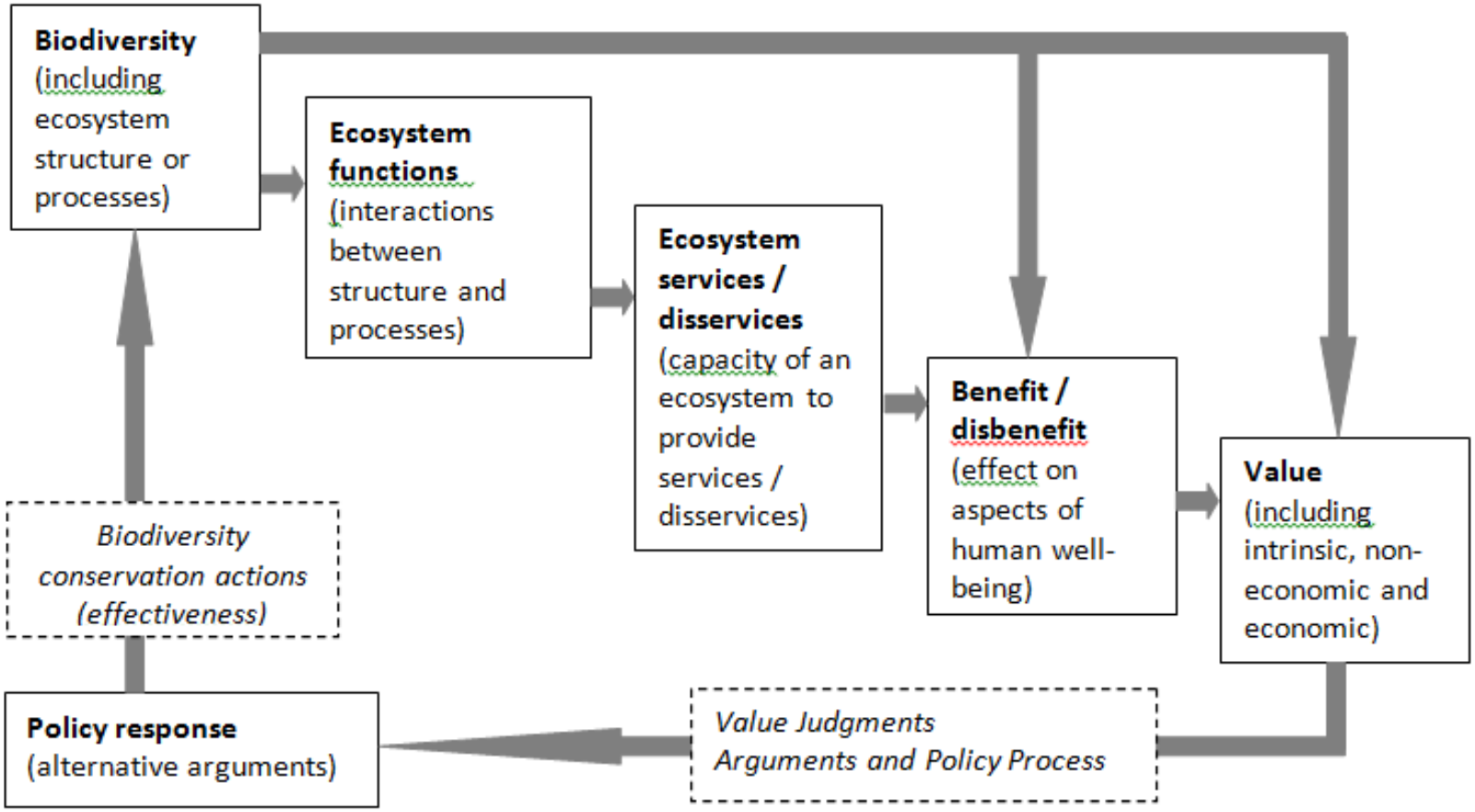
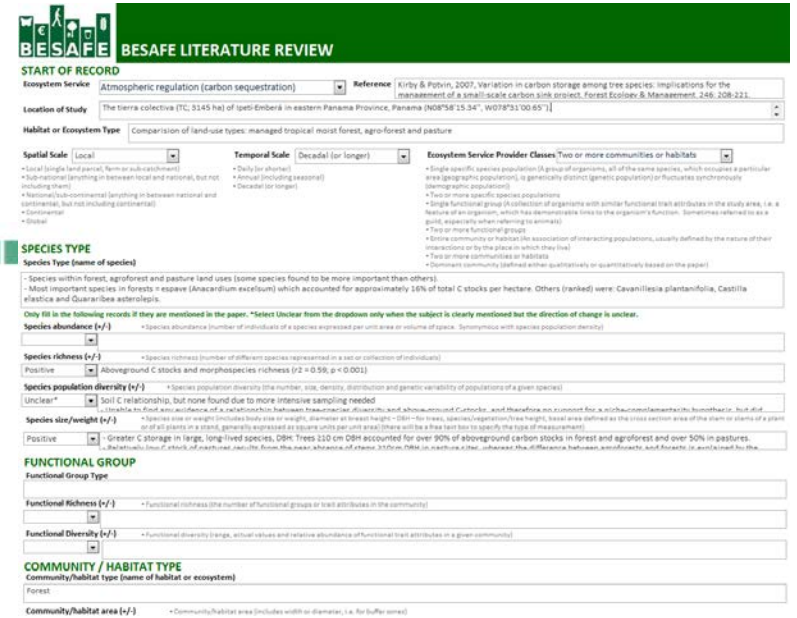
"Evidence for the links between biodiversity and ecosystem services and how ecosystem services are used in argumentation"

Pam Berry and BESAFE partners

Background


Biodiversity (including ecosystem structure or processes)
Ecosystem functions (interactions between structure and processes)
Ecosystem services / disservices (capacity of an ecosystem to provide services / disservices)
Benefit / disbenefit (effect on aspects of human well-being)
Value (including intrinsic, non-economic and economic)
Biodiversity conservation actions (effectiveness)
Policy response (alternative arguments)
Value Judgments Arguments and Policy Process

Database


BESAFE LITERATURE REVIEW

START OF RECORD

Ecosystem Service: Atmospheric regulation (carbon sequestration)

Reference: Kirby & Potvin, 2007, Variation in carbon storage among tree species: implications for the management of a small-scale carbon sink project. Forest Ecology & Management, 246: 208-221.

Location of Study: The tierra colectiva (TC; 3145 ha) of Ipetí-Emberá in eastern Panama Province, Panama (N08°58'15.34", W078°31'00.65")

Habitat or Ecosystem Type: Comparision of land-use types: managed tropical moist forest, agro-forest and pasture

Spatial Scale: Local

Temporal Scale: Decadal (or longer)

Ecosystem Service Provider Classes: Two or more communities or habitats

SPECIES TYPE

Species Type (name of species)

- Species within forest, agroforest and pasture land uses (some species found to be more important than others).
- Most important species in forests = espave (Anacardium excelsum) which accounted for approximately 16% of total C stocks per hectare. Others (ranked) were: Cavanillesia plantanifolia, Castilla elastica and Quararibea asterolepis.

Only fill in the following records if they are mentioned in the paper. *Select Unclear from the dropdown only when the subject is clearly mentioned but the direction of change is unclear.

Species abundance (+/-)

Species richness (+/-): Positive — Aboveground C stocks and morphospecies richness (r2 = 0.59; p < 0.001)

Species population diversity (+/-): Unclear* — Soil C relationship, but none found due to more intensive sampling needed

Species size/weight (+/-): Positive — Greater C storage in large, long-lived species, DBH: Trees ≥10 cm DBH accounted for over 90% of aboveground carbon stocks in forest and agroforest and over 50% in pastures.

FUNCTIONAL GROUP

Functional Group Type

Functional Richness (+/-)

Functional Diversity (+/-)

COMMUNITY / HABITAT TYPE

Community/habitat type (name of habitat or ecosystem): Forest

Community/habitat area (+/-)

- Ecosystem service
- Reference
- Location of the study
- Spatial scale
- Temporal scale
- Ecosystem service provider (ESP; 7 classes)
- Important attributes or traits of the ESP (27 classes)
- Abiotic factors which affect service delivery
- Is the ESP also an ecosystem service antagoniser (ESA)
- Negative effects of biodiversity on the service
- Ecosystem service beneficiary (ESB; 6 classes)
- Source of value (7 classes)
- Strength of the evidence.

Ecosystem services reviewed

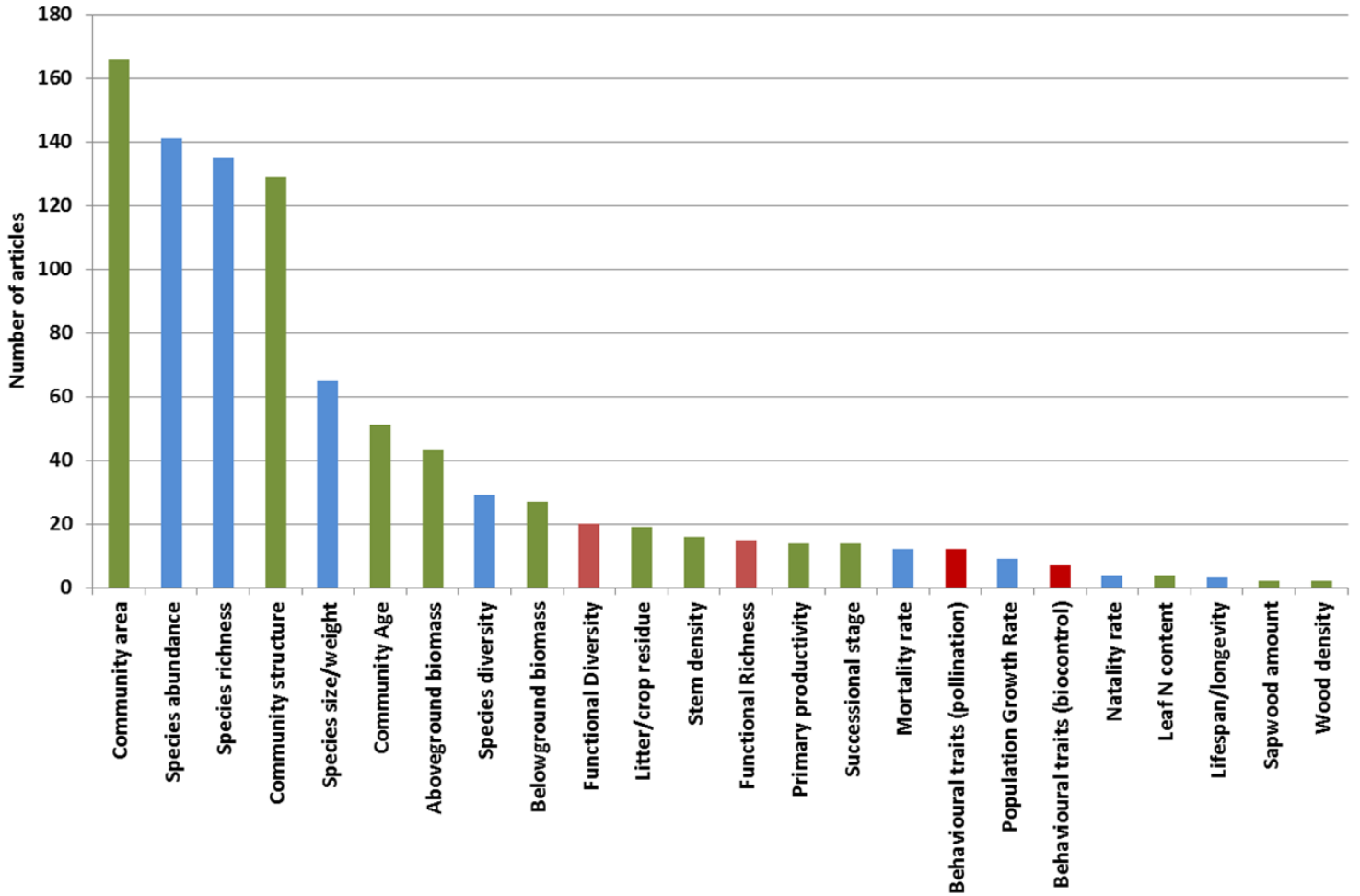
- **Provisioning services:**
  - Potable water (quantity)
  - Timber production
  - Freshwater fishing
- **Regulating services:**
  - Water quality regulation
  - Water flow regulation (flood protection)
  - Mass flow regulation (erosion protection)
  - Atmospheric regulation (carbon sequestration)
  - Pollination
  - Pest & disease control (biological control)
- **Cultural services:**
  - Recreation activities
  - Landscape aesthetics

Links between ESP classes & ES

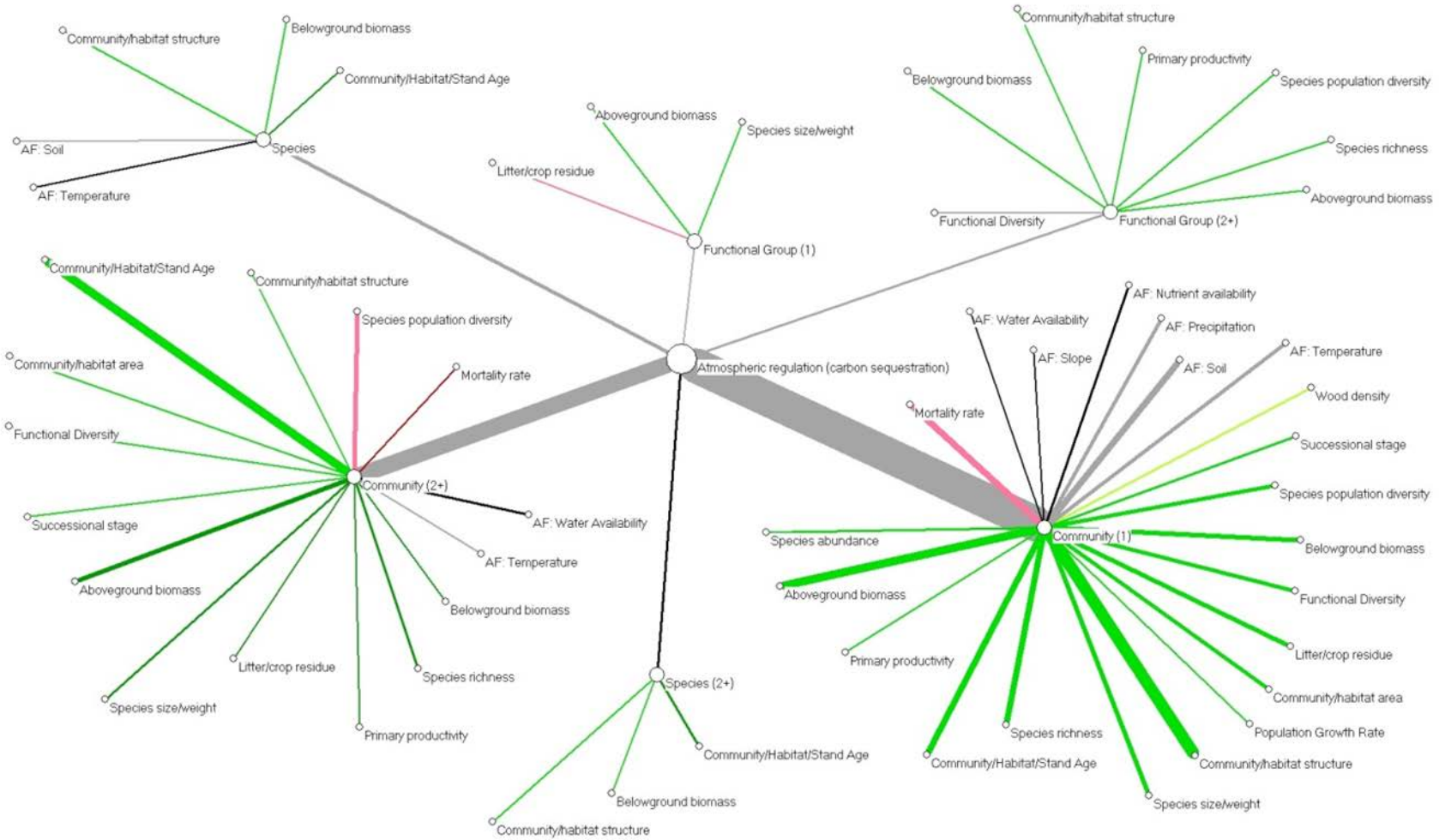
Ecosystem service	SP1	SP2+	FG1	FG2+	DC	CH1	CH2+
Provisioning services:							
Timber production	0	80	0	20	0	0	0
Freshwater fishing	27	69	0	0	0	4	0
Freshwater provision	2	8	0	0	0	42	48
Regulating services:							
Water purification	6	10	0	2	0	54	28
Water flow regulation (flood protection)	8	20	0	0	4	50	18
Mass flow regulation (erosion protection)	4	10	2	10	0	46	28
Atmospheric regulation (carbon sequestration)	6	4	2	4	0	56	28
Pest regulation (biological control)	20	12	30	14	0	20	4
Pollination	6	16	70	6	0	0	2
Cultural services:							
Recreation (species-based)	30	66	0	0	0	4	0
Landscape aesthetics	0	0	0	0	0	84	16

SP = specific population; FG = functional group; DC = dominant community; CH = community/habitat

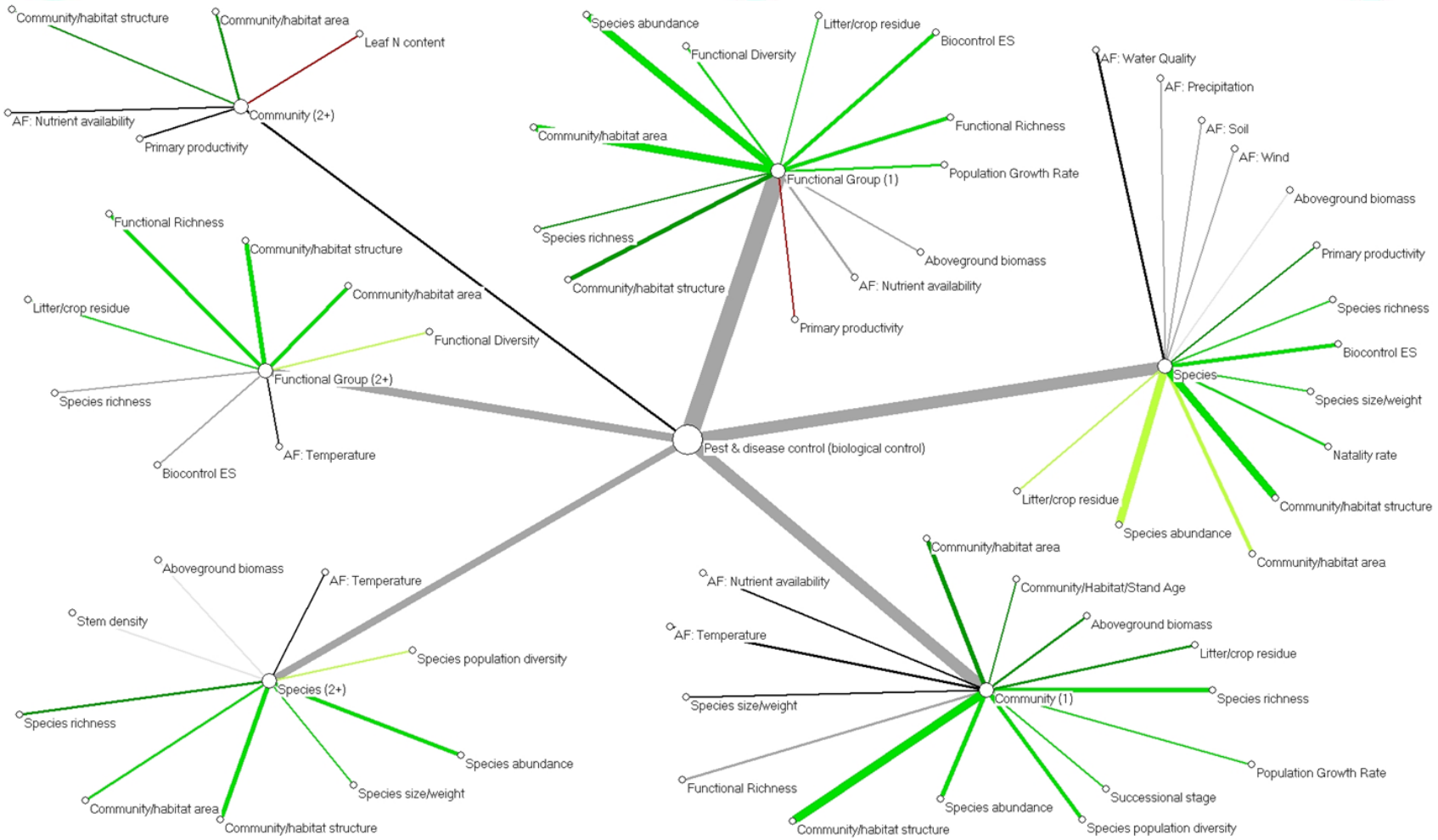
Links between attributes and ES



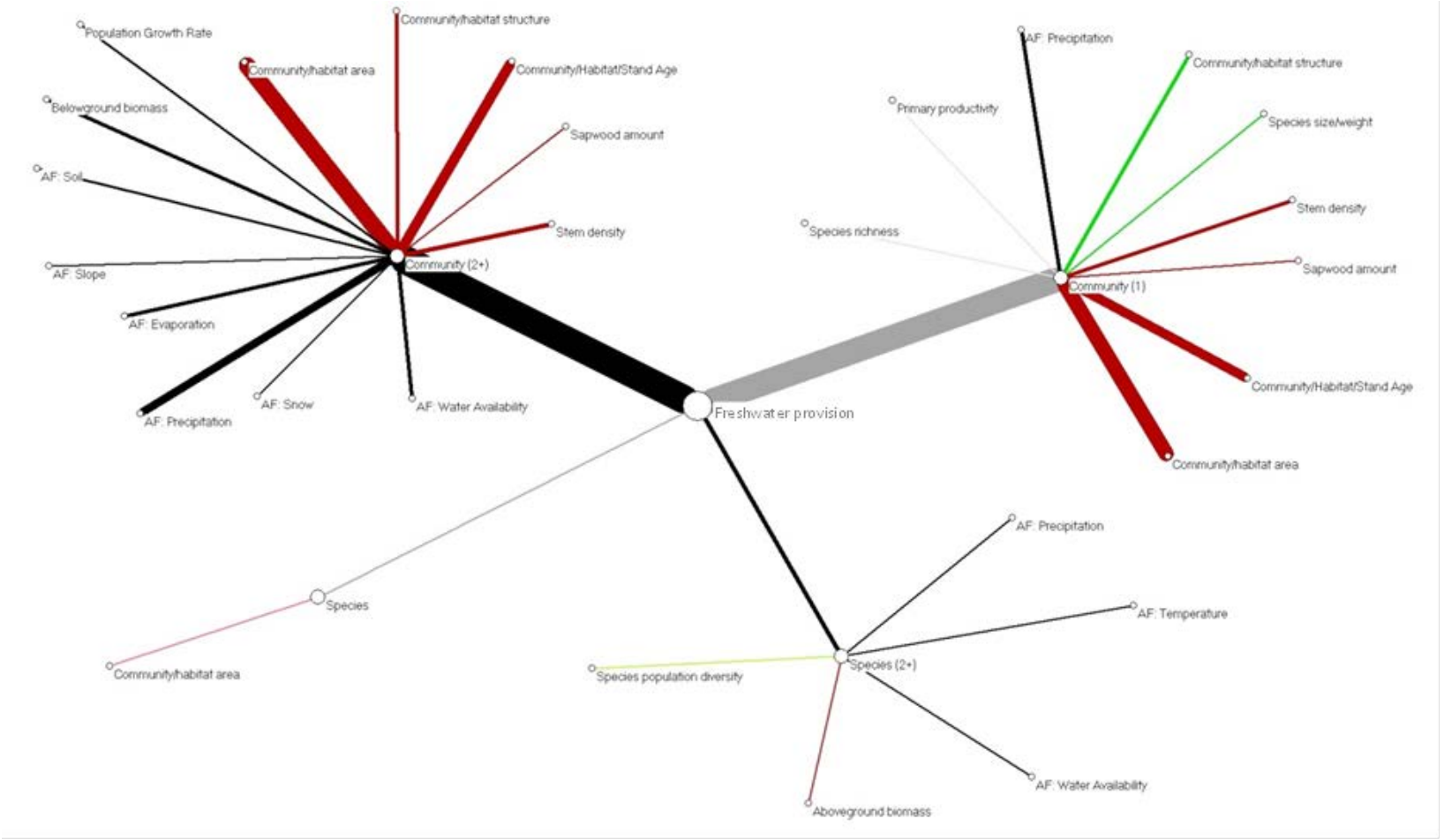
Network analysis: Atmospheric regulation



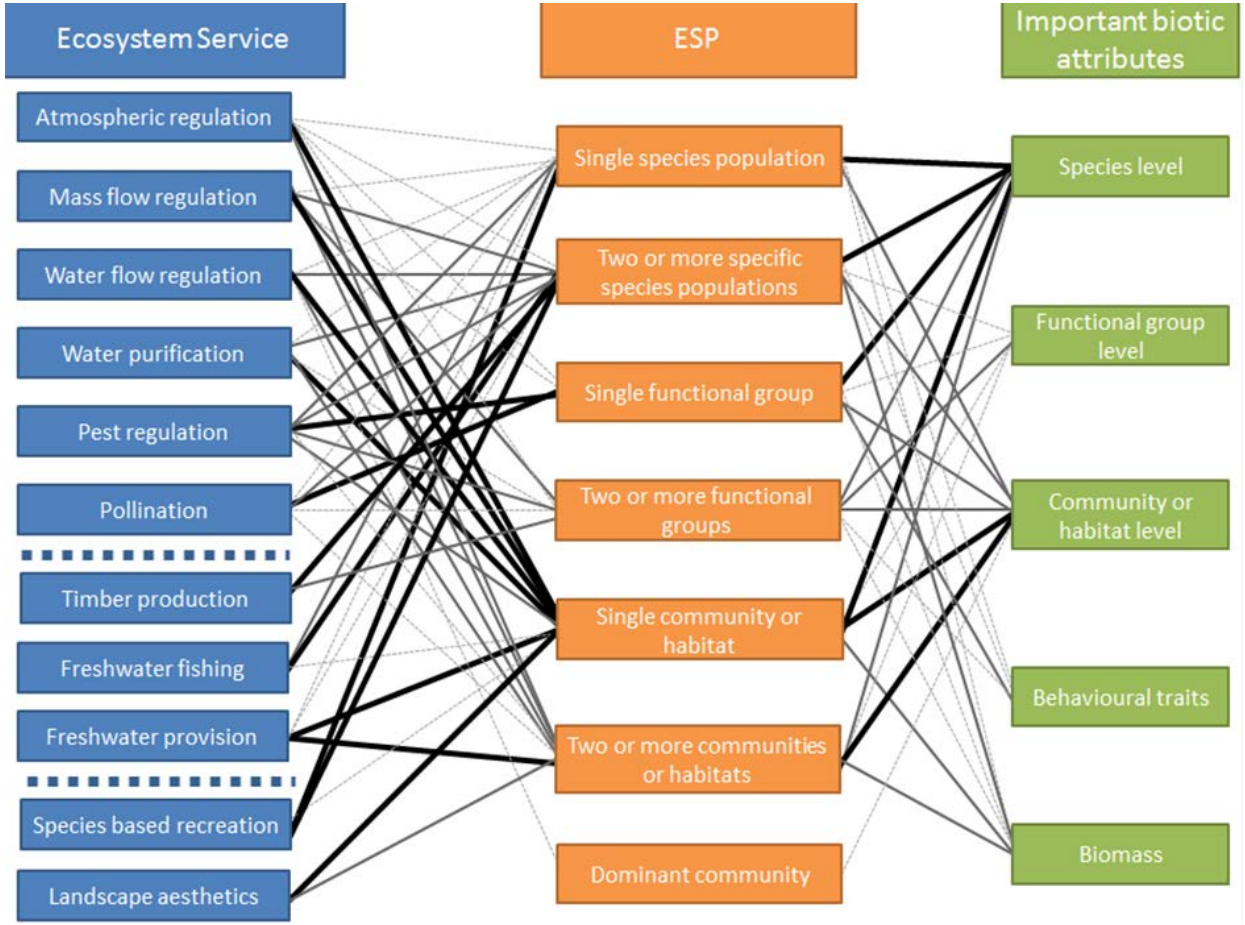
Network analysis: Pest regulation



Network analysis: freshwater provision



Combined network analysis



(inc. species richness, diversity, abundance, size and weight)

(inc. functional diversity and functional richness)

(inc. habitat area, age, structure, successional stage)

(inc. flower visiting behaviour and bio-control)

(inc. above and belowground biomass and litter or crop residue).

Conclusions on links between biodiversity and ES

- Certain types of ES tend to be linked with certain types of ESPs, however, there are still many gaps in knowledge on the direction and strength of specific relationships between ES – ESPs – biotic attributes.
- While the ES valuation literature is extensive, only very few studies explicitly cover the relationships from values – ESBs – ESPs – biodiversity.
- The results will be compared with and how stakeholder perceptions of these relationships affect argumentation surrounding biodiversity conservation and with the awareness of different stakeholder groups regarding the relationship between biodiversity, ecosystem services and values.

Mapping stakeholders views

Studying stakeholders' subjectivity in terms of the importance of biodiversity and ES and their view on the relationship between biodiversity and ES through a Q study

The aim of the Q-study:

To identify and characterise different views across stakeholders and EU member states

The hypothesis is that argumentation will be more effective if it acknowledges the receiver's view point

The Q-study

The methodology:

1) Select **statements** from the literature which spans the debate on biodiversity and ecosystem service priorities

2) Select **interviewees** representing different stakeholder groupings

3) Interviewees **sort statements** according to the degree to which they agree with the statements.

4) Characterisation of similar sorts – identifying **existing viewpoints** or discourses

The Q-study cont.

The Q study:

1) Selected 42 **statements** from review of biodiversity argumentation to represent different argument types

2) Selected 15-20 **interviewees** from each of the 8 countries (Denmark, Finland, Hungary, Norway, Poland, Romania, Spain, UK) representing policy makers, researchers and NGOs

3) Face-to-face interviews with more than 120 stakeholders.

...ly illustration of results (I)

The extinction of a species is like the destruction of a great work of art

Protecting ecosystem service providers is important because they are a source of economic value.

S... ...nto three stake...
Poli... ...chers and NGOs

The data are the sorts (ranking) of the 42 statements from each of the stakeholder groups.

The analyses allow us to identify different points of view within stakeholder groups using factor analysis.

The earth's biodiversity should be conserved because genetic diversity may be valuable in the development of new drugs against disease.

Q-study illustration of results (II)

Policymakers: we found three statistically distinct and coherent views on the topic:

View No 1: Values biodiversity and pristine nature in itself.

View No 2: Values ES and finds biodiversity important as underpinning service delivery

View No 3: A utilitarian perspective. Gives priority to the ways in which biodiversity and ES are important for human beings

Q-study illustration of results (III)

Researchers: we found four statistically distinct and coherent views:

View No 1: Favours intrinsic value points of view

View No 2: Sees the functional value of biodiversity as the most important argument for conservation

View No 3: This view puts higher emphasis than the other views on the role of uncertainty in biodiversity conservation debates

View No 4: This view represents a utilitarian perspective.

Q-study illustration of results (IV)

NGOs: we found two statistically distinct and coherent views on the topic:

View No 1: Ranks both intrinsic value and utilitarian aspects of biodiversity and ES arguments highly.

View No 2: Values spiritual and aesthetic aspects of biodiversity and nature in general

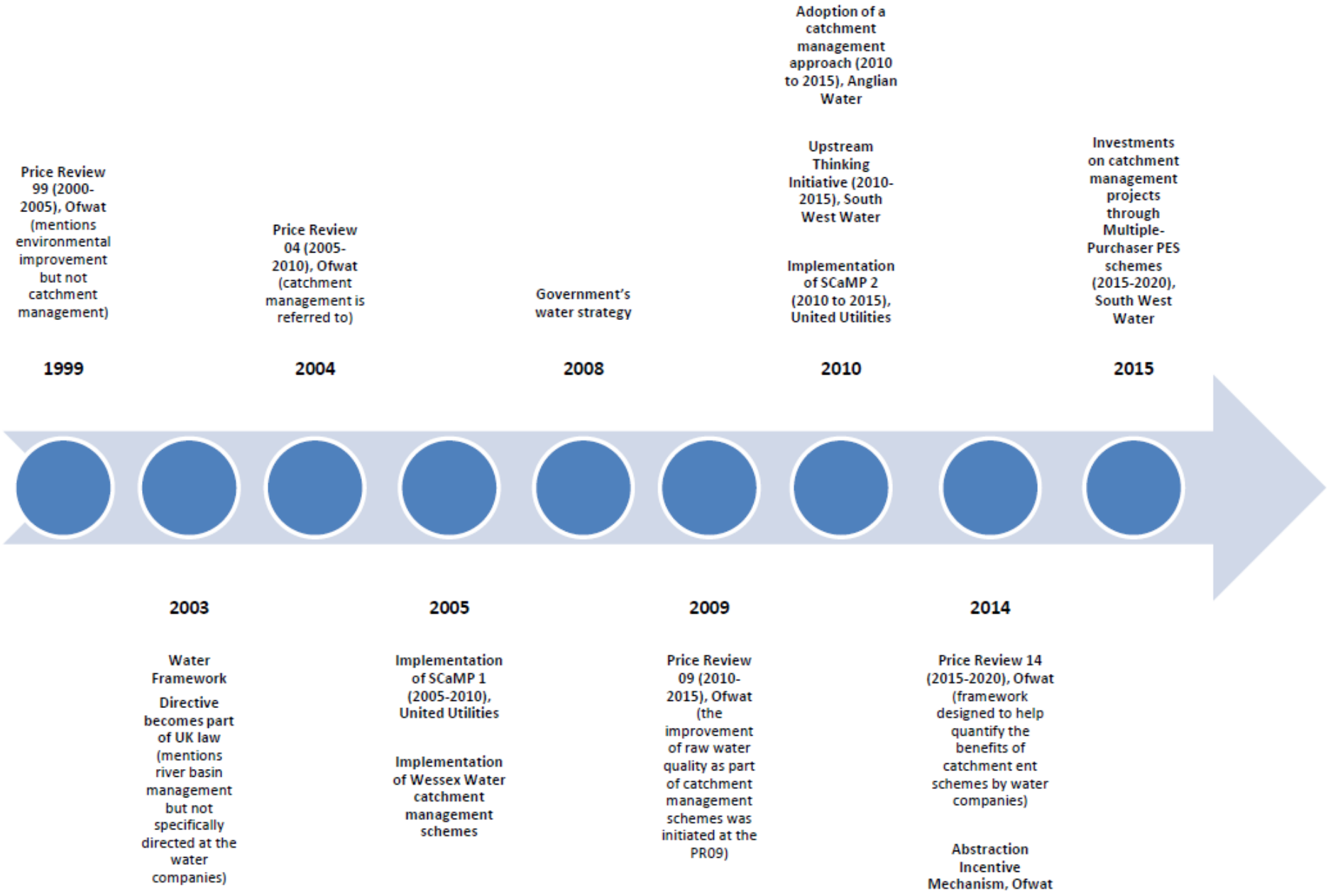
Preliminary conclusions on arguments used by stakeholders

- All three have a utilitarian perspective in common
- researchers and NGOs have another view in common (intrinsic value)
- there appears to be a difference in how policymakers view nature
- there are differences in the arguments you should/could use to influence the various groups

Water industry case study

- How do water companies use arguments to justify large scale (€bns) investments in catchment management?
- How do others react to these arguments and what supporting or counter arguments do they use?
- How do arguments combine to influence the investment strategy of water companies and the industry regulator's decisions?
- How effective are arguments used in supporting the protection of biodiversity and environmental quality?

Figure 1. Timeline of events related to the implementation of the catchment management approach



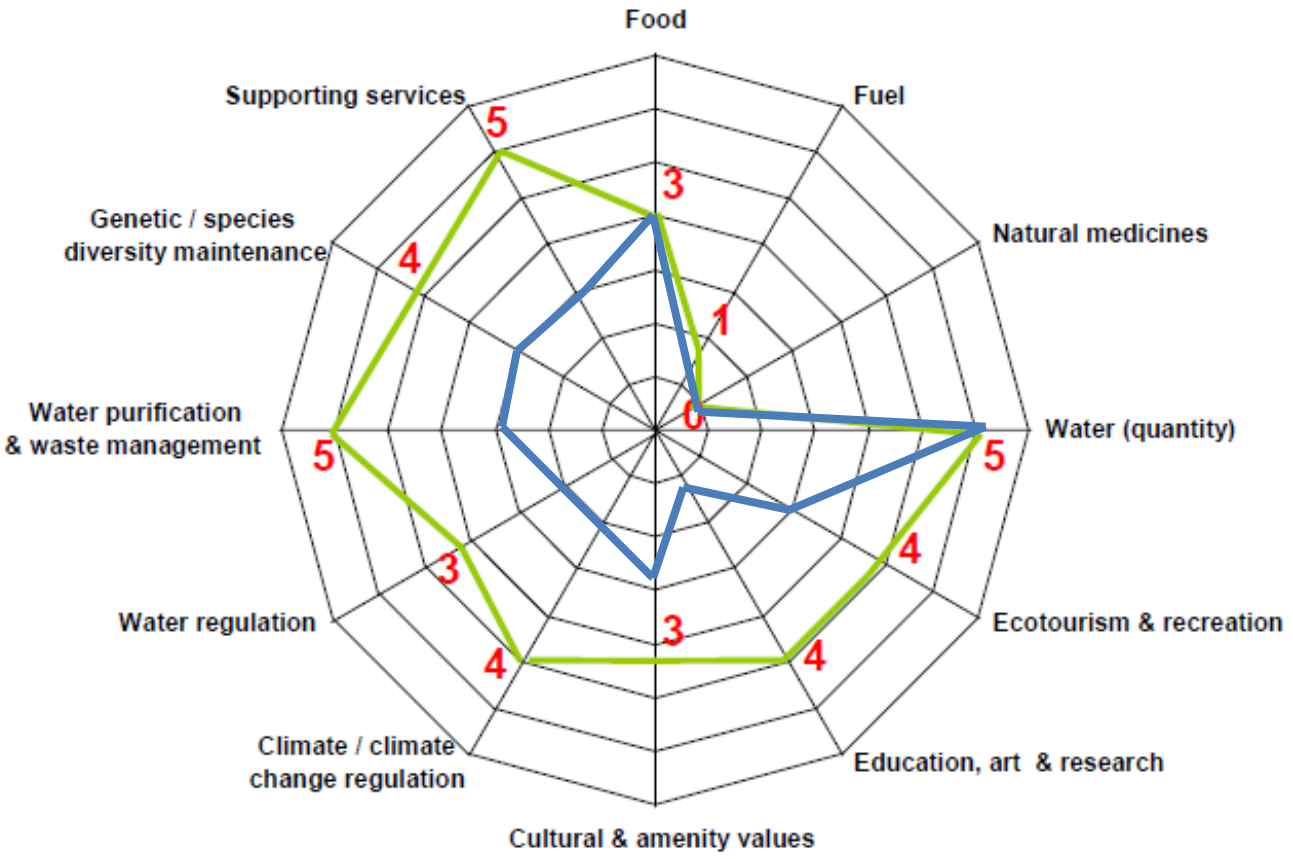
SCaMP (United Utilities)

- Grip blocking, rewetting, grazing management
- Rapid restoration of ecosystem and services

BESAFE: UK Water industry study

- From catchment to customer: Can upstream catchment management deliver a better deal for water customers and the environment?
- 2009 price review “agreed companies’ plans to invest £5.3 billion by 2015 to maintain/improve water quality and environmental standards.”
- c. 2/3 for restoring upland water catchments
- “More work is needed to ensure that the benefits … are demonstrated clearly”

Ecosystem services SCaMP



Service	Present value (50 years)	Present value (100 years)	Notes (and see details of unit estimates above)
Food	0	0	assumed negligible
Fibre	0	0	
Renewables	Not applicable.		
Water quality	Not valued – positive, could be very significant, but high uncertainty		
Flood risk	Not valued – positive, could be significant.		
Recreation	£4.7 million	£7.3million	based on small increase in value for large number of visits per year
Field sports	Not valued – positive, probably minor.		
Non-use: historic and cultural	£4.7 million	£7.3 million	based on small willingness to pay per household spread over population of region. Some risk of double counting with recreation.
GHGs	£0.86 million	£1.9 million	based on official values and assumed sequestration potential
Biodiversity /wildlife	Not assessed separately due to risk of double counting with non-use and recreation, and because suitable values for transfer not available,. But likely additional value.		
Total service changes	**£10.2 million**	**£16.4 million**	sum of above very approximate estimates. True benefits will be higher due to omitted categories.
Costs	£15 million	£16 million	making small *ad hoc* allowances for ongoing costs after first 10 years
Net present value	**-£4.8 million**	**£0.4 million**	Note that omitted categories likely to bring substantial benefits, hence the NPV figures are not reliable.

Arguments used (regulator)

- …companies reduce pollution levels in the water they take from the environment … by working with other stakeholders … to reduce the amount of diffuse pollution
  - water requires less treatment to make it fit to drink.
  - This **lowers costs to customers** …
  - …and **avoids generating greenhouse gas emissions** from treatment processes.
  - can also reduce … extra treatment …before returning water to environment.
- These techniques can also deliver other benefits. For example… work to restore an area of upland moorland could:
  - **boost the environment's natural capacity** to store carbon and help mitigate climate change;
  - **improve the variety of animal and plant life** that the environment can support; and
  - slow down the rate at which rainwater runs off land to **reduce the risk of flooding**.

Dynamics in arguments

- "We are changing our regulatory approach to focus more on ensuring the companies deliver the **broader outcomes that customers and society value**"
- Companies to supply **evidence** including:
  - cost-benefit analysis (including carbon);
  - evidence of customer support; **AND**
  - approaches for dealing with risk and uncertainty in decision-making

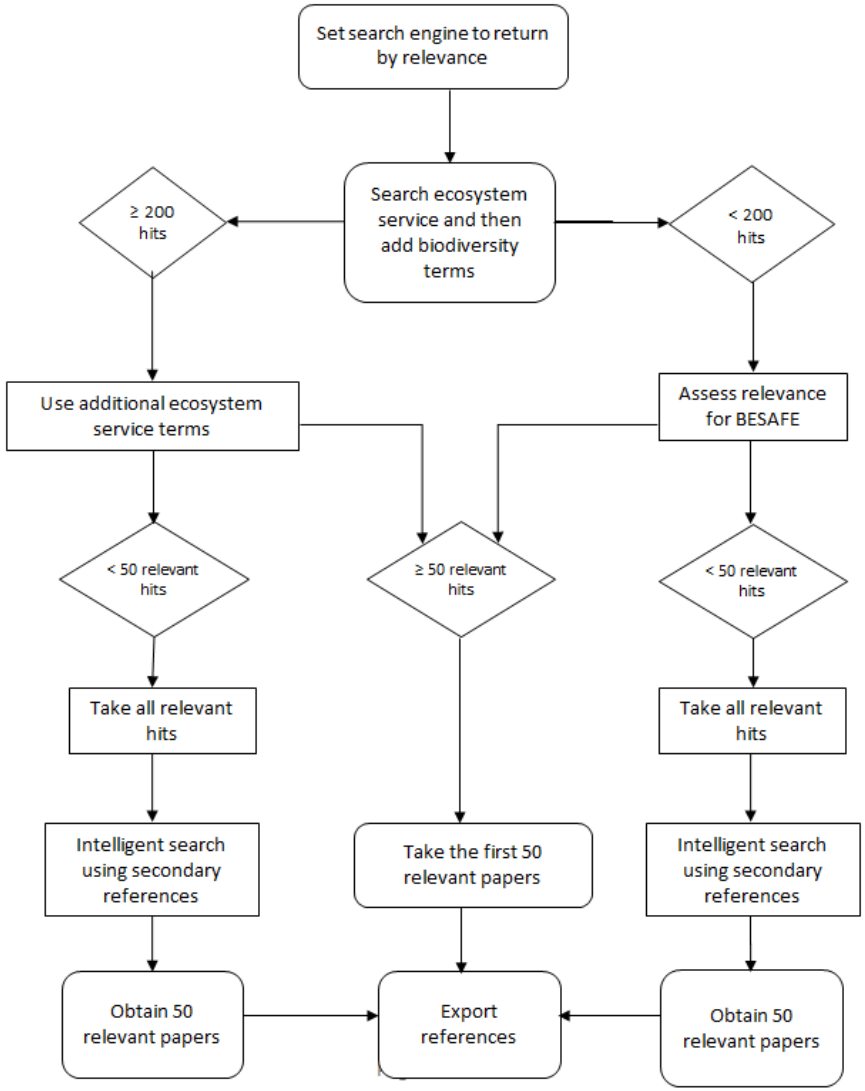
Questions for break out

1a. How could/would you use the information on the links between biodiversity and ES?

1b. How would you like it made available?

2. How could you use knowledge of different stakeholders views of the arguments?

Review protocol



Example keywords for atmospheric regulation:

Ecosystem service/ disservice terms	Biodiversity terms	Additional terms
Carbon storage	Biodiversity	Tree*
Carbon sequestration	"Biological diversity"	Soil*
Carbon loss	Species	Biomass
Carbon emissions	Habitat*	
	Genetic	
	Trait*	
	Function*	
	Landscape	
	Richness	
	Abundance	