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National and Global Ecosystem Assessments

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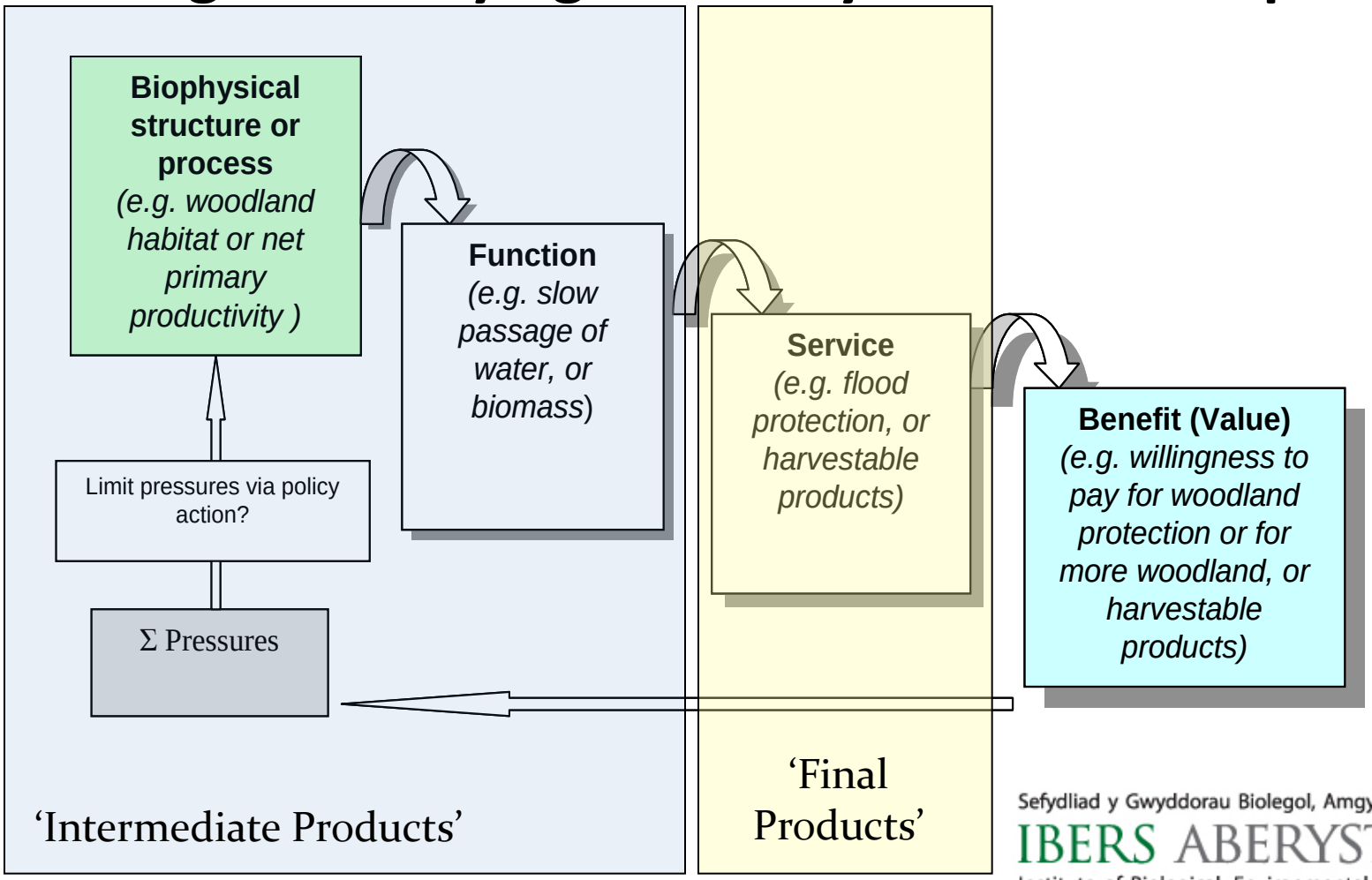
Overview

- Ecosystems approach to policy making
- TEEB
- UK NEA

What is ecosystem valuation?

- An ecosystems approach to valuation provides a framework for looking at **whole ecosystems** in decision making, and for **valuing the ecosystem services they provide**, to ensure that we can maintain a healthy and resilient natural environment now and for future generations.

The logic underlying the ecosystem services paradigm.



Source: Haines-Young *et al.*, (2006)

Ecosystems

- … a functioning interdependent grouping of living things existing in equilibrium with their physical environment.
- In ecosystems (such as those in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes), living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them. If one part is damaged or disappears, it can have an impact on everything else.

Ecosystems services

- Ecosystems provide valuable *services* for people; 'ecosystem services'.
- There is no single way of categorising ecosystem services, but include the provision of :
  - Resources for basic survival, such as clean air and water;
  - A contribution to good physical and mental health, for example through access to green spaces, both urban and rural, and genetic resources for medicines;
  - Natural processes, such as climate regulation and crop pollination;
  - Support for a strong and healthy economy, through raw materials for industry and agriculture, or through tourism and recreation; and
  - Social, cultural and educational benefits, and well-being and inspiration from interaction with nature.

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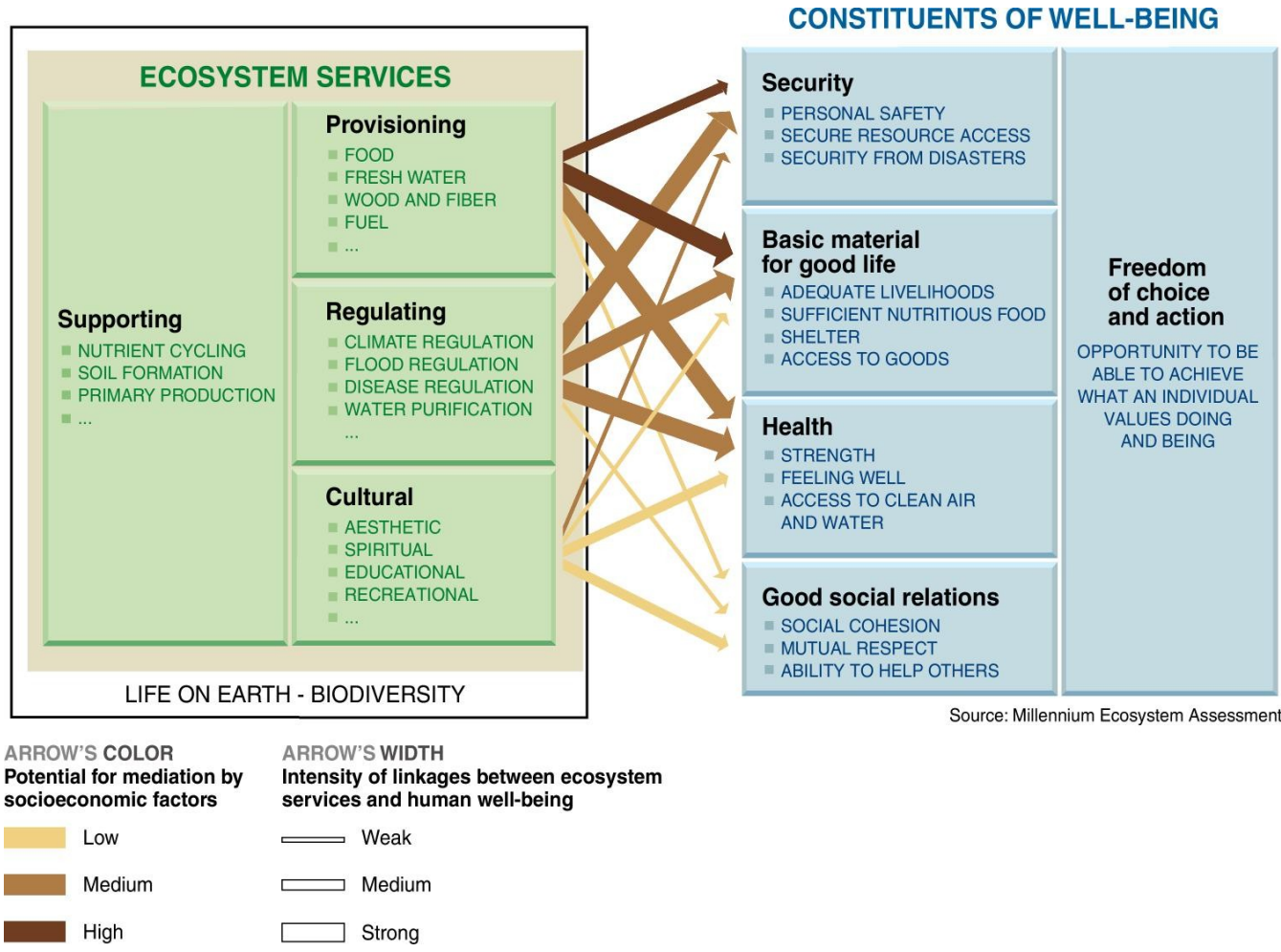
MEA (2005): Linkages between Ecosystem services and Human well-being.



Source: Millennium Ecosystem Assessment

MEA categories

Provisioning

Regulating

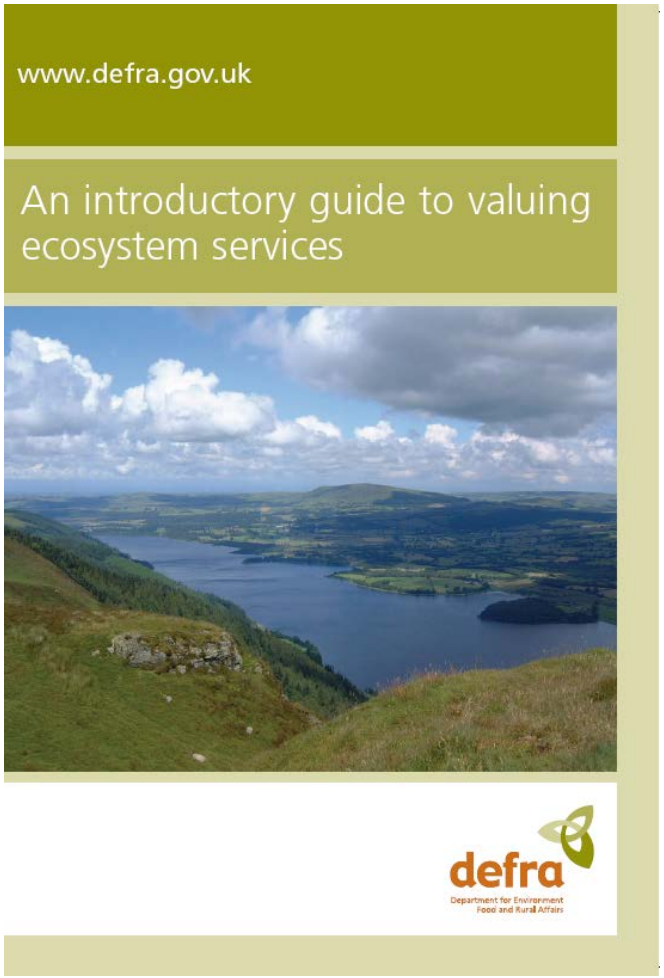
Cultural

Supporting

Category	Examples of ecosystem services provided
Provisioning services i.e. products obtained from ecosystems	• Food e.g. crops, fruit, fish • Fibre and fuel e.g. timber, wool • Biochemicals, natural medicines and pharmaceuticals • Genetic resources: genes and genetic information used for animal/plant breeding and biotechnology • Ornamental resources e.g. shells, flowers
Regulating services i.e. benefits obtained from the regulation of ecosystem processes	• Air-quality maintenance: ecosystems contribute chemicals to and extract chemicals from the atmosphere • Climate regulation e.g. land cover can affect local temperature and precipitation; globally ecosystems affect greenhouse gas sequestration and emissions • Water regulation: ecosystems affect e.g. the timing and magnitude of runoff, flooding etc. • Erosion control: vegetative cover plays an important role in soil retention/prevention of land/asset erosion • Water purification/detoxification: ecosystems can be a source of water impurities but can also help to filter out/decompose organic waste • Natural hazard protection e.g. storms, floods, landslides • Bioremediation of waste i.e. removal of pollutants through storage, dilution, transformation and burial
Cultural services i.e. non-material benefits that people obtain through spiritual enrichment, cognitive development, recreation etc	• Spiritual and religious value: many religions attach spiritual and religious values to ecosystems • Inspiration for art, folklore, architecture etc • Social relations: ecosystems affect the types of social relations that are established e.g. fishing societies • Aesthetic values: many people find beauty in various aspects of ecosystems • Cultural heritage values: many societies place high value on the maintenance of important landscapes or species • Recreation and ecotourism
Supporting services, necessary for the production of all other ecosystem services	• Soil formation and retention • Nutrient cycling • Primary production • Water cycling • Production of atmospheric oxygen • Provision of habitat

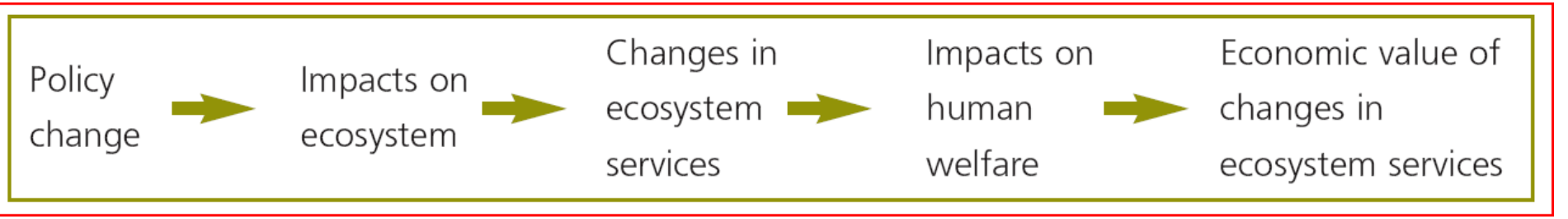
Source: MEA (2005)

Policy background - UK



Provides a practical introduction to the key steps to be undertaken in valuing ecosystem services in a policy appraisal context.

Key steps in the valuation of ecosystem services: impact pathway.



- **The impact pathway to policy change**
  - Helps to ensure a more systematic approach to accounting for impacts on ecosystems.
  - It recognises that there is considerable complexity in understanding and assessing the causal links between a policy, its effects on ecosystems and relating services and then valuing these effects in economic terms.
  - Requires integrated work with policy, science and economics disciplines.

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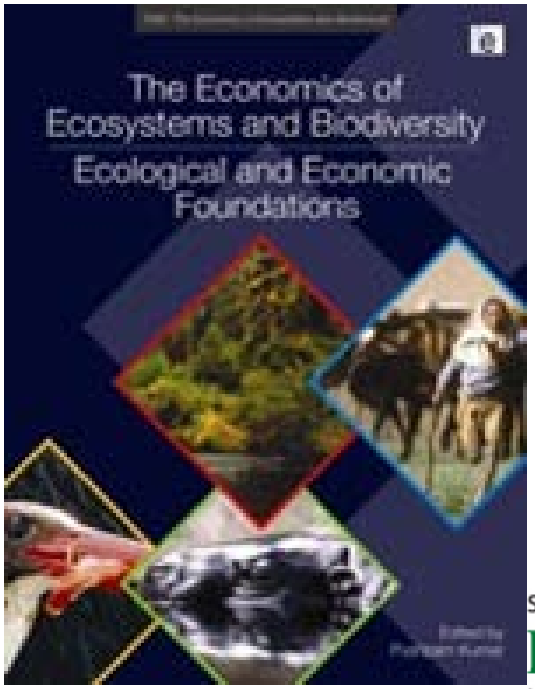
TEEB



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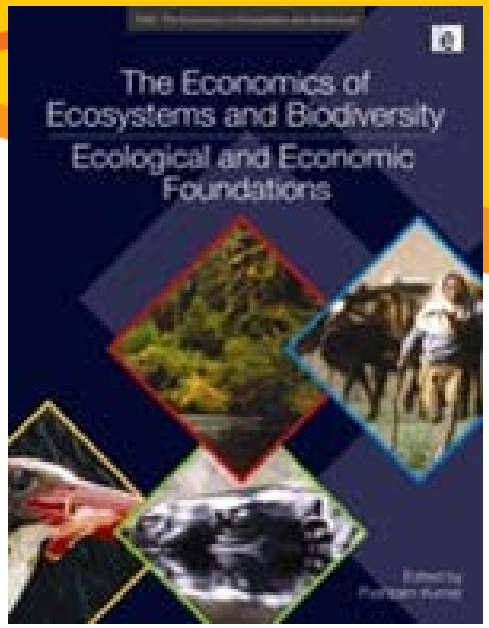


TEEB report

- 'The Economics of Ecosystems and Biodiversity' (TEEB) study was launched in 2007 in response to a proposal by the G8+5 Environment Ministers.

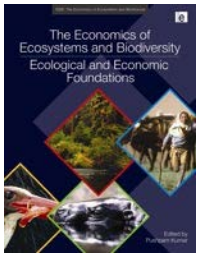
- TEEB aims to:
  - To draw attention to the global economic benefits of biodiversity,
  - To highlight the growing economic and human welfare cost of biodiversity loss and ecosystem degradation, and
  - To draw together expertise from the fields of science, economics and policy to enable practical actions to reduce biodiversity loss.

Study leader:
Pavan Sukhdev

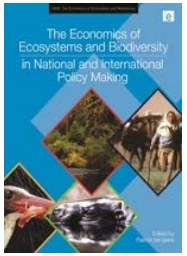
TEEB reports

TEEB has produced a series of reports, aimed at different audiences:

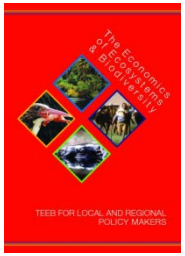
- Ecological and economic foundations (TEEB –D0)



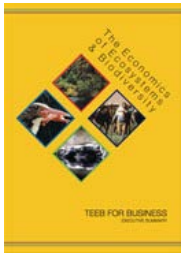
- TEEB for international and national policy makers (TEEB-D1)



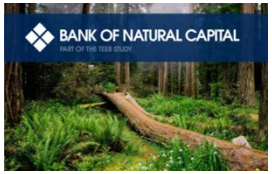
- TEEB for local governments (TEEB-D2)



- TEEB for business (TEEB-D3)



- TEEB for citizens (TEEB-D4)



TEEB conceptual framework and valuation

- The TEEB framework used meta analysis to collate existing data on the costs of biodiversity loss and ecosystem degradation to estimate mean values for:
  - 22 ESS
  - across 12 biomes.

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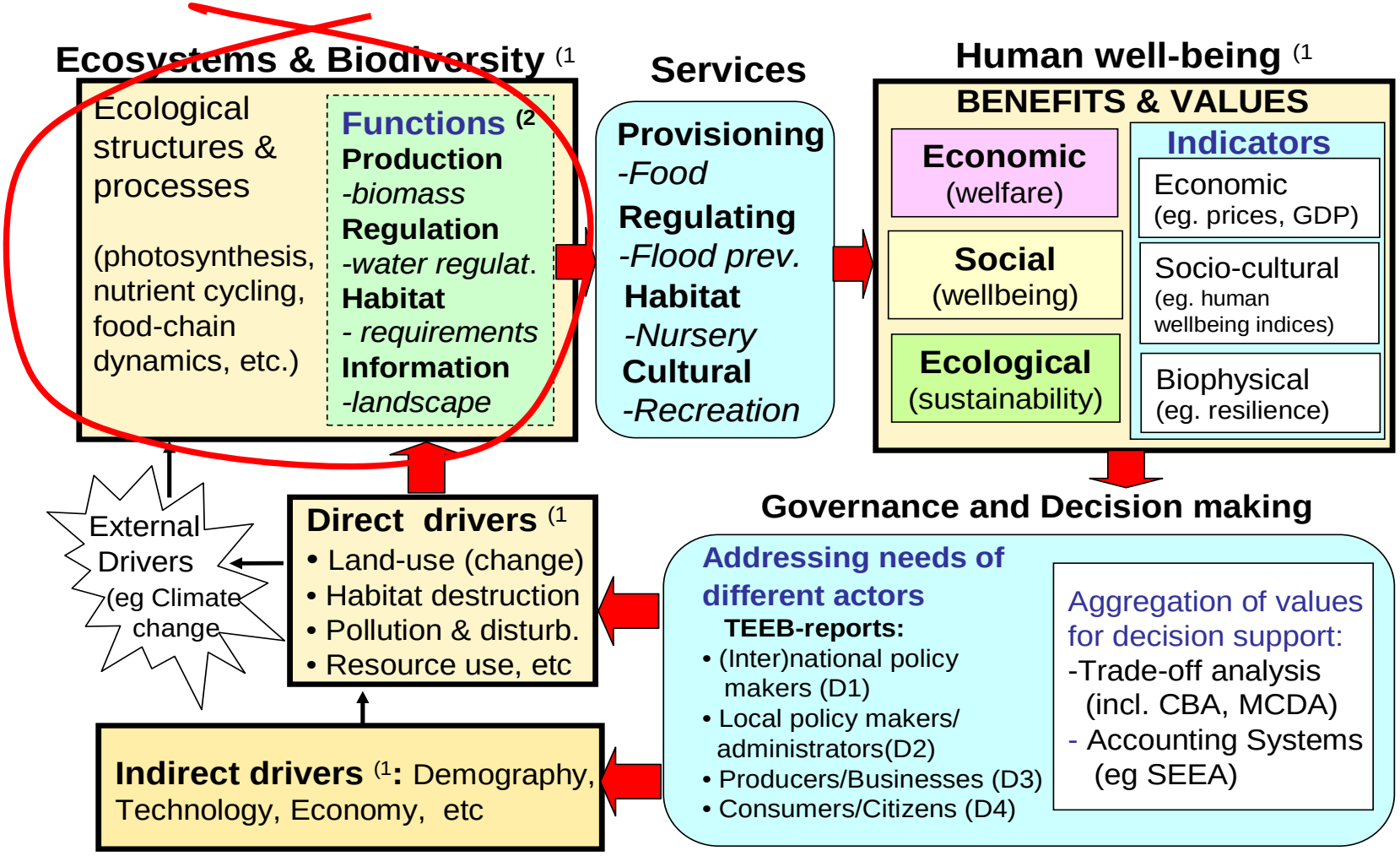
TEEB conceptual framework



1) The four bold-lined, brown filled boxes coincide with the overall MA-Framework

2) subset of ecosystem processes & components that is directly involved in providing the service

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TEEB Biomes

1	Marine / Open Ocean
2	Coastal systems
3	Wetlands
4	Lakes/Rivers
5	Forests
6	Woodland & shrubland
7	Grass/Rangeland
8	Desert
9	Tundra
10	Ice/Rock/Polar
11	Cultivated
12	Urban

These biomes were sub-divided in a much larger number of ecosystem types

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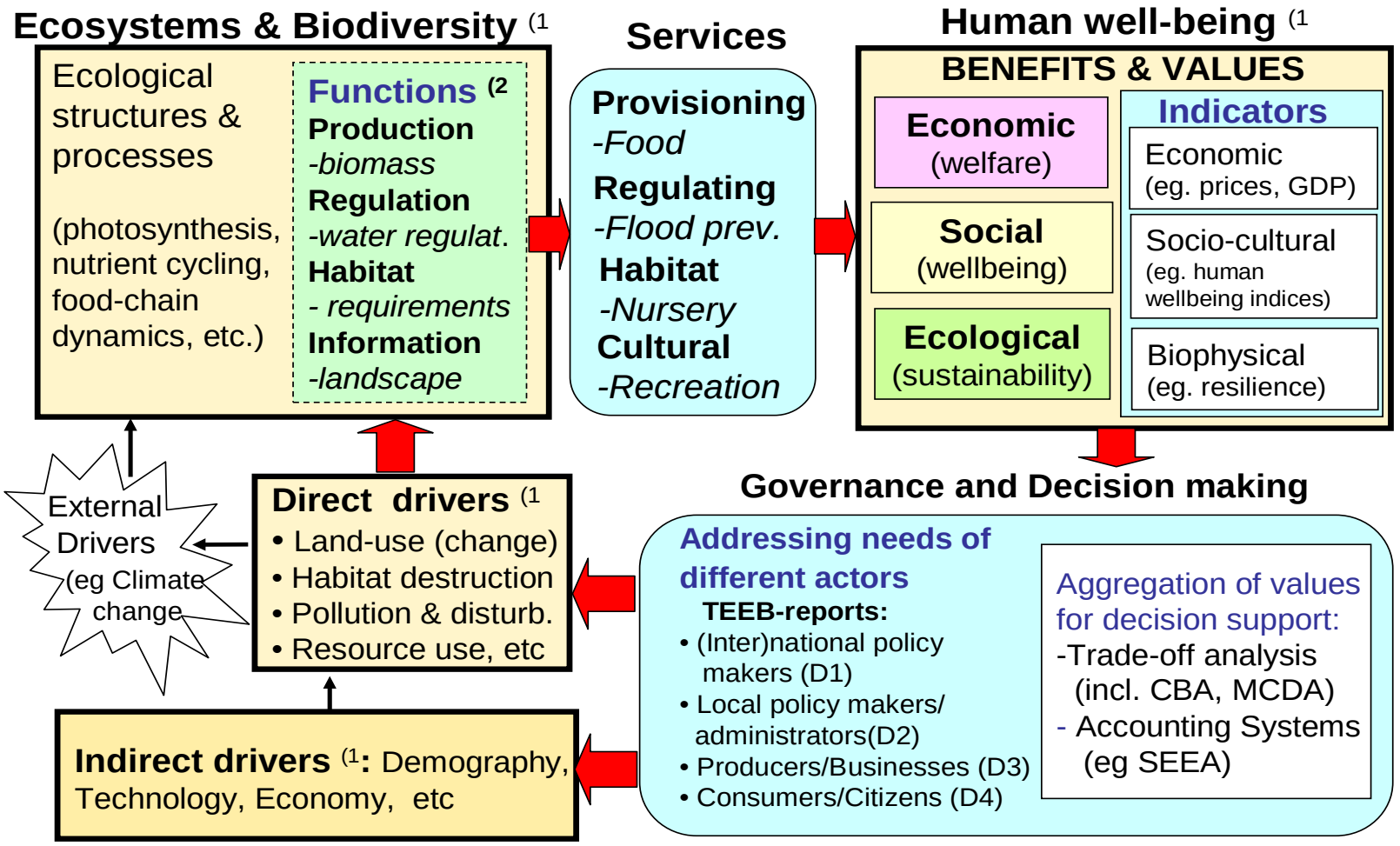
TEEB conceptual framework



1) The four bold-lined, brown filled boxes coincide with the overall MA-Framework

2) subset of ecosystem processes & components that is directly involved in providing the service

ES Services in TEEB

Provisioning

1 - Food
2 - Water
3 - Raw Materials
4 - Genetic resources
5 - Medicinal resources
6 - Ornamental resources

Regulating

7 - Air quality regulation
8 - Climate regulation
9 - Moderation of extreme events
10 - Regulation of water flows
11 - Waste treatment
12 - Erosion prevention
13 – Maint. soil fertility
14 - Pollination
15 - Biological control

Habitat/Supporting

16 – Maint. of migratory species (incl. nursery service)
17 – Maint. of genetic diversity (incl. evolutionary processes)

Cultural *[provide opportunities for:]*

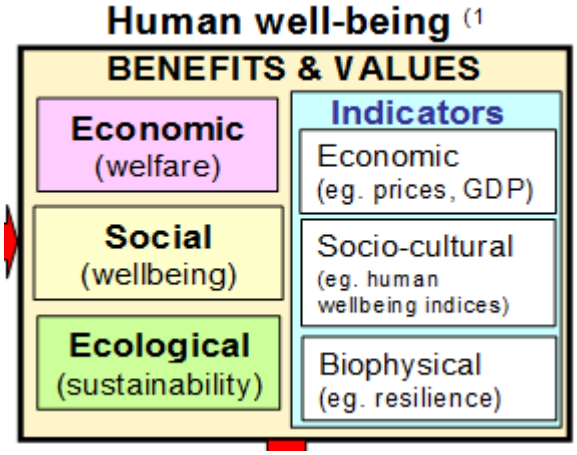
18 - Aesthetic enjoyment
19 - Recreation & tourism
20 - Inspiration for culture, art & design
21 - Spiritual experience
22 - Cognitive development

Benefits and values

- Economic benefits:
  - Captures ‘total economic value’.
    - Use values: e.g. Direct use values and Indirect use
    - Non-use values: Option, bequest, existence
  - There are a ranges of economic methods to capture these values

- Social-cultural benefits:
  - Includes mental health, historical, ethical, religious and spiritual values.

- Ecological values:
  - Ecological measures such as integrity, ‘health’ or resilience indicators
  - Important to determine critical thresholds and minimum requirements for ESS provision



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Valuation methods used in the TEEB value transfer

- 1 Direct Market Pricing
- 2 Avoided cost
- 3 Replacement cost
- 4 Factor income
- 5 Travel cost method
- 6 Hedonic pricing
- 7 Contingent Valuation
- 8 Group valuation

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TEEB-Framework

Link with decision-making

D1 – D4 reports used to disseminate information

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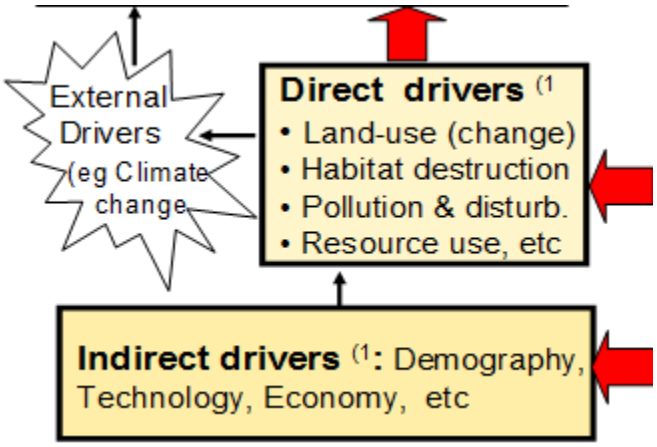
TEEB-Framework

Scenario analysis:

- Used to inform decision makers of the welfare gains and losses of alternative possible futures and different associated policy packages

- Drivers
  - Direct drivers
  - Indirect drivers
  - External



Living With Environmental Change

UK National Ecosystem Assessment

Ian Bateman

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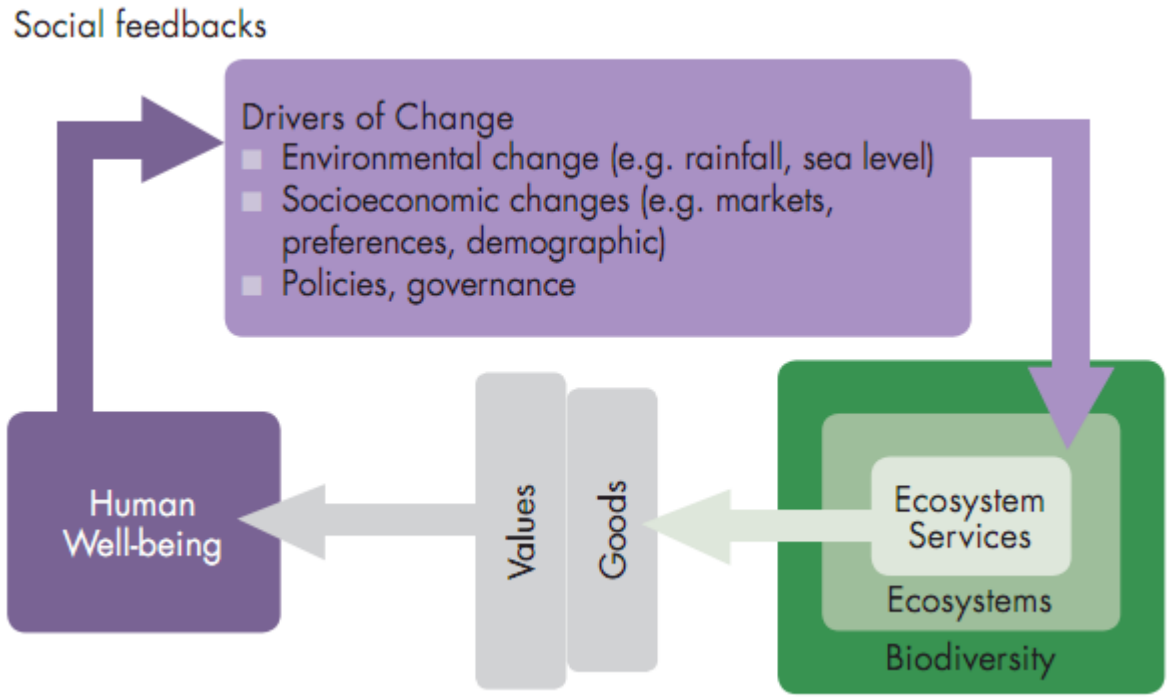
UK National Ecosystem Assessment

– NEA conceptual framework



UK NEA: Key questions

1. What are the status and trends of the UK's ecosystems and the services they provide to society?
2. What are the drivers causing changes in the UK's ecosystems and their services?
3. How do ecosystem services affect human well-being, who and where are the beneficiaries, and how does this affect how they are valued and managed?
4. Which vital UK provisioning services are not provided by UK ecosystems?
5. What is the current public understanding of ecosystem services and the benefits they provide?
6. Why should we incorporate the economic values of ecosystem services into decision making?
7. How might ecosystems and their services change in the UK under plausible future scenarios?
8. What are the economic implications of different plausible futures?
9. How can we secure and improve the continued delivery of ecosystem services?
10. How have we advanced our understanding of the influence of ecosystem services on human well-being and what are the knowledge constraints on more informed decision making?

TRENDS:

Importance of, and trends in, the **impact of drivers of change on UK habitats**

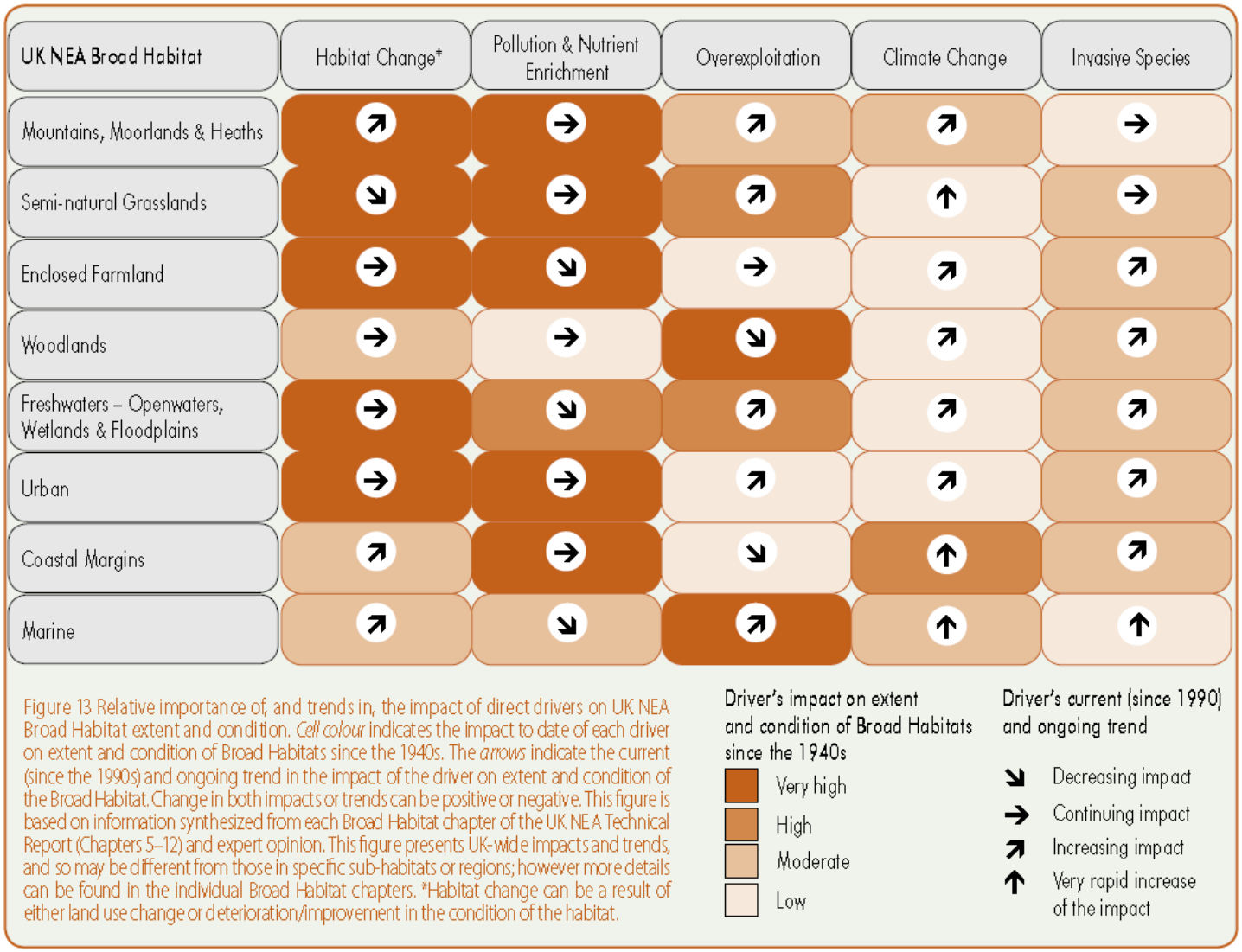


Figure 13 Relative importance of, and trends in, the impact of direct drivers on UK NEA Broad Habitat extent and condition. *Cell colour* indicates the impact to date of each driver on extent and condition of Broad Habitats since the 1940s. The *arrows* indicate the current (since the 1990s) and ongoing trend in the impact of the driver on extent and condition of the Broad Habitat. Change in both impacts or trends can be positive or negative. This figure is based on information synthesized from each Broad Habitat chapter of the UK NEA Technical Report (Chapters 5–12) and expert opinion. This figure presents UK-wide impacts and trends, and so may be different from those in specific sub-habitats or regions; however more details can be found in the individual Broad Habitat chapters. *Habitat change can be a result of either land use change or deterioration/improvement in the condition of the habitat.

Trends

Importance of, and trends in, the **impact of drivers of change on UK ecosystems services**

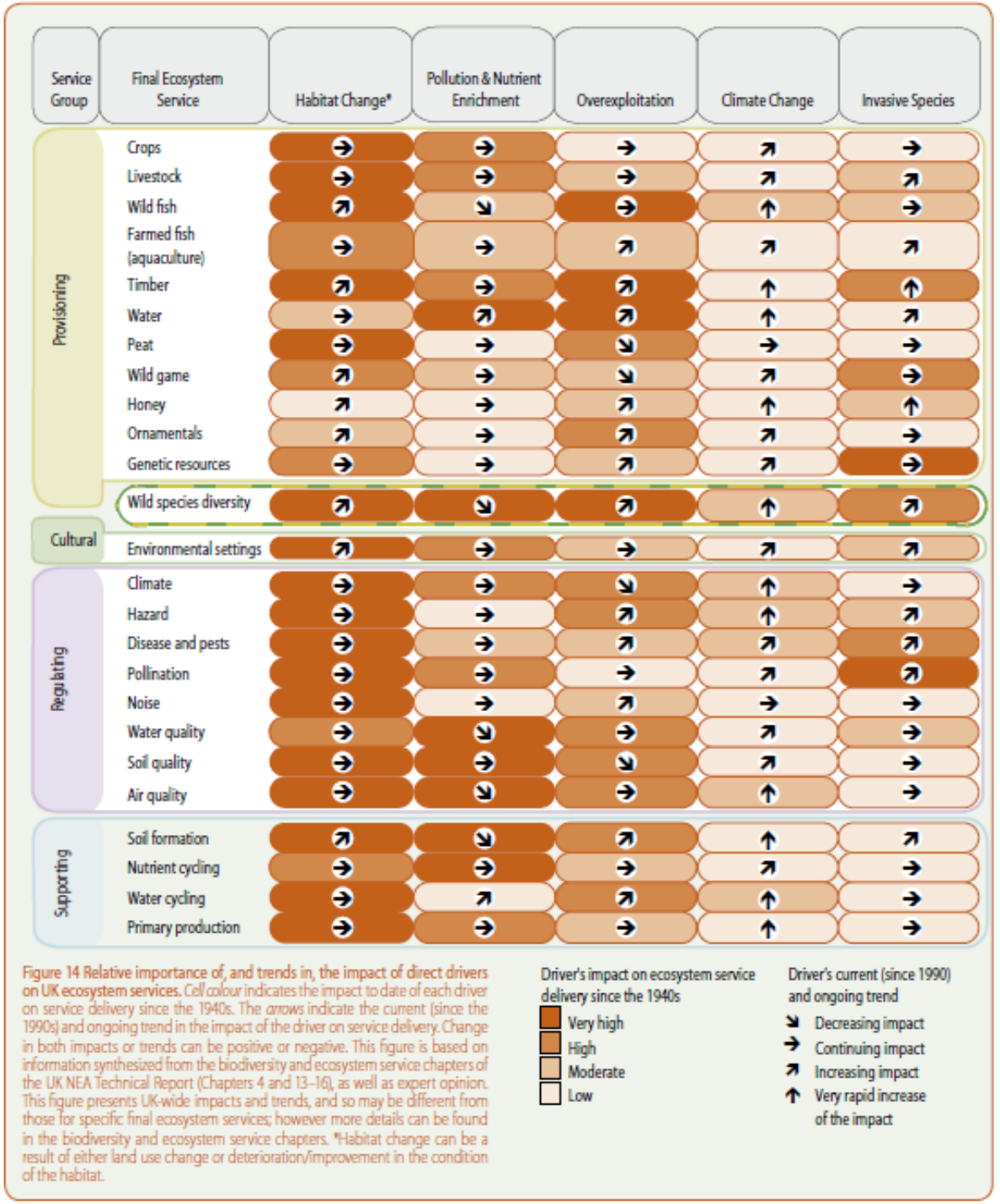


Figure 14 Relative importance of, and trends in, the impact of direct drivers on UK ecosystem services. *Cell colour* indicates the impact to date of each driver on service delivery since the 1940s. The *arrows* indicate the current (since the 1990s) and ongoing trend in the impact of the driver on service delivery. Change in both impacts or trends can be positive or negative. This figure is based on information synthesized from the biodiversity and ecosystem service chapters of the UK NEA Technical Report (Chapters 4 and 13–16), as well as expert opinion. This figure presents UK-wide impacts and trends, and so may be different from those for specific final ecosystem services; however more details can be found in the biodiversity and ecosystem service chapters. *Habitat change can be a result of either land use change or deterioration/improvement in the condition of the habitat.

TRENDS:

Importance of, and trends in, the **capacity of UK habitats to deliver ecosystem services**

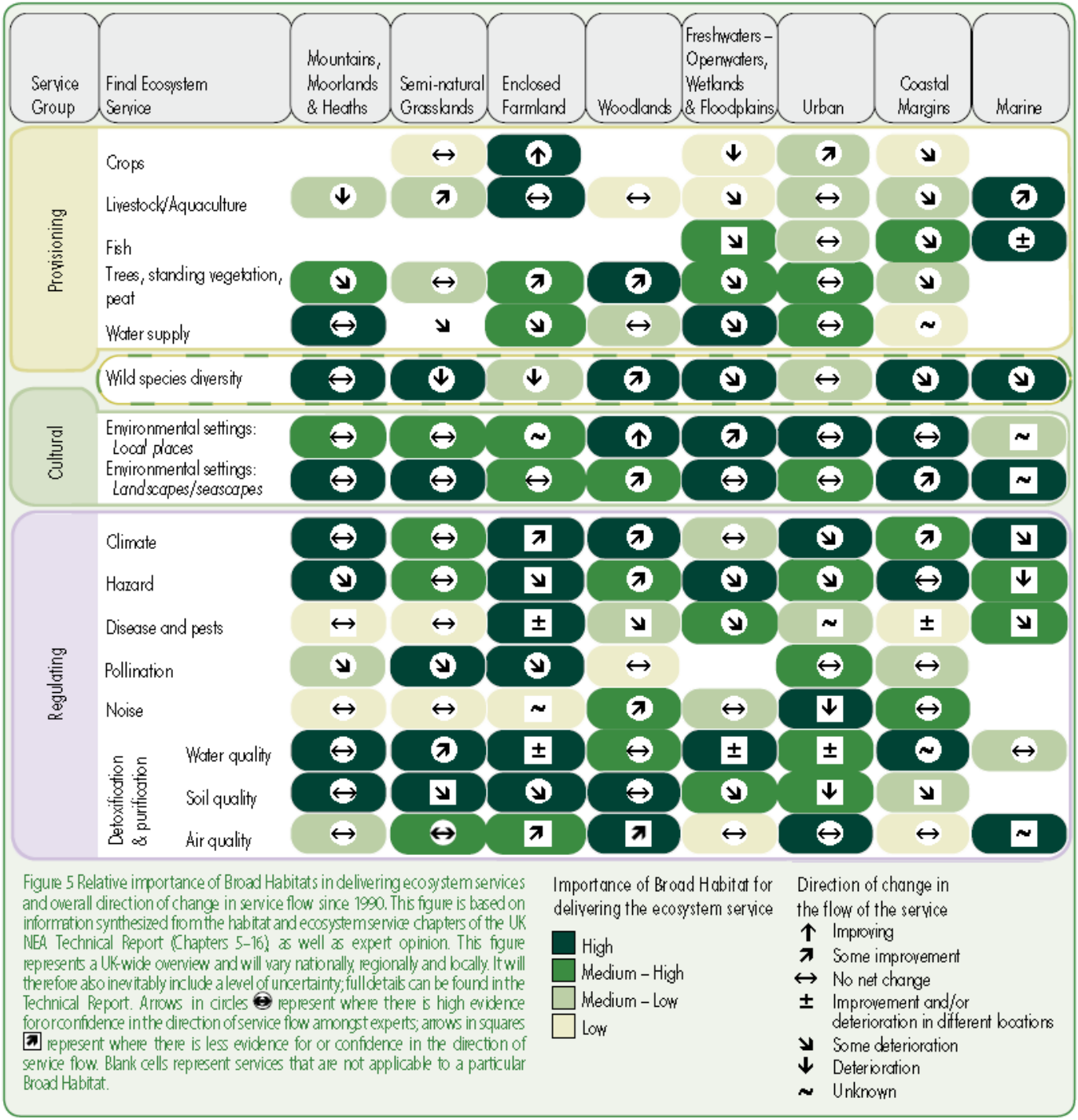


Figure 5 Relative importance of Broad Habitats in delivering ecosystem services and overall direction of change in service flow since 1990. This figure is based on information synthesized from the habitat and ecosystem service chapters of the UK NEA Technical Report (Chapters 5–16), as well as expert opinion. This figure represents a UK-wide overview and will vary nationally, regionally and locally. It will therefore also inevitably include a level of uncertainty; full details can be found in the Technical Report. Arrows in circles represent where there is high evidence for or confidence in the direction of service flow amongst experts; arrows in squares represent where there is less evidence for or confidence in the direction of service flow. Blank cells represent services that are not applicable to a particular Broad Habitat.

What are the economic implications of different plausible futures?

- What was valued?
  - 6 scenarios
  - 8 habitats
  - 5 ecosystem services

- How were values estimated?
  - Values were estimated using spatially sensitive value functions from pan UK spatially referenced data
  - GHG based on a process model which was adjusted for land use and soil characteristics.

UK NEA: Scenarios

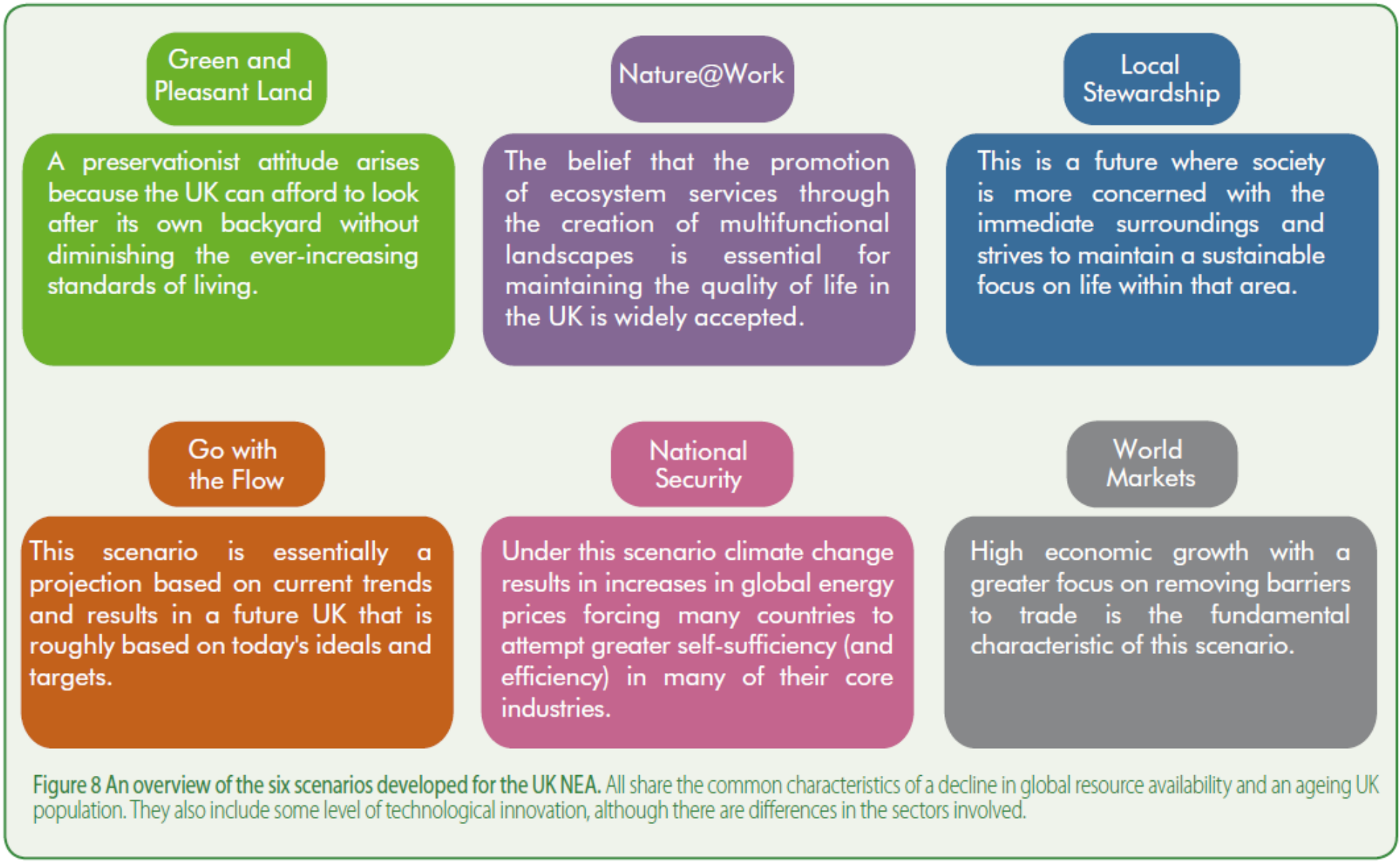


Figure 8 An overview of the six scenarios developed for the UK NEA. All share the common characteristics of a decline in global resource availability and an ageing UK population. They also include some level of technological innovation, although there are differences in the sectors involved.

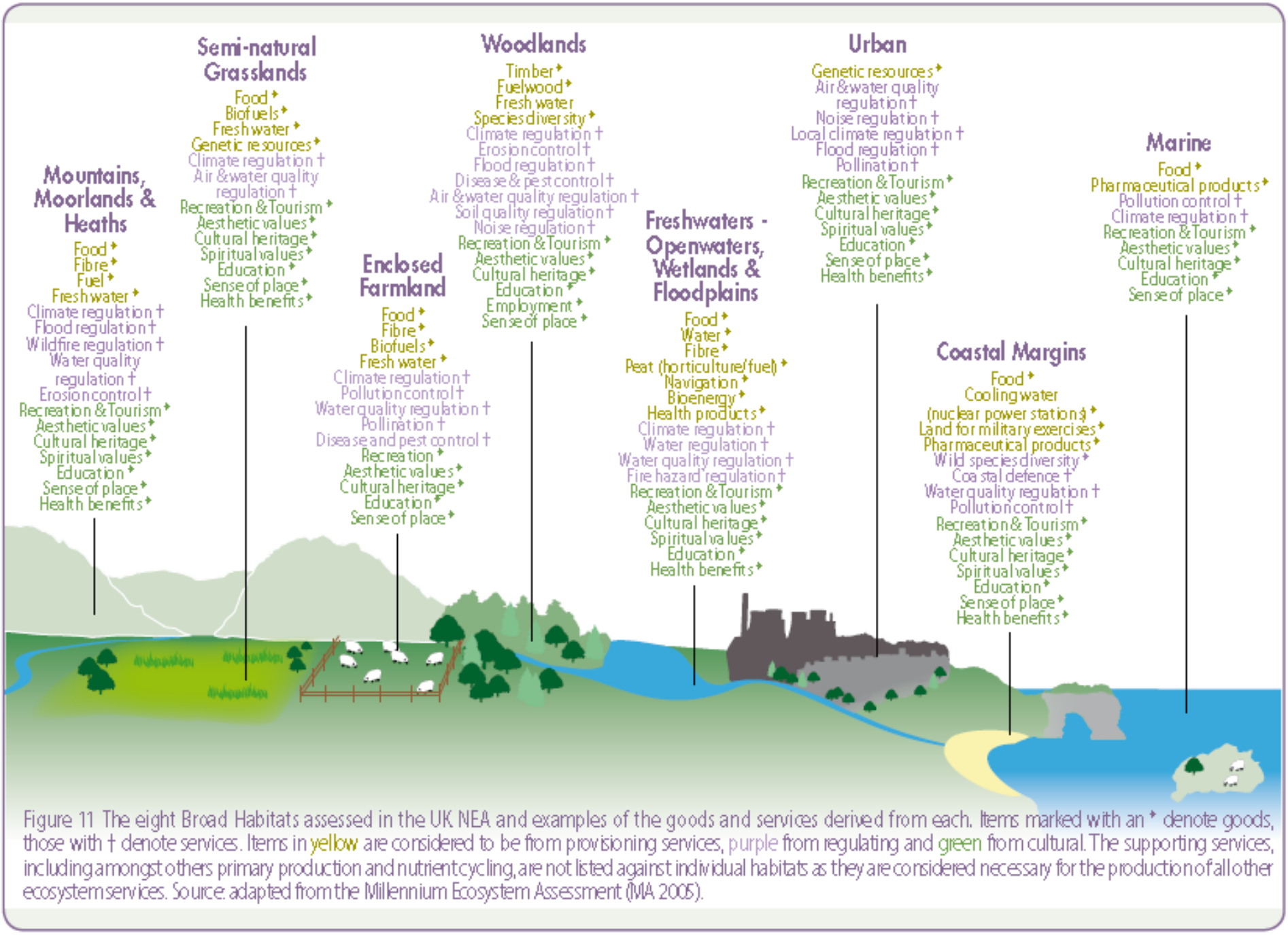


Figure 11 The eight Broad Habitats assessed in the UK NEA and examples of the goods and services derived from each. Items marked with an * denote goods, those with † denote services. Items in yellow are considered to be from provisioning services, purple from regulating and green from cultural. The supporting services, including amongst others primary production and nutrient cycling, are not listed against individual habitats as they are considered necessary for the production of all other ecosystem services. Source: adapted from the Millennium Ecosystem Assessment (MA 2005).

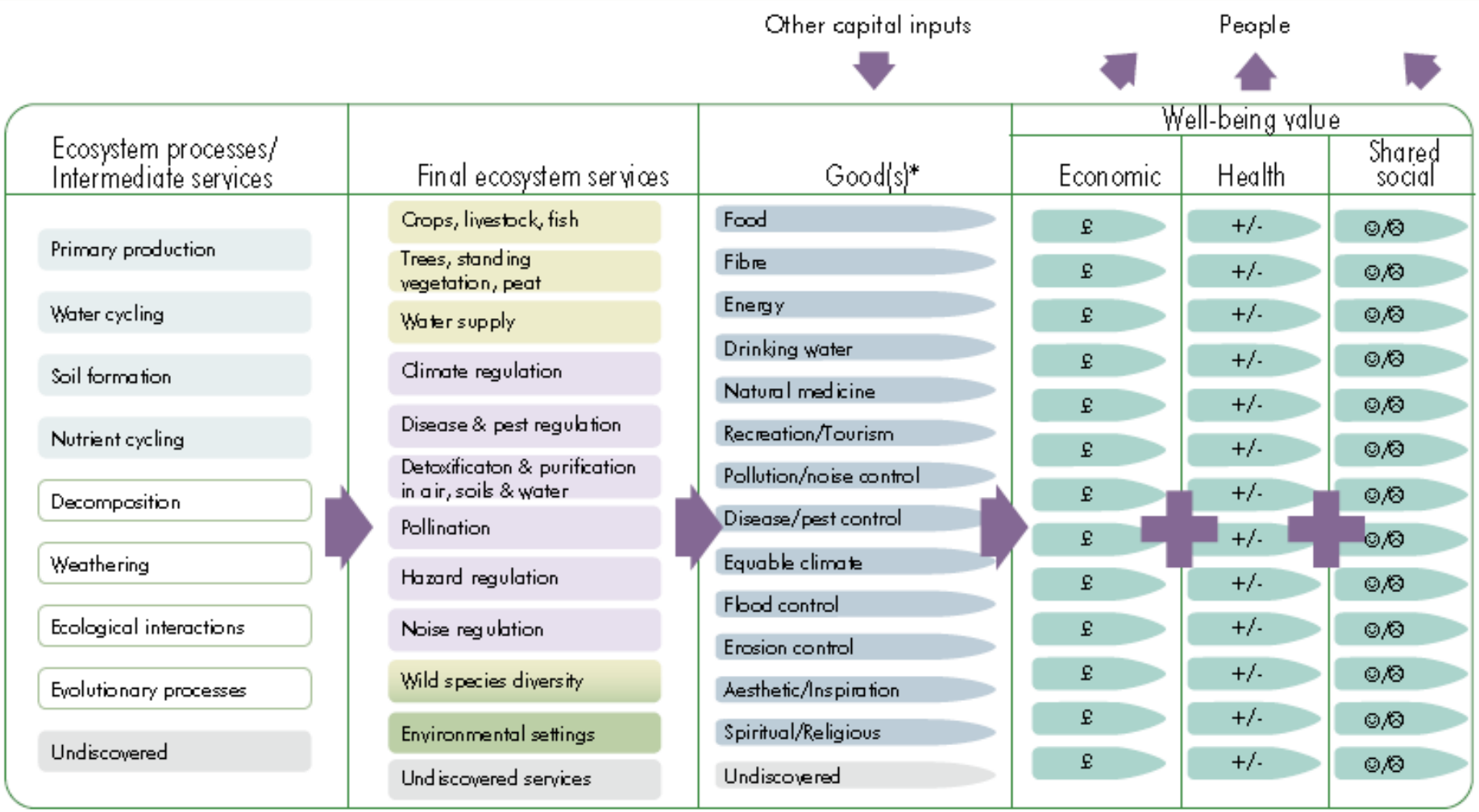


Figure 10 The full set of ecosystem processes, services, goods/benefits and values used in the UK NEA. Note that some ecosystem services can be both intermediate and final services. For simplicity, in this figure, services are shown only in the most final position that they occupy. Services such as pollination and climate regulation that also play important roles further back in the chain are not represented here. Cells with no colour are ecosystem processes/services that were not in the Millennium Ecosystem Assessment classification. *Note that the term good(s) includes all use and non-use, material and non-material outputs from ecosystems that have value for people. Source: adapted from Fisher *et al.* (2008).

Living With Environmental Change

UK National Ecosystem Assessment

- Key findings

Table 1 Summary impacts for the changes from the 2000 baseline to 2060 under each of the UK NEA Scenarios (low climate change scenario) in Great Britain (£million per year). Positive numbers indicate improvements from the baseline (negative numbers indicate worsening situations). The last but one row ranks the Scenarios when only their market values are considered (1= highest value; 6 = lowest values with green values being positive and purple indicating negatives). The final row repeats this ranking when all values (market and non-market) are considered. Scenarios are as follows: GF = *Go with the Flow*; GPL = *Green and Pleasant Land*; LS = *Local Stewardship*; NS = *National Security*; NW = *Nature@Work*; WM = *World Markets*

	GF	GPL	LS	NS	NW	WM
Market agricultural output values *	220	-290	350	680	-510	420
Non-market GHG emissions †	-800	2,410	-100	3,590	4,590	-2,130
Non-market recreation ‡	5,710	6,100	1,540	4,490	24,170	5,040
Non-market urban greenspace ¶	-1,960	2,350	2,160	-9,940	4,730	-24,000
Total monetised values §	**3,170**	**10,570**	**3,950**	**-1,180**	**32,980**	**-20,670**
Rank: Market values only	4	5	3	1	6	2
Rank: All monetary values	4	2	3	5	1	6

* Change in total Great Britain farm gross margin.

† Change from baseline year (2000) in annual costs of greenhouse gas (GHG) emissions from Great Britain terrestrial ecosystems in 2060 under the UK NEA Scenarios (millions £/year); negative values represent increases in annual costs of GHG emissions

‡ Annual value change for all of Great Britain.

¶ Undiscounted annuity value; negative values indicate losses of urban greenspace amenity value.

§ We acknowledge some double counting between urban recreation and urban greenspace amenity value. Further data is needed to correct for this.

Summary: An ecosystems approach to policy making

- Provides a way of linking together a number of cross-cutting environmental challenges into a single, coherent framework.
- It helps ensure that policy makers are able to deal with cumulative pressures on the natural environment and capture the true value of ecosystem services, so that they can design policies in a way which will enable us to live within environmental limits and mitigate and adapt to climate change and other pressures on the natural environment.