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Pricing nature:
Recent advances in the valuation of biodiversity and ecosystem services

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OVERVIEW

- Biodiversity and biodiversity loss
- Approaches to valuing biodiversity
- Case studies
- Issues for valuing biodiversity and ecosystems

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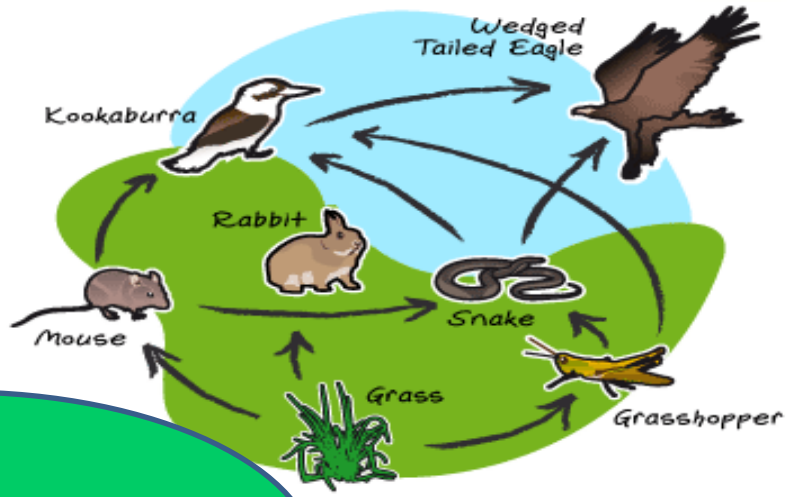
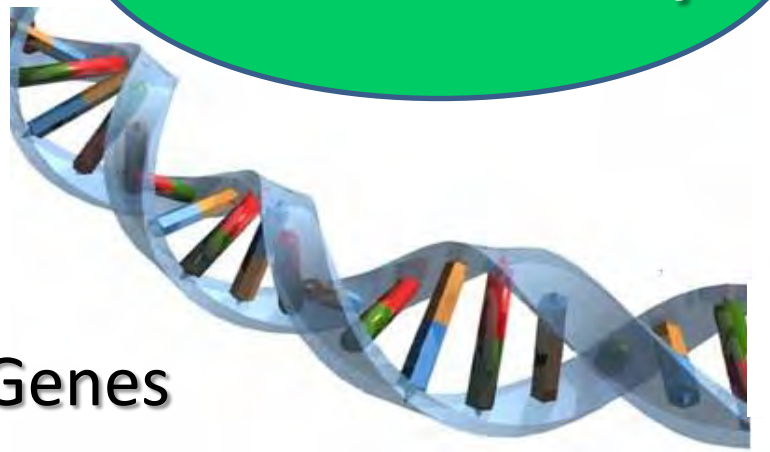


Biodiversity

Species

Ecosystems



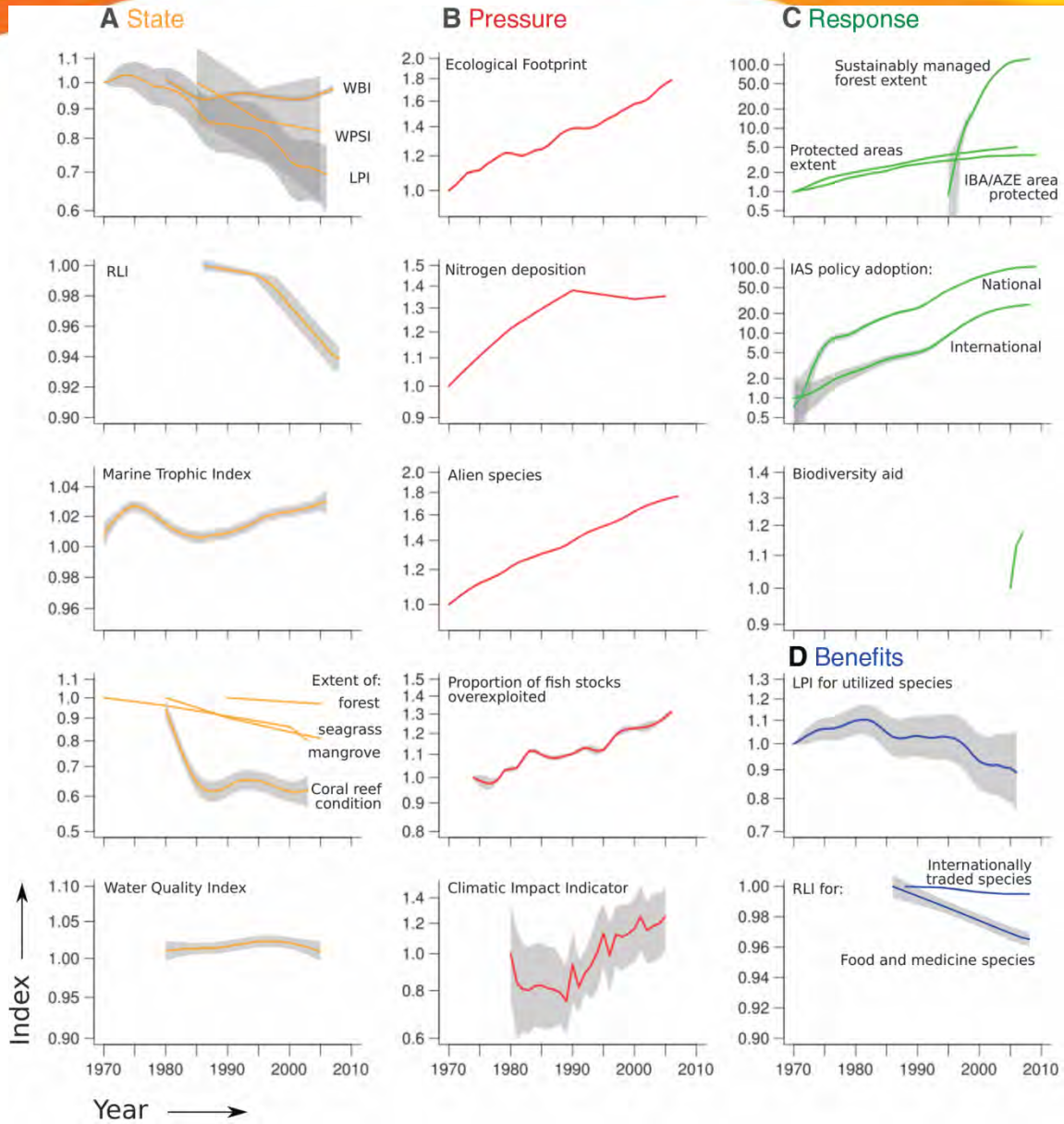
Genes

Biodiversity Trends

A. the state of biodiversity
B. pressures upon it
C. responses to address its loss
D. the benefits humans derive from it.

WBI, Wild Bird Index;
WPSI, Waterbird Population Status Index;
LPI, Living Planet Index;
RLI, Red List Index;
IBA, Important Bird Area;
AZE, Alliance for Zero Extinction site;
IAS, invasive alien species.

Source: Butchart et al. (2010) *Science*



In 2002, Governments set 2010 as a deadline to achieve a significant reduction in the rate of loss of biodiversity for reducing poverty.

All assessments of progress indicate that we are far from reaching this goal.

2010 Biodiversity Targets

- Reducing the rate of loss of the components of biodiversity
- Promoting **sustainable use** of biodiversity;
- Addressing the major threats to biodiversity;
- Maintaining ecosystem integrity, and **the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;**
- **Protecting traditional knowledge, innovations and practices;**
- **Ensuring the fair and equitable sharing of benefits** arising out of the use of genetic resources;
- Mobilizing financial and technical resources for implementing the Convention and the Strategic Plan.

Biodiversity targets are very much **linked to human use!**

Pricing nature?

Over the few decades, environmental economists have attempted to measure the economic value of biodiversity and ecosystem services.

WHY … ?

Why biodiversity valuation is important?

- People attain a wide range of social, economic, cultural, spiritual and health benefits from biodiversity – often termed *'ecosystem services'*

- These benefits are often 'un-priced' and therefore risk being ignored is decision making.
- Governments need to deliver 'value for money' on nature conservation policies.

- **Biodiversity valuation methods**
  - Revealed preference
  - Stated preference
  - Cost-based approaches

Approaches to valuing biodiversity

- Early valuation studies largely focused on individual species or habitat, e.g.

£11.91

(£6.4 million)

£7.44

(£4.0 million)

- New ‘Ecosystems approach’ to valuation aims to identify and value the wide range of ‘ecosystem service’ benefits from biodiversity

Ecosystem approach to valuation

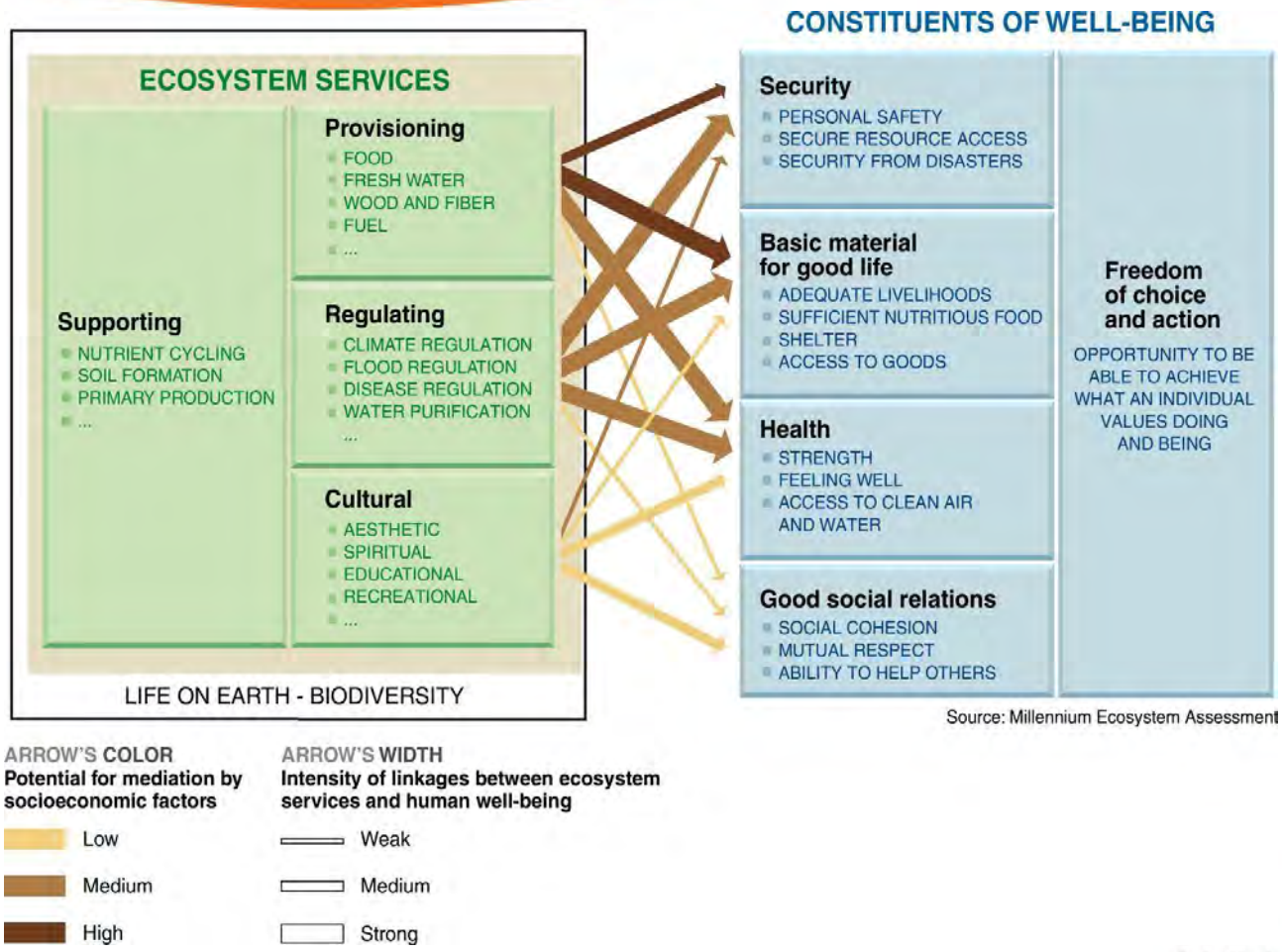
'An ecosystems approach to valuation provides a framework for looking at **whole ecosystems** in decision making, and for **valuing the ecosystem services they provide**, to ensure that we can maintain a healthy and resilient natural environment now and for future generations.'

(Defra, 2007)

Ecosystem services …

- Are the **benefits** people obtain from ecosystems.
- These include:
  - **Provisioning services** such as food and fibre;
  - **Regulating services** such as flood prevention, carbon storage and pollination;
  - **Cultural services** such as spiritual, recreational, and cultural benefits;
  - **Supporting services** such as nutrient cycling that maintain the conditions for life on Earth.

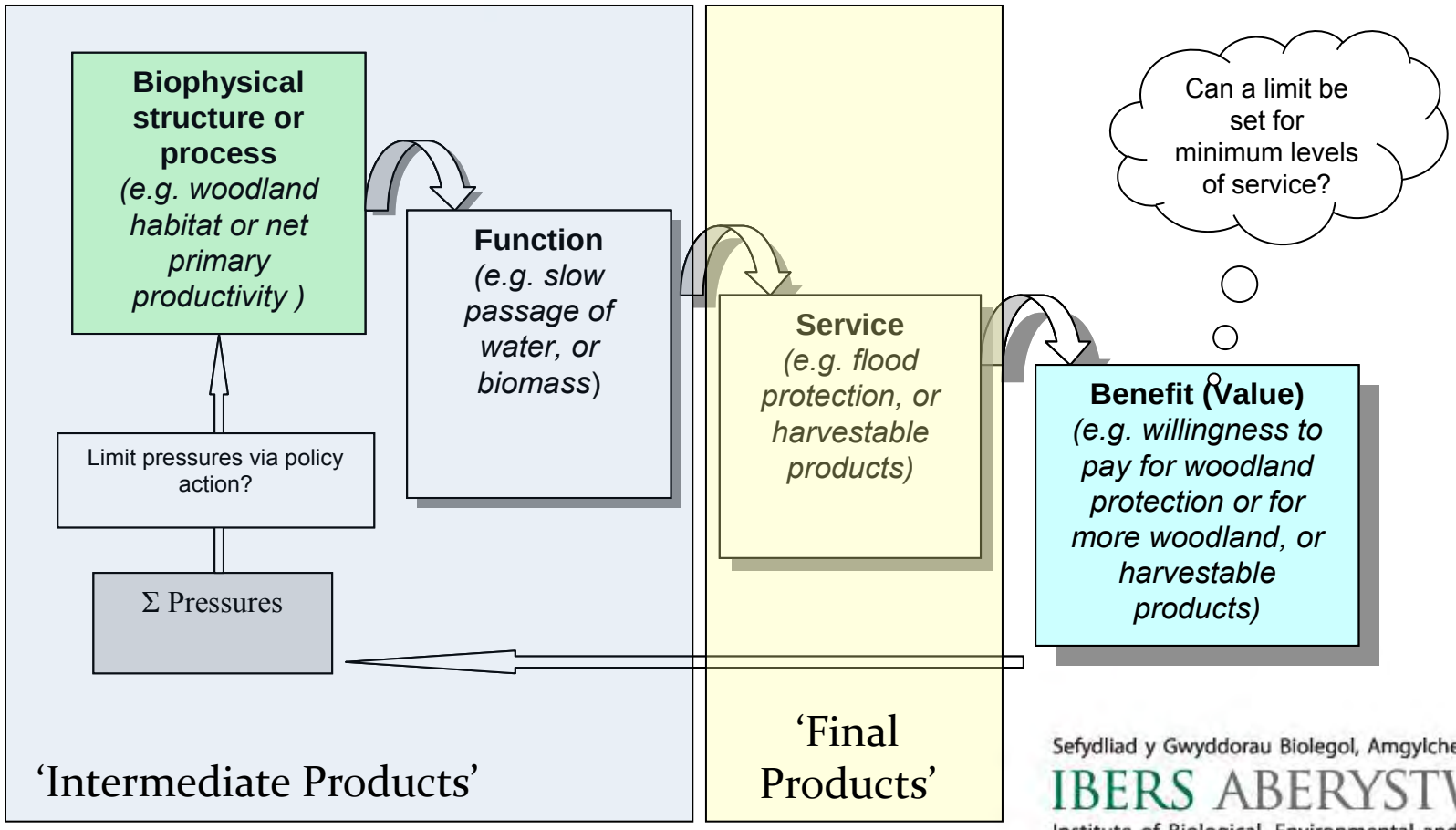
  - **People, generally, do not have to pay for these services; but may still benefit from them.**



An 'Ecosystems Approach' to valuation

Millennium Ecosystems Assessment (2005)

An 'Ecosystems Approach' to biodiversity valuation



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

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Case study:

An economic evaluation of the ecosystem service benefits of the UK Biodiversity Action Plan

Christie, M, Hyde, T, Cooper, R, Fazey, I, Dennis, P, Warren, J Gibbons, J, and Hanley, N.

Funded by Defra and others

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Research aims

1. To assess the economic value of ecosystem services delivered by the UK BAP
2. To assess the levels of ecosystem services delivered by BAP habitats.
3. To estimate the economic value of the delivered ecosystem services by BAP habitats.

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Step 1: Assessment of the economic value of ecosystem services delivered by the UK BAP: Choice experiment

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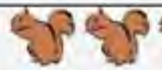
Task	BASELINE	OPTION A	OPTION B
wild food	 LESS WILD FOOD *8.5% less wild food in Wales*	 LESS WILD FOOD *8.5% less wild food in Wales*	 MORE WILD FOOD *7% more wild food in Wales*
non-food	 LESS NON-FOOD *8.5% less non-food products in Wales*	 NO CHANGE *No change to non-food products in Wales*	 MORE NON-FOOD *7% more non-food products in Wales*
climate regulation	 MORE CO2 *Habitats release 331,000 tonnes co2 which contributes to global warming*	 MORE CO2 *Habitats release 331,000 tonnes co2 which contributes to global warming*	 LESS CO2 *Habitats absorb 404,000 tonnes co2 helping to reduce global warming*
water regulation	 MORE FLOODING *5,000 more people at risk*	 LESS FLOODING *5,000 fewer people at risk*	 NO CHANGE *No change to people at risk*
sense of place	 FEWER HABITATS MAINTAINED *26% of semi natural and natural habitats maintained*	 NO CHANGE *37% of semi natural and natural habitats maintained*	 MORE HABITATS MAINTAINED *41% of semi natural and natural habitats maintained*
threatened mammals, birds, amphibians, reptiles, moths and butterflies	 FEWER SPECIES MAINTAINED *0 species stabilised* *203 species decline*	 MORE SPECIES MAINTAINED *203 species stabilised* *0 species decline*	 NO CHANGE *67 species stabilised* *136 species decline*
threatened trees, plants, insects and bugs	 FEWER SPECIES MAINTAINED 0 species stabilised 300 species decline	 NO CHANGE 120 species stabilised 180 species decline	 MORE SPECIES MAINTAINED 300 species stabilised 0 species decline
Annual increase in tax over the next 10 years	0	75	25
I prefer:	No BAP	Action Plan A	Action Plan B

Choice experiment example: UK BAP

UK BAP: Regional CE models

	Scotland	Wales	NI	NE	NW	YH	WM	EM	EofE	Lon	SE	SW	UK
$WildFood_{NoBAP}$	**-0.280**	-0.161	-0.114	**-0.279**	-0.088	-0.191	0.244	**-0.227**	**-0.344**	**-0.272**	**-0.390**	**-0.315**	**-0.230**
$WildFood_{FulBAP}$	0.150	0.118	-0.024	0.081	0.046	0.134	-0.196	0.067	0.215	0.256	**0.424**	**0.251**	**0.138**
NFP_{NOBAP}	-0.095	-0.096	-0.291	-0.042	**-0.381**	-0.256	**-0.477**	**-0.177**	**-0.278**	-0.170	-0.072	**-0.210**	**-0.190**
NFP_{FULBAP}	**-0.071**	0.170	0.208	0.042	0.290	**0.394**	**0.777**	**0.254**	0.178	0.350	-0.030	-0.048	**0.164**
$Climate_{NOBAP}$	**-0.443**	**-0.577**	**-0.493**	**-0.582**	**-0.615**	**-0.730**	**-1.197**	**-0.247**	**-0.540**	**-0.678**	**-0.791**	**-0.604**	**-0.544**
$Climate_{FULBAP}$	**0.362**	**0.472**	**0.564**	**0.482**	**0.723**	**0.407**	**0.521**	**0.264**	**0.436**	**0.296**	**0.720**	**0.418**	**0.400**
$Water_{NOBAP}$	**-0.340**	**-0.549**	**-0.493**	**-0.695**	-0.243	**-0.644**	**-0.821**	**-0.437**	-0.237	**-0.717**	**-0.841**	**-0.410**	**-0.470**
$Water_{FULBAP}$	0.163	**0.479**	**0.480**	**0.467**	-0.081	**0.623**	**0.628**	**0.260**	**0.352**	**0.488**	**0.614**	**0.205**	**0.326**
SOP_{NOBAP}	**-0.377**	**-0.590**	0.016	**-0.321**	**-0.333**	**-0.445**	**-0.326**	**-0.196**	-0.049	**-0.493**	**-0.678**	**-0.400**	**-0.325**
SOP_{FULBAP}	**0.441**	0.249	**0.460**	0.299	**0.431**	**0.429**	0.046	**0.291**	**0.386**	**0.466**	**0.556**	**0.502**	**0.362**
$CharSpp_{NOBAP}$	**-0.662**	**-0.339**	**-0.248**	**-0.545**	**-0.663**	**-0.615**	**-0.693**	**-0.339**	**-0.220**	**-0.391**	**-0.687**	**-0.445**	**-0.457**
$CharSpp_{FULBAP}$	**0.594**	**0.443**	**0.394**	**0.509**	**0.937**	**0.695**	**0.513**	0.161	0.089	0.281	**0.891**	**0.539**	**0.442**
$NoChar_{NOBAP}$	**-0.389**	**-0.323**	-0.161	**-0.333**	**-0.547**	-0.196	0.029	**-0.265**	**-0.266**	**-0.326**	**-0.328**	**-0.332**	**-0.272**
$NoChar_{FULBAP}$	**0.300**	**0.360**	0.219	0.292	0.067	0.220	0.127	**0.207**	**0.311**	-0.083	0.079	0.091	**0.181**
COST	**-0.005**	**-0.005**	**-0.005**	**-0.008**	**-0.007**	**-0.002**	**-0.004**	**-0.004**	**-0.003**	**-0.002**	**-0.006**	**-0.004**	**-0.004**
LL model	-441	**-178**	-215	-186	-183	-184	-193	-501	-233	-227	-179	-459	-3330
LL constants	-533	**-217**	-217	-248	-224	-225	-264	-573	-277	-243	-246	-537	-3901
R-sq	0.17	0.18	0.16	0.25	0.18	0.18	0.27	0.12	0.16	0.06	0.27	0.14	0.14
N	615	250	275	285	275	290	330	600	295	325	320	650	4510

Economic value of ecosystem services (Av UK)

Ecosystem Service	Present BAP (£/household/yr)	Full implementation (£/household/yr)
Wild food	79	90
Non food products	53	86
Climate regulation	168	231
Water regulation	150	195
Sense of place	71	168
Charismatic species	115	220
Non-charismatic species	88	111
Total BAP	724	1100

Note: values are relative to the 'No BAP' scenario.

Economic value of UK BAP scenarios by region ('£/household/yr' relative to no BAP scenario)

Region	Scot	Wales	NI	NE	NW	YH	WM	EM	EofE	Lon	SE	SW
Current BAP	686	580	269	418	480	1390	1137	521	586	2213	768	911
Full BAP	961	960	867	607	762	2554	1582	777	1202	2793	1252	1225

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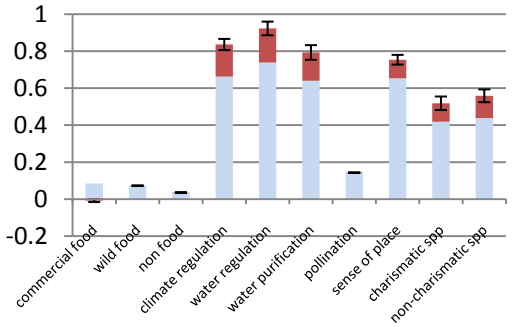
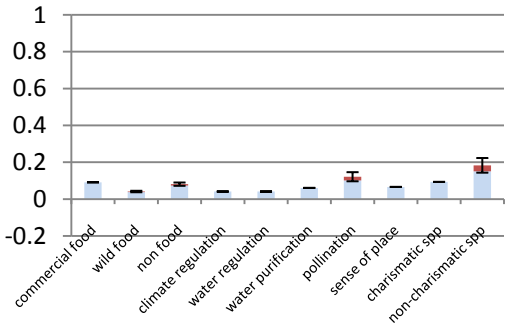
Step 2: Assessment of the levels of ecosystem services delivered BAP habitats.

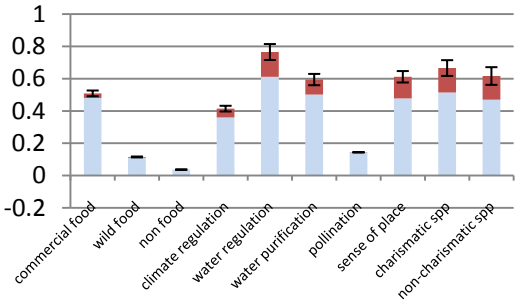
Linking BAP habitats to ecosystem services



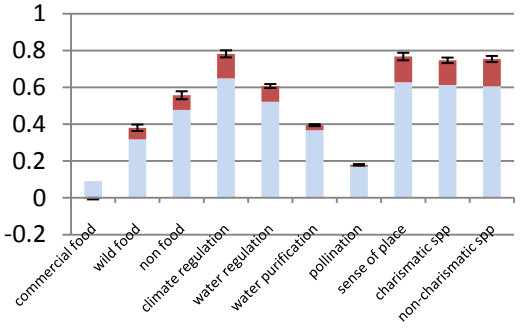
Blanket bogs



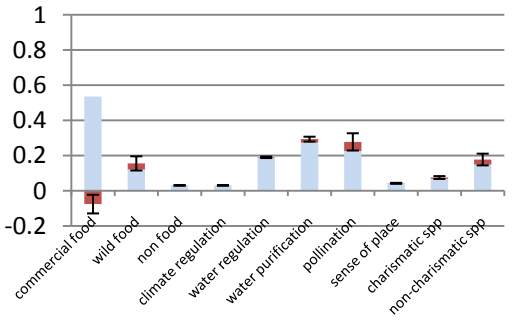
Lowland Dry Acid Grassland



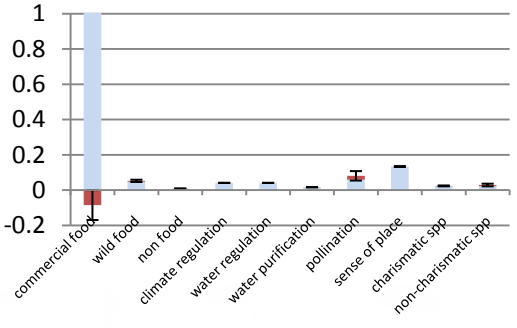
Coastal and Floodplain grazing marsh



Native Woodland



Arable margins



Arable fields

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Step 3: Value of the UK Biodiversity Action Plan

£1,366 million per annum

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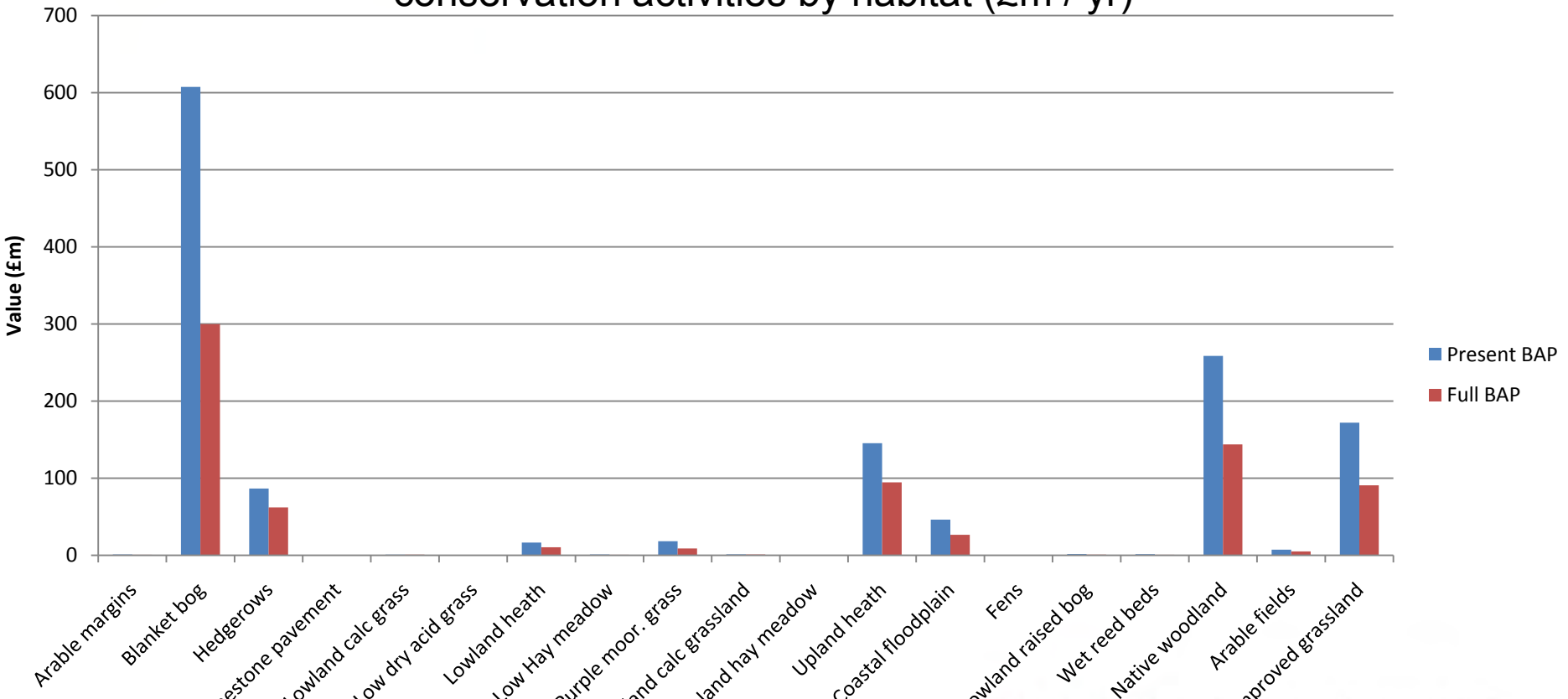
Total value for additional ecosystem services delivered through BAP conservation activities by habitat (£m / yr)



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- **Current spend on UK BAP:**
  - £321m on HAPs;
  - £21m on SAPs (individual species)
  - £322m on SAPs (widespread species).

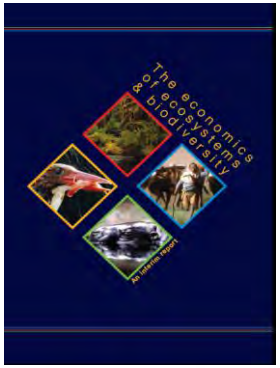
- **Does this spend represent value for money ?**
  - Benefit : cost ratio = 2.91:1
- **Is spend appropriately targeted?**
  - Study suggest a focus on ES

Value of global biodiversity:

- Costanza (1997) *Nature*:

  Value of all of the World's ecosystem services

  = $33 trillion / yr



- TEEB (2010)

  Annual global economic impact of biodiversity loss

  = $2 - 4.5 trillion / yr

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Critique of valuation methods

- Environmental valuation methods have seen significant developments over the past few decades.
- There is now general consensus among academics and policy makers that valuation studies are useful.
- However, valuation of biodiversity and ecosystems tend to push the boundaries of valuation methodology.

Issues for valuing biodiversity and ecosystem services

- Valuing complex goods – may need to incorporate participatory and deliberative approaches to valuation
- Value transfer
- Valuation in developing countries
- Species conservation vs ecosystem services

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Thank you for your attention

Any questions?

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