Evidence for the value of biodiversity, and what it means to decision-makers

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Preliminary results from the BESAFE project (*Biodiversity and Ecosystem Services: Arguments for our Future Environment*)

Aim: To help policy-makers understand the effectiveness of different arguments for biodiversity protection under varying circumstances.

1. Literature review: How do different aspects of biodiversity contribute to ecosystem services? (Figures 1,2 and 3)

Links between biodiversity and ecosystem services are mainly positive. Negative links relate to mortality rate, impacts of non-native species, and impact of some forest plantations on water supply. The four most commonly cited biodiversity attributes are:

1. **The entire community /habitat area:** e.g.. the area of forest in a catchment is linked to flood protection; wetlands improve water quality; vegetation prevents erosion on steep slopes. Longer-established habitats can provide a greater service, e.g. for flood protection and carbon storage.
2. **The abundance of particular species:** important for provisioning services (fishing and timber), species-based recreation (e.g. eco-tourism, hunting), pest regulation and pollination. Species size is important for some services, e.g. larger trees store more carbon; large species are important for fishing.
3. **Species richness** and **functional diversity:** important for many services, especially carbon storage, timber production, pest regulation and pollination. Due to niche complementarity (e.g. a mix of plant species with different heights and root depths can more fully exploit available sunlight, water and nutrients) and the selection effect (a greater chance of high-performing species occurring in a richer community). Also good for recreation (eco-tourism).
4. **Physical structure**: more complex structures (e.g. old-growth forests, or wetlands with varied vegetation heights) often provide a greater level of service. Structural diversity is important for aesthetic benefits and for providing good habitat for pest predators and pollinators.

Figure 1: Links between biodiversity attributes and the 11 ecosystem services

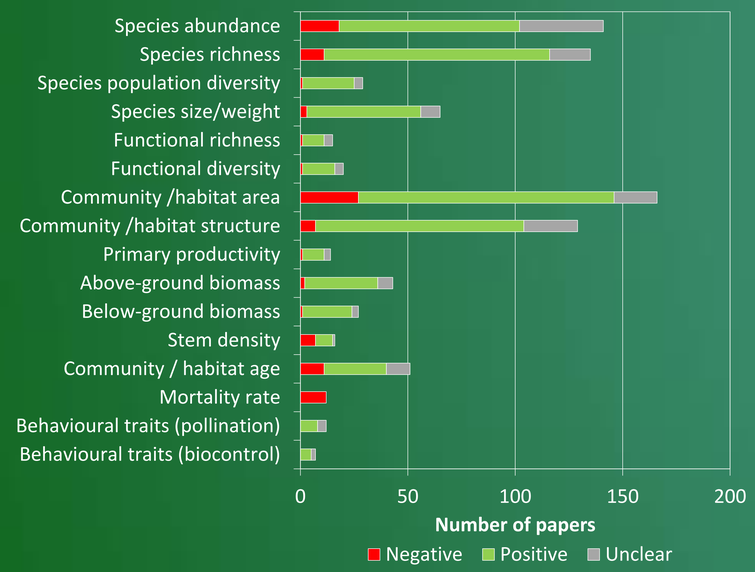
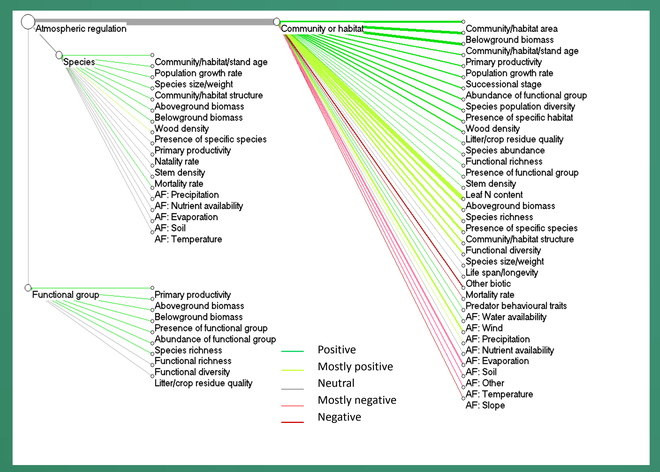


Figure 2: Network diagram of the links between ecosystem service providers, biodiversity attributes and abiotic factors for the service of atmospheric regulation



	Species abundance	Species richness	Species diversity	Species size/weight	Mortality rate	Functional richness	Behavioural traits (pollination)	Behavioural traits (biocontrol)	Community /habitat area	Community / habitat structure	Primary production	Aboveground biomass	Belowground biomass	Stem density	Community/habitat / age	Litter / crop residue quality
Provisioning services																
Timber production	↑	↑↓														
Freshwater fishing	↑	↑		↑	↓						↑					
Freshwater provision									↑↓					↓	↓	
Regulating services																
Water purification		↑							↑							
Water flow regulation									↑	↑					↑	
Mass flow regulation		↑							↑	↑		↑	↑			
Atmospheric regulation		↑	↑	↑	↓					↑		↑	↑		↑	↑
Pest regulation	↑	↑				↑		↑	↑	↑						↑
Pollination	↑↓	↑					↑									
Cultural services																
Recreation (species)	↑↓	↑	↑	↑												
Landscape aesthetics									↑	↑						

Figure 3: Summary of positive and negative relationships between biodiversity attributes and ecosystem services. *↑ = strong positive relationship (found in ≥ 50% of papers); ↑ = moderate positive relationship (found in 10-49% of papers). ↓ = moderate negative relationship. Weak relationships (found in <10% of papers) are excluded.*

2. What do different stakeholders think about biodiversity conservation and ecosystem services?
Survey of three expert groups (decision-makers, NGOs and researchers) in nine EU countries, using Q-analysis, supplemented by five local case studies.

Local case studies show **considerable variation between stakeholder groups**, e.g. local people often place more value on provisioning services, government on regulating services, tourists on recreational and cultural services. But this can change if they are given more scientific information on the benefits.

Preliminary results of the expert survey show a **complex pattern** with a broad range of stakeholder attitudes within all three expert groups:

- Valuing biodiversity because it contributes to ecosystem services that provide **practical and monetary benefits** for humans;
- **Emotional arguments** about the beauty of nature and how nature gives meaning to life;
- Belief in the **intrinsic rights** of all species to exist irrespective of their value to humans;
- Protecting ecosystems as an **insurance policy** against future change.

Also, there are differences between experts' personal views and the dominant views used in decision-making. Many think personally that there is an ethical basis for conservation, but there are **conflicting perspectives** too with some members of all three groups responding mainly to economic arguments, and others to ethical and moral arguments.

Conclusions

- **There are strong synergies** between biodiversity conservation and many regulating and cultural ecosystem services. Rich and diverse ecosystems can deliver services such as carbon storage, flood protection, soil fertility and landscape aesthetics, as well as providing habitat for wildlife.
- **However there are also conflicts** between ecosystem services ,e.g. provisioning services such as farming, fishing and timber extraction may damage wildlife habitat, and reduce the ability of ecosystems to provide regulating or cultural services.
- **Careful management is essential** to exploit synergies and minimise conflicts, e.g. by promoting eco-tourism, and sustainable agriculture, halting over-extraction of resources, and regulating to reduce water pollution.
- **Decision-makers respond to a wide range of economic and non-economic arguments** for valuing biodiversity and ecosystem services. Not all decision-makers in a certain group will respond to the same arguments. This suggests that a **wider range of arguments** for the conservation of nature could be used to influence these groups, with more emphasis on **ethical and moral arguments** and the protection of biodiversity as an '**insurance policy**'.
- **More effective communication** of the arguments for biodiversity conservation is needed, with broader public participation. The message needs to be tailored to the audience, and delivered by people who are trusted in the local community. Better valuation of ecosystem services can be useful, but it should also be recognised that many benefits cannot be valued in economic terms.

REFERENCE: Harrison et al. (2014), 'Linkages between biodiversity attributes and ecosystem services: A systematic review'. Ecosystem Services, DOI 10.1016/j.ecoser.2014.05.006i

"Biodiversity conservation cannot be accomplished by placing a glass bell over a protected area; you have to realise that nature is a resource and a provider of services for the socio-economic activities within an area." Quote from stakeholder.

SEVENTH FRAMEWORK PROGRAMME