottingham.ac.uk Site by Matth.eu © 2009

- Developed for the **System of Environmental - Economic Accounting – SEEA**, led by the United Nations Statistical Division (UNSD)
- First proposed in 2009; revised in 2013
- New version under development

<http://cices.eu/>

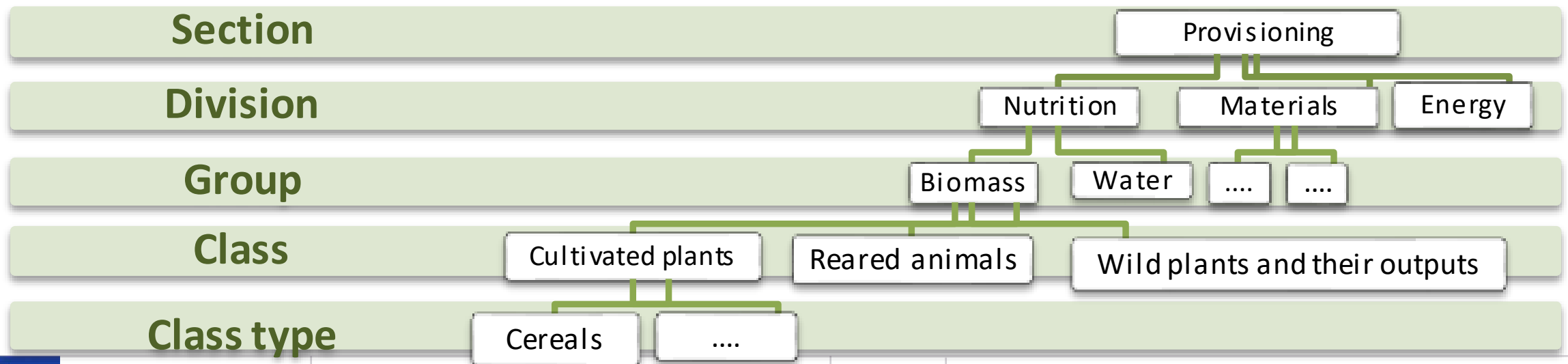


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# The hierarchical structure of CICES

- Three major 'sections' of services - '**provisioning**', '**regulating**' and '**cultural**'
- sections are into 'divisions', 'groups' and 'classes'
- allows to go down to the most appropriate level as well as combine results for generalised reports
- in the cascade model refers to the 'final services'



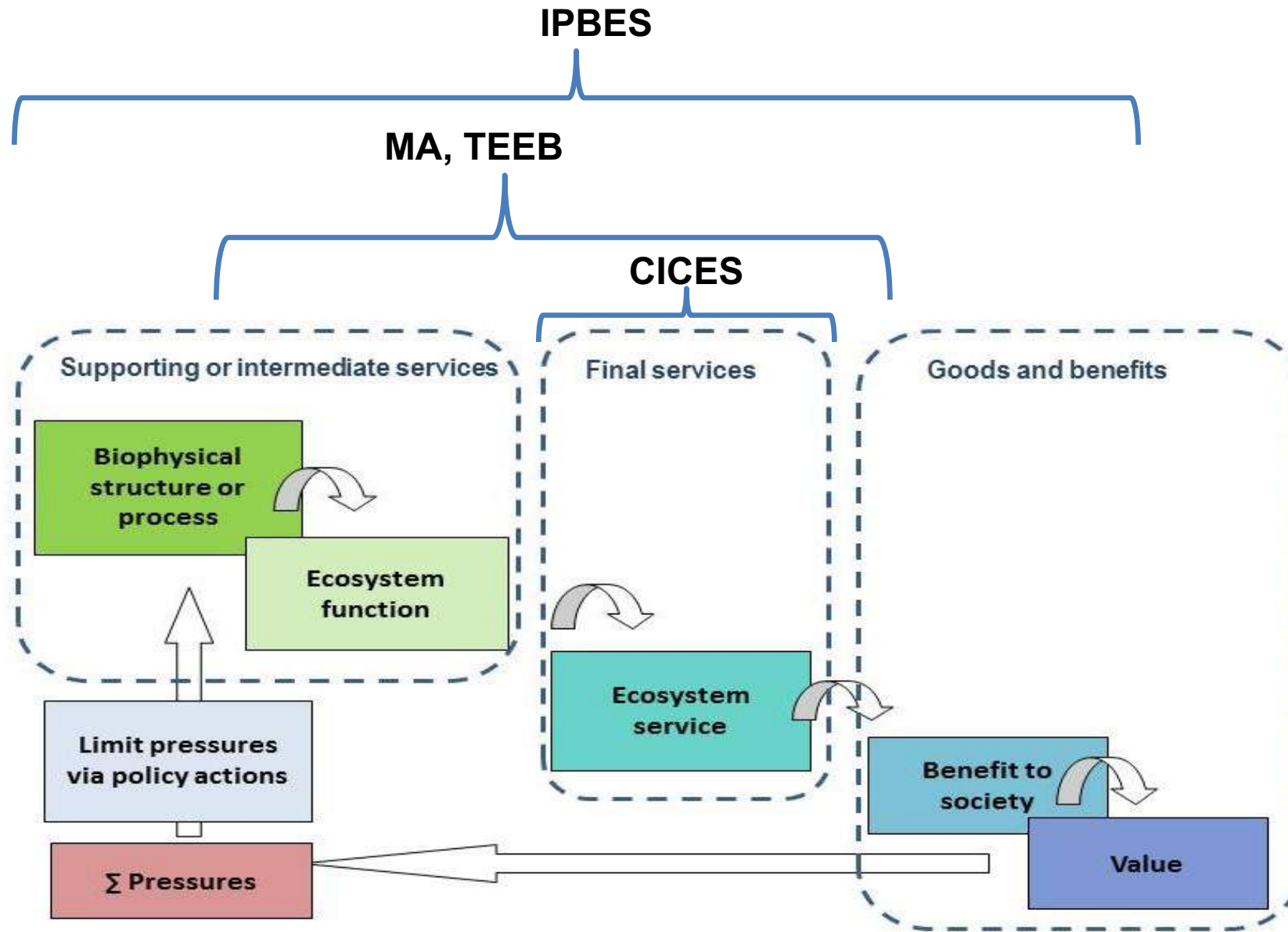
# IPBES approach for classification of ES

Provides an overarching typology of values, arising from different worldviews:

- **intrinsic value of nature** - including individual organisms, biophysical assemblages, biophysical processes and biodiversity
- **nature's benefits to people:**
  - ✓ biosphere's ability to enable human endeavor (energy; net primary production; total material consumption; life cycles, etc.);
  - ✓ nature's ability to supply benefits (habitats for fisheries, contribution of soil biodiversity to sustenance of long-term yields, etc.);
  - ✓ nature's gifts, goods and services (regulating, provisioning and cultural services);
- **good quality of life** – security and livelihoods; sustainability and resilience; diversity and options; living well and in harmony with nature and Mother Earth



# ES classification approaches in relation to cascade model

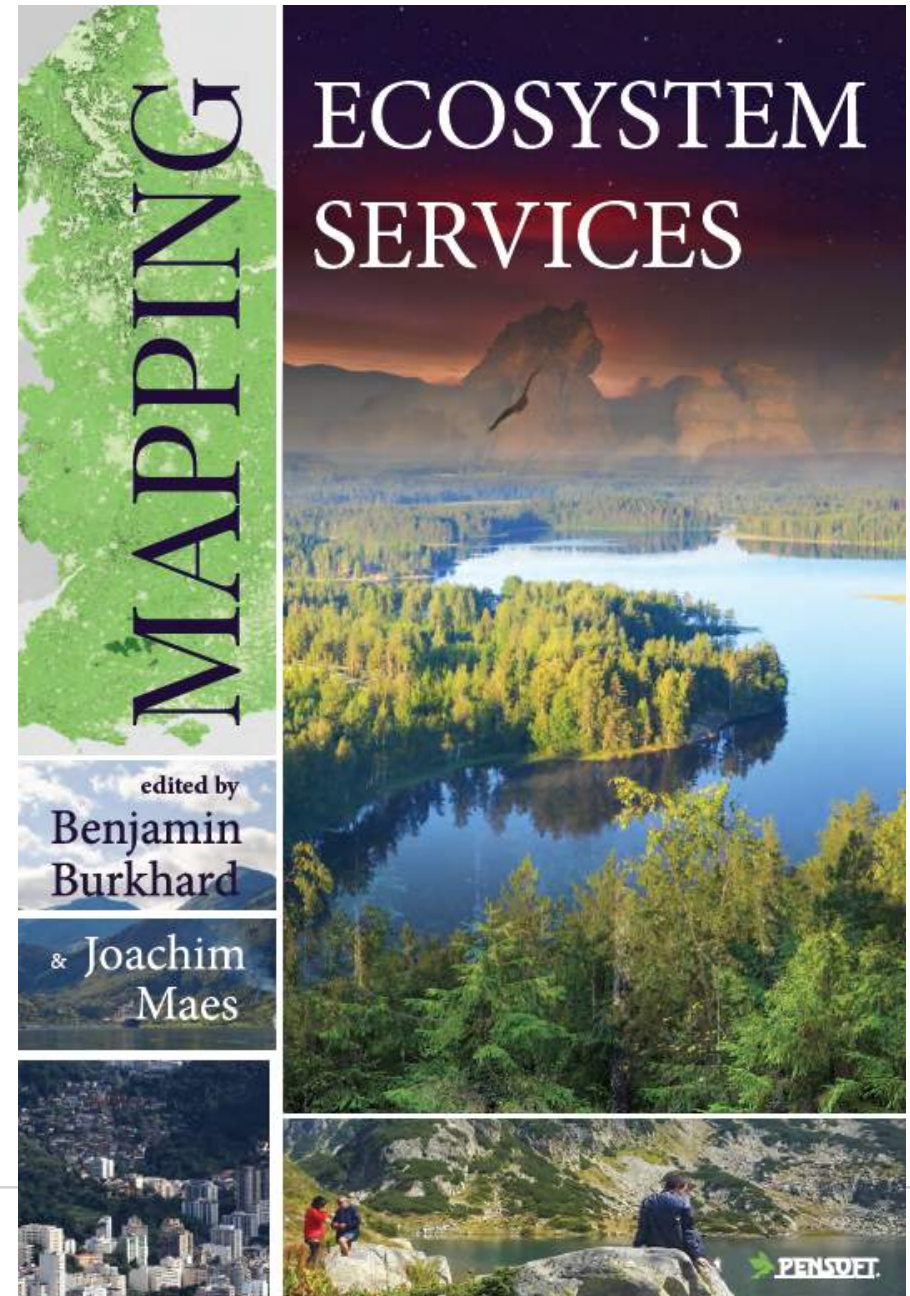


# Read more about ES in:

Burkhard B., Maes J. (Eds.) (2017):  
**Mapping Ecosystem Services.**  
Pensoft Publishers, Sofia, 374 pp.

Available online:

<http://books.pensoft.net/book/13161/mapping-ecosystem-services>





# Ecosystem service concept and classification systems

