The TEEB Report: *inspiring* conservation

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1. TEEB: Overview

2. *Inspiring change*: Marine ecosystem services valuation for the UK Marine and Coastal Access Bill

3. TEEB: Interim Findings and next steps

TEEB - context

"**Potsdam Initiative – Biological Diversity 2010**"

1) The economic significance of the global loss of biological diversity

the global economic ***benefit of biological diversity****,*

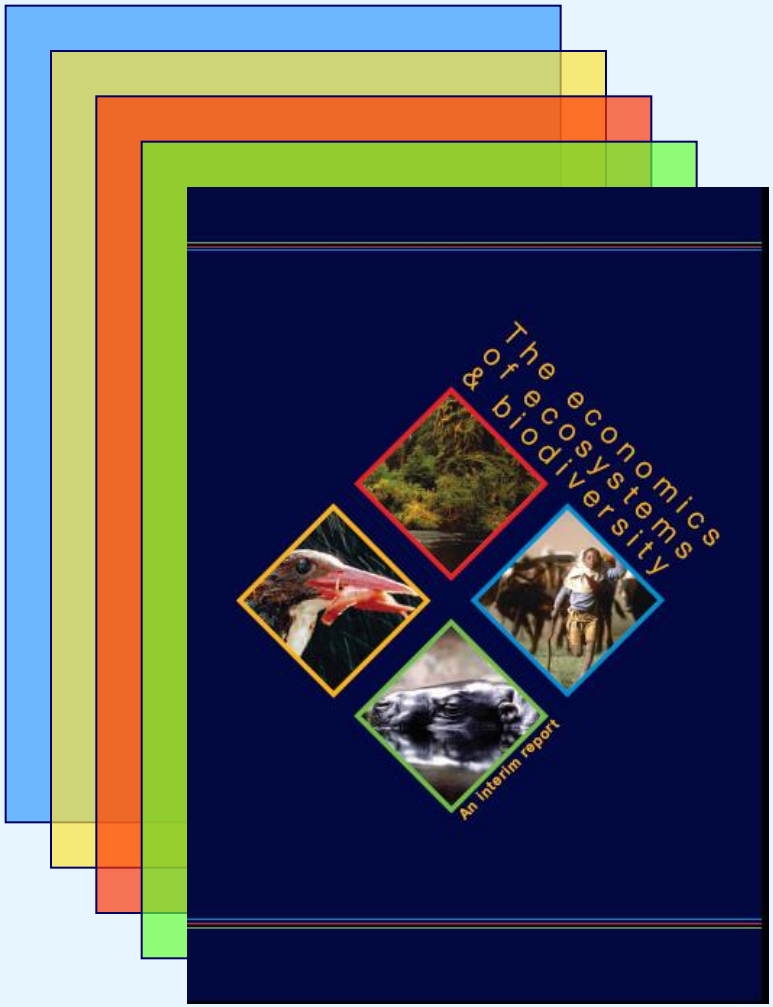
the ***costs of the loss of biodiversity*** *and*

the failure to take protective measures versus the costs of effective conservation*.*

TEEB: Goals and aspirations

- To **mainstream** the economics of ecosystems and biodiversity
- To **review** extensively the current state of the science and economics of ecosystems and biodiversity, and recommend valuation and evaluation frameworks and methodologies
- To address the needs of the **end-users**

TEEB- Final Reports



Science & Economics Foundations, Policy Costs & Costs of Inaction — **D0**

Policy Evaluation for Policy-Makers — **D1**

Decision Support for Administrators — **D2**

Business Risks & Opportunities — **D3**

Consumer Ownership — **D4**

The UK Marine Bill – Marine Nature Conservation Proposals- valuing the benefits

Published in *Ecological Economics* (Hussain *et al*., 2010)

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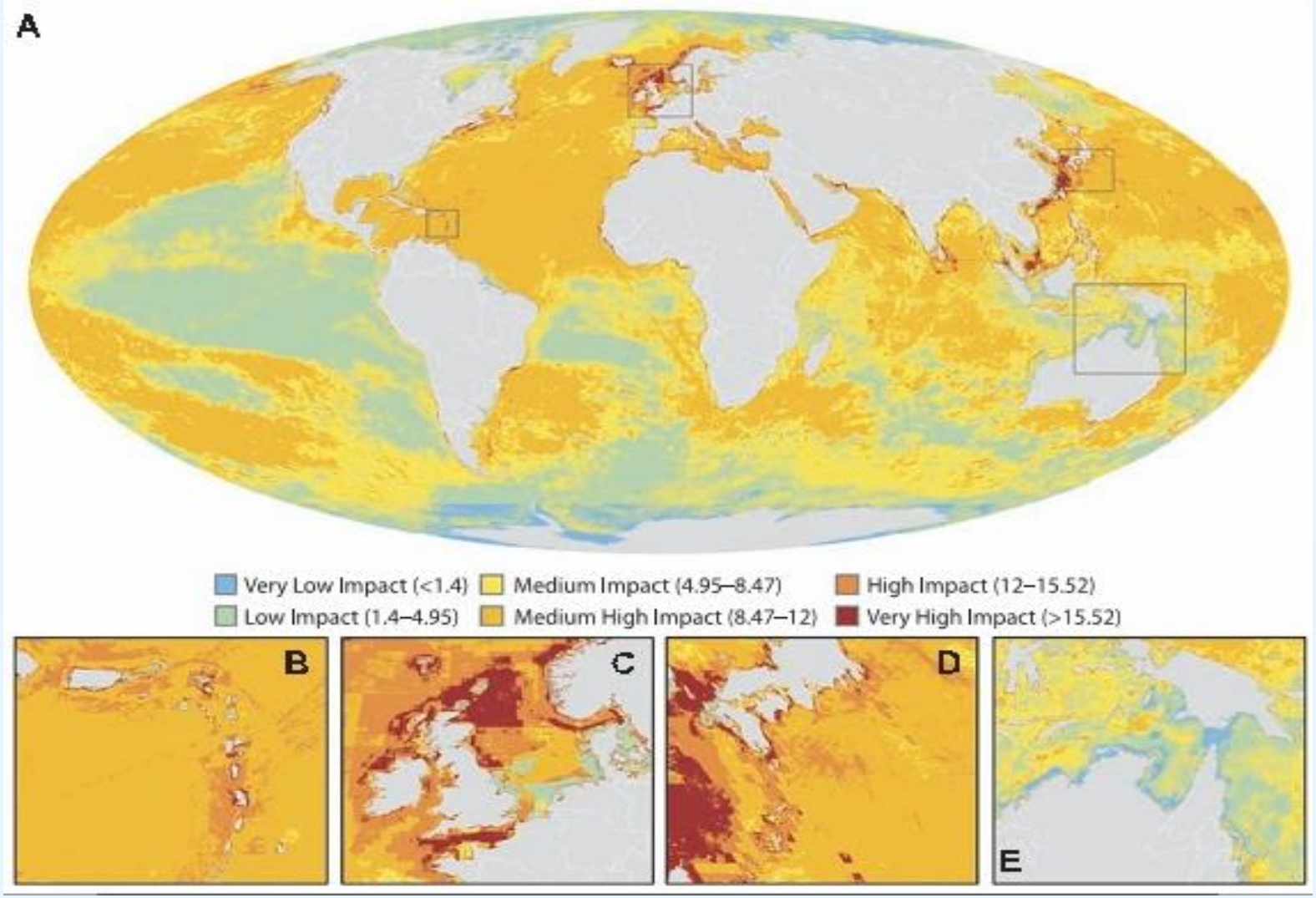
Marine Protected Areas

- UN World Summit on Sustainable Development: requires the establishment of representative networks of marine protected areas (MPAs) by 2012
- What is the economic rationale?
- Can such a policy intervention be substantiated?
  - Does the extant literature allow us to do so?
  - Where are the gaps in the evidence base?

Background to the study

- Different *drivers* impact on marine ecosystems
- Study in *Science* (Halpern *et al*.,2008) applies a multi-scale spatial model to analysis anthropogenic drivers of ecological change in 20 marine ecosystems.
  - 41% are strongly affected by *multiple* drivers.
- These drivers stimulate a shift in the production of *ecosystem goods and services* (e.g. gas and climate regulation)
- These services can be *valued*
- According to study in *Nature* (Costanza *et al*., 1997) service provision by marine ecosystems constitutes around two-thirds of the global total

Anthropogenic impacts



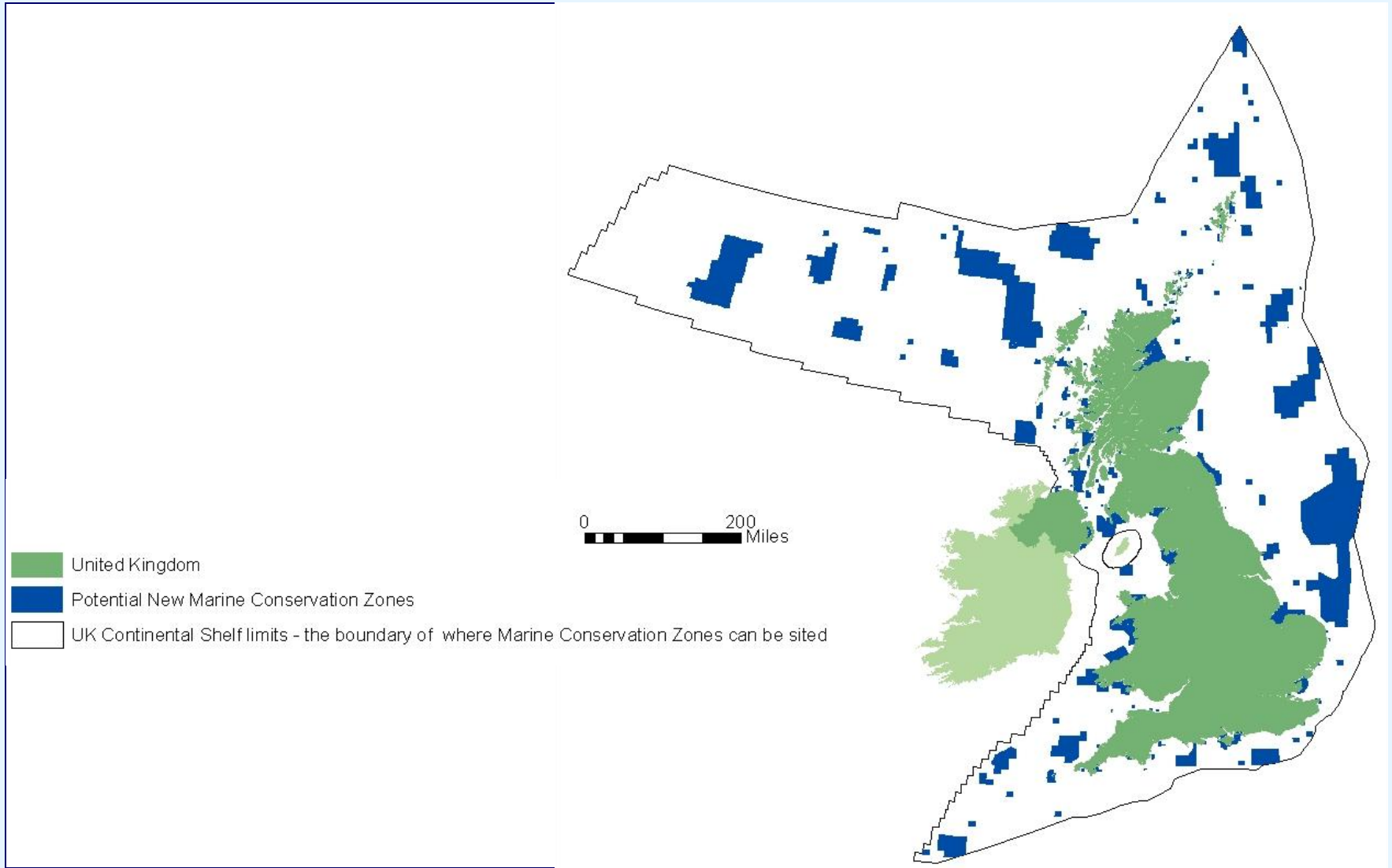
Objectives of the study

1. To estimate monetary economic benefits derived from the marine protected areas (MCZs) proposals being put forward as part of the Marine and Coastal Access Bill;
2. Where agreed, to provide qualitative benefits where monetised values cannot be given; and
3. To provide the necessary detail for Impact Assessment reporting

The three network scenarios selected by Defra from Kaiser *et al.* (2006)

Scenario	% of OSPAR Species and Habitats included	% of UK Marine Landscapes included	Network size (1000 km2)	Additional Criteria
A	20%	10%	125.7	None
G	60%	10%	156	Commercial fishery species spawning and nursery areas preferred to protect areas essential to life history stages
J	60%	10%	147.2	Locked out sites licensed for aggregate extraction, dredging and dredge disposal activities.

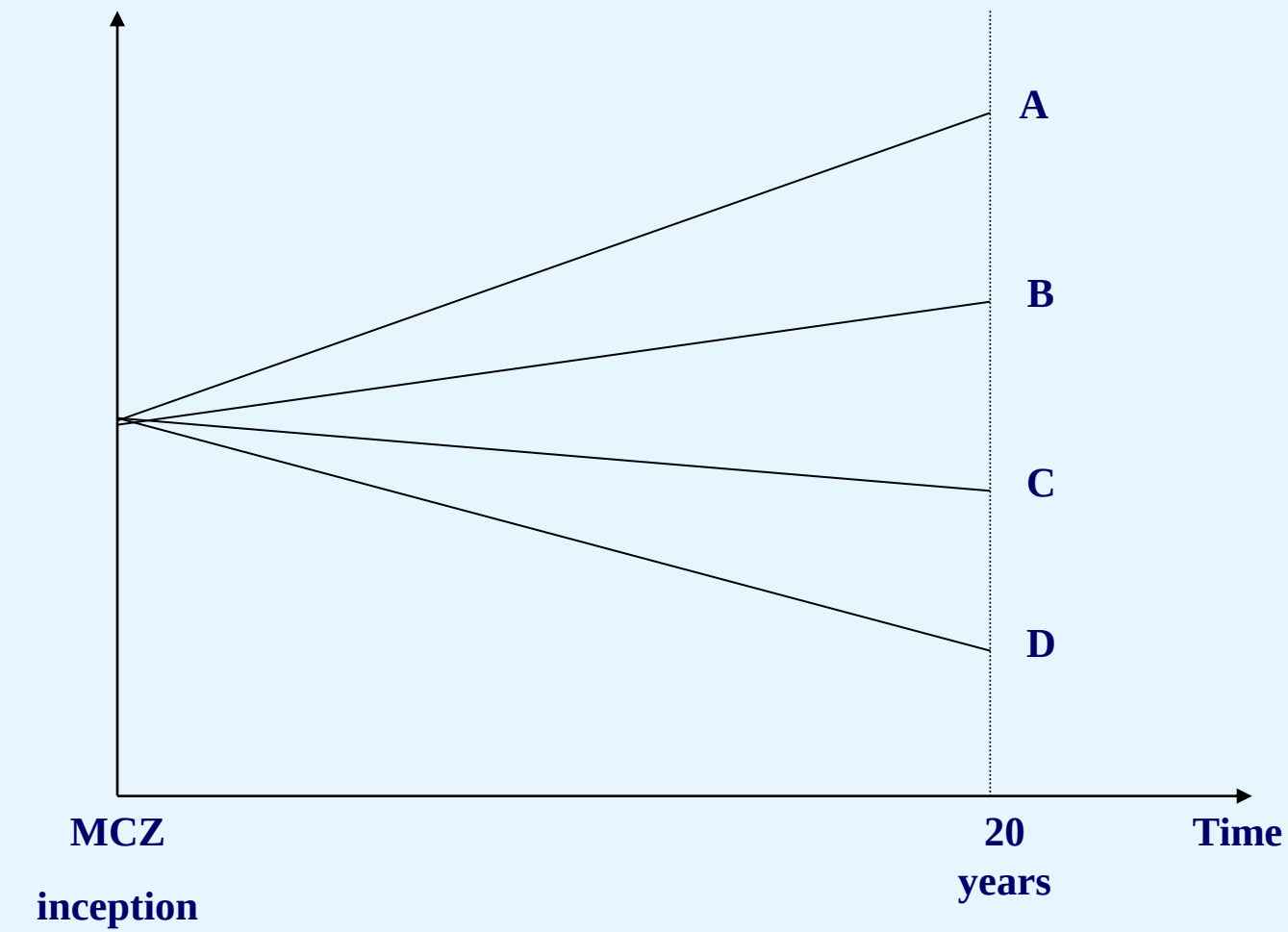
UK MCZs/UK Continental Shelf limits



Management regimes defined by UK government (Defra)

	Conservation Objective	
	Highly Restricted (HR-MCZ)	**Maintenance of Conservation Status (MCS-MCZ)**
Management Regime **Restrictions**	• **General presumption against fishing of all kinds, all constructive, destructive and disturbing activities** • Recovery measures appropriate to the local situation (enhanced restoration/aftercare measures on expiry of operating licences)	• New development activities permitted where in the public interest (on social or economic grounds) • **Existing activities to continue if do not cause site condition to deteriorate** • Restriction of bottom fishing gears either spatially or temporally and technical conservation measures • Recovery measures appropriate to the local situation (enhanced restoration/aftercare measures on expiry of operating licences)

Comparisons against the baseline status quo



MA categories pertaining to terrestrial marine ecosystems

MEA Category	Ecosystem Good/ Service	Definition
Provisioning	Food provision	Plants and animals taken from the marine environment for human consumption
	Raw materials	The extraction of marine organisms for all purposes, except human consumption
Supporting	Nutrient cycling	The storage, cycling and maintenance of availability of nutrients mediated by living marine organism
	Resilience and resistance	The extent to which ecosystems can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly flipping to alternate states
Regulating	Gas and climate regulation	The balance and maintenance of the chemical composition of the atmosphere and oceans by marine living organisms
	Biologically mediated habitat	Habitat which is provided by living marine organisms
	Disturbance prevention and alleviation	The dampening of environmental disturbances by biogenic structures
	Bioremediation of waste	Removal of pollutants through storage, dilution, transformation and burial
Cultural	Cultural heritage and identity	The cultural value associated with the marine environment e.g. for religion, folk lore, painting, cultural and spiritual traditions
	Cognitive values	Cognitive development, including education and research, resulting from marine organisms
	Leisure and recreation	The refreshment and stimulation of the human body and mind through the perusal and engagement with, living marine organisms in their natural environment

Synopsis of valuation literature

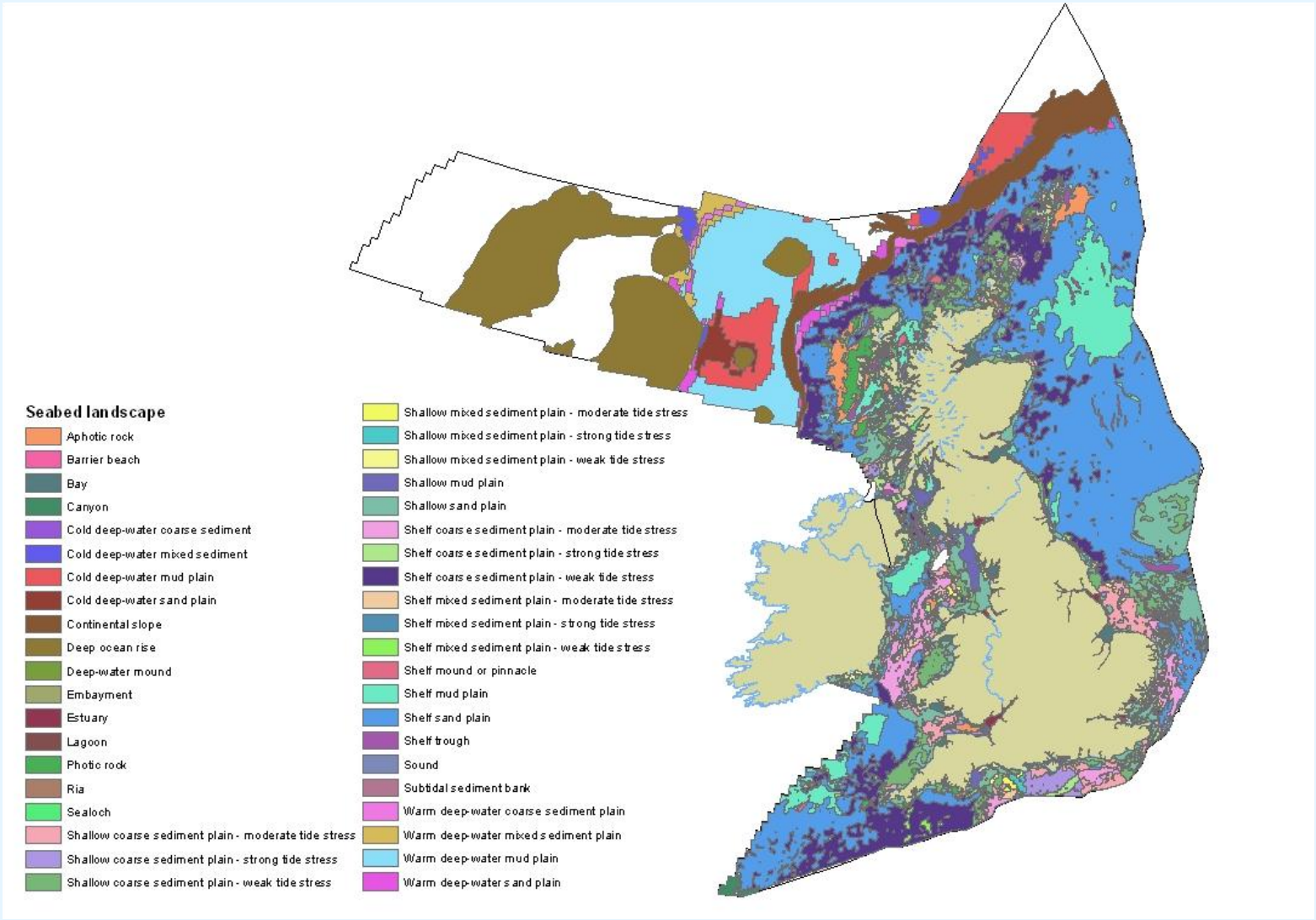
Good/Service	Defra CRO 380		
	Monetary Value	**Valuation method**	**Subjective Reliability**
Food provision	£884.9 million	Market data	MEDIUM: value added factor simplification
Raw materials	£116.5 million	Market data	MEDIUM: some data unavailable
Leisure and recreation	£1.4-£3.4 billion	Market data	LOW: based on market data but wide variability
Resilience and resistance	N/A	N/A	N/A
Nutrient cycling	£ 1.3 billion	Market, WTP	MEDIUM: used 'open seas' estimates
Gas and climate regulation	£8.2 billion	Avoidance cost approach	HIGH: social cost of carbon used
Bioremediation of waste	N/A	N/A	N/A
Biologically mediated habitat	N/A	N/A	N/A
Disturbance prevention and alleviation	0.44 billion	Avoidance cost approach	MEDIUM: based on extrapolated
Cultural heritage and identity	N/A	N/A	N/A
Cognitive values	£453.3 million	Market data	HIGH: based on reliable survey data

Methodological steps

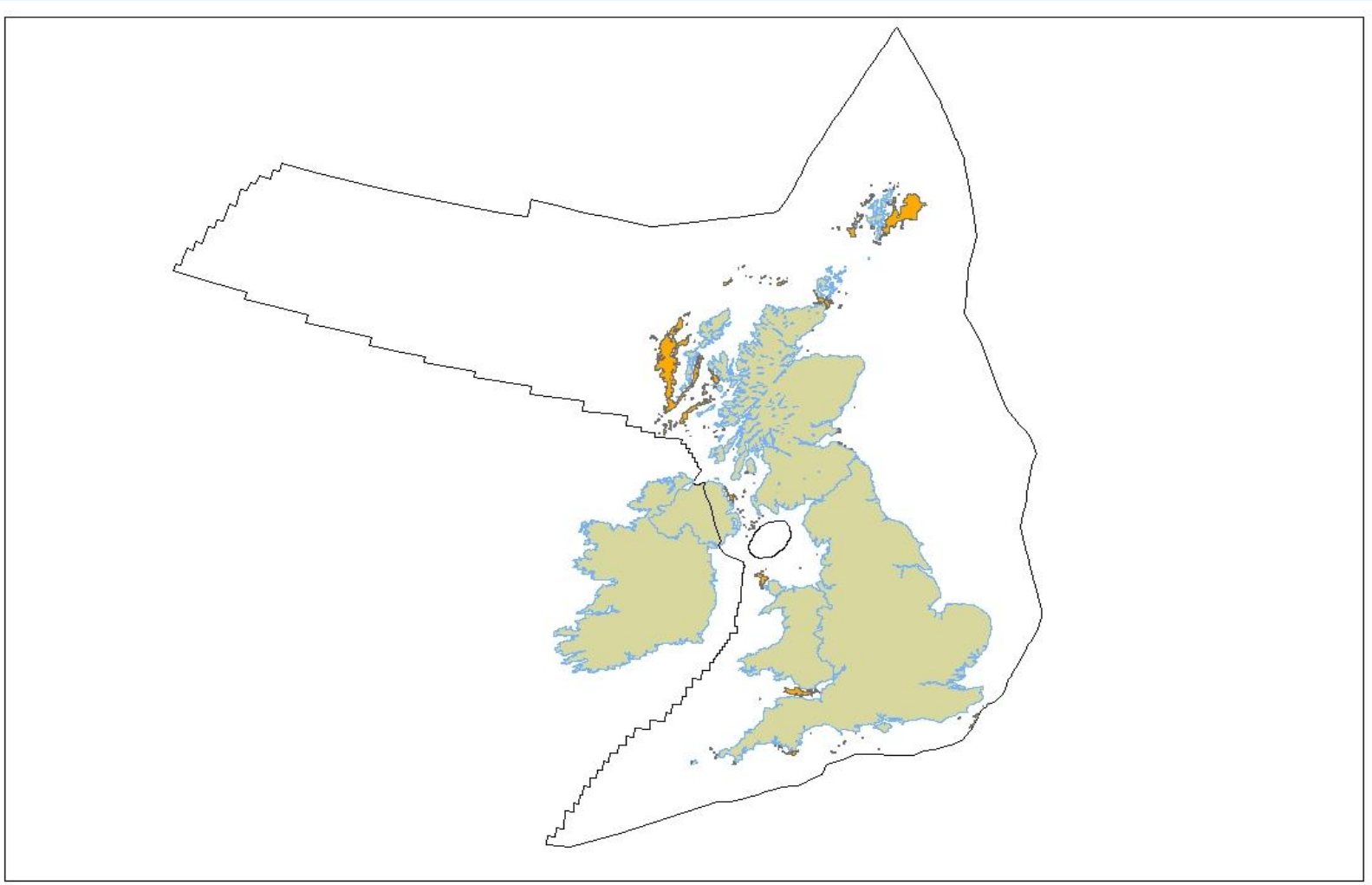
1. For *one hectare* of the habitat/landscape what is the *extra* provision of this ecosystem service brought about by Highly Restricted or Less Restricted as compared with the counterfactual?
2. How many hectares are there in each network scenario A, G and J?
3. What proportion is going to be protected under Highly Restricted and how much under Less Restricted?

- Summing across all habitats/landscapes and across all ecosystem services gives the total value of each network

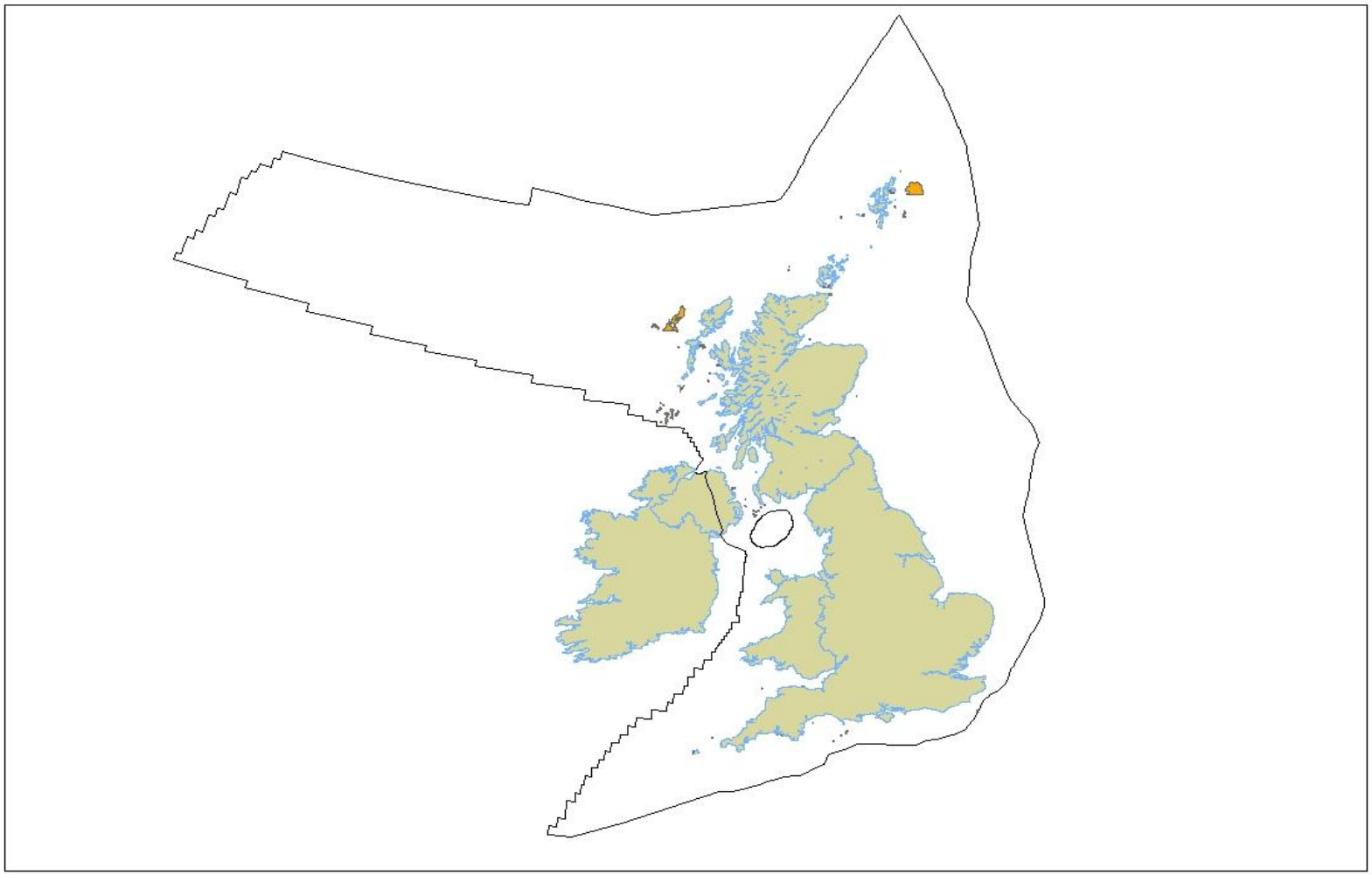
UK Seabed Landscapes



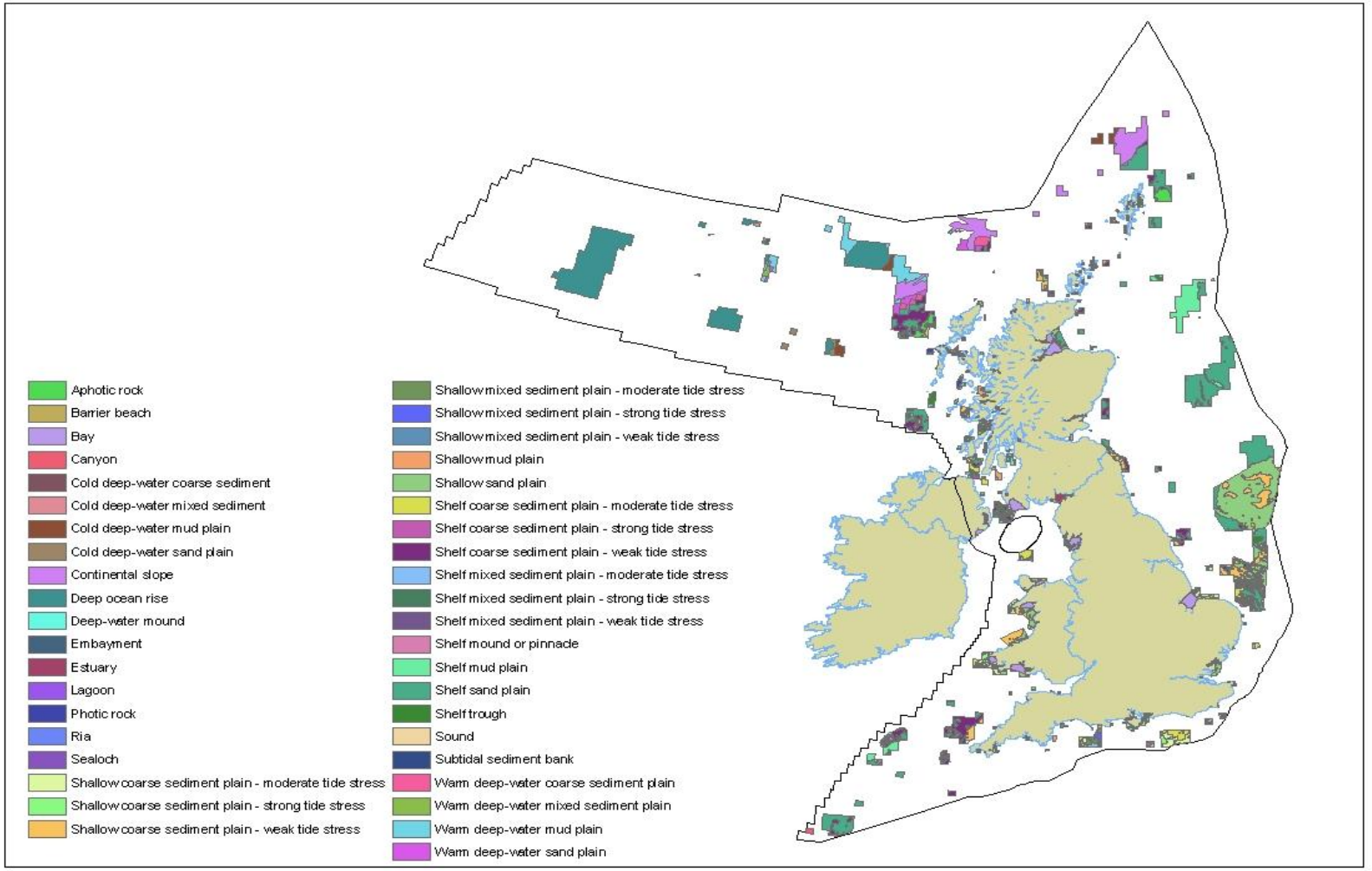
Aphotic reef - UK



Aphotic reef – network scenario A



Landscapes – Scenario A



Apportioning total value of an ecosystem service across habitats/landscapes

- Code A: biological partitioning
  - (area/impact per unit area)

    nutrient recycling
    bioremediation of waste
    gas and climate regulation
    food provision
    raw materials

- Code B: area only

    biologically mediated habitat
    resistance and resilience

- Code C: biological partitioning/location specific

    disturbance prevention and alleviation

- Code D: No biological basis for partitioning

    leisure and recreation
    cultural heritage and identity
    non-use/bequest value
    option use value
    cognitive values

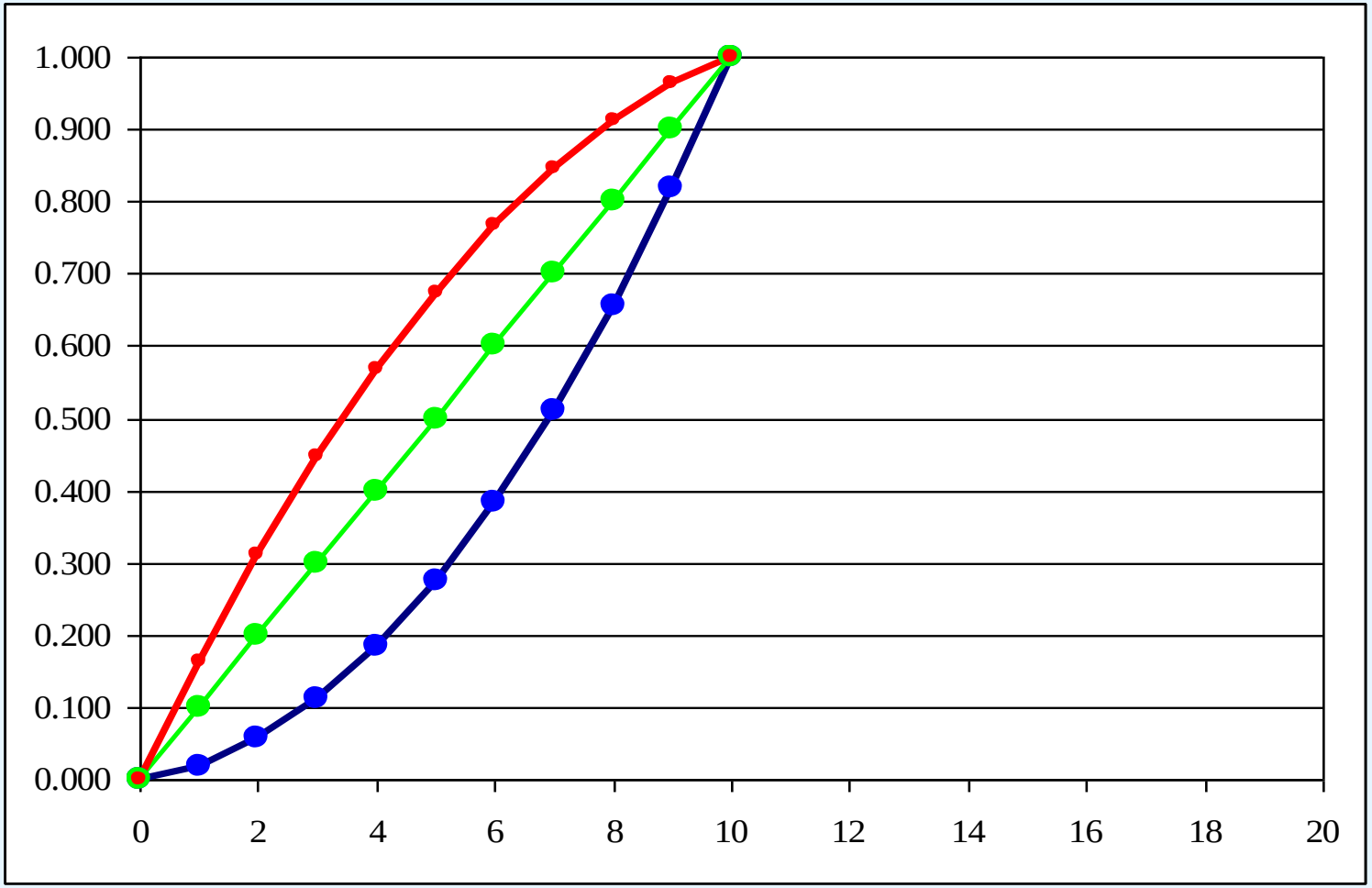
Coding for extent of impacts from MCZ designation (compared with status quo)

Interpretation of the impact coding for the valuation estimate

Coding	*Percentage range*	*Mid-point*	*High value*	*Low value*
VH (very high)	90-100%	95%	100%	90%
H (high)	50-89%	70%	89%	50%
M (medium)	10-49%	30%	49%	10%
L (low)	1-9%	5%	9%	1%
VL (very low)	<1%	0.5%	1%	0%

Coding for timing of impact – the benefits stream over the 20 year IA period

Trajectories for impact path for 10/20 coding



Aggregation of on-site benefit from enhanced provision of ecosystem services

Present values (£) for protecting the entire network under Highly Restricted Less Restricted (3.5% discounted rate)

Network/ management		Nutrient Recycling	Gas/climate regulation	Food provision	Raw Materials	Disturbance prevention/ alleviation	Leisure and recreation	Cognitive value	**SUM**
Total Value		1,300,000,000	8,238,601,638	884,900,000	116,500,000	440,000,000	3,400,000,000	453,300,000	
A/HP-MCZ	%	95.49	95.49	0.07	0.08	0.07	39.76	127.14	
	Total	1,241,366,354	7,867,017,601	613,414	92,394	304,829	1,351,868,807	576,306,372	**11,037,569,771**
A/MCS-MCZ	%	89.75	89.75	2.37	0.64	0.07	33.74	106.15	
	Total	1,166,762,575	7,394,224,662	20,966,407	751,400	304,829	1,147,060,637	481,176,256	**10,211,246,765**
G/HP-MCZ	%	168.38	168.38	0.12	0.13	0.12	59.74	195.06	
	Total	2,188,948,181	13,872,209,283	1,053,612	149,169	511,987	2,031,245,922	884,192,259	**18,978,310,412**
G/MCS-MCZ	%	157.47	157.47	3.98	1.03	0.12	47.70	159.43	
	Total	2,047,131,025	12,973,459,245	35,212,089	1,198,696	511,987	1,621,700,525	722,703,371	**17,401,916,938**
J/HP-MCZ	%	220.22	220.22	0.14	0.14	0.14	51.08	173.20	
	Total	2,862,802,868	18,142,686,461	1,280,813	167,192	617,613	1,736,676,286	785,128,064	**23,529,359,297**
J/MCS-MCZ	%	212.19	212.19	3.85	1.32	0.14	42.95	146.99	
	Total	2,758,431,506	17,481,244,863	34,074,307	1,533,579	617,613	1,460,315,811	666,290,327	**22,402,508,006**

Overall results

- With a 3.5% discount rate, the present value benefits range from **£10.3 billion to £22.7 billion** depending on network scenario/split between Highly and Less Restricted
- Sensitivity analysis: present value range falls to £6.4 billion to £15.1 billion
- Present value of *costs* **£0.4 billion to £1.2 billion**
- Mean annual undiscounted benefit range: **£0.9 billion to £1.9 billion**

Limitations

- No ‘network effect’ accounted for
- Exclusions/local conditionality for restrictions
- Apportioning of benefits crude
- Benefits Transfer – limited number of studies

Take home messages: MCZ study

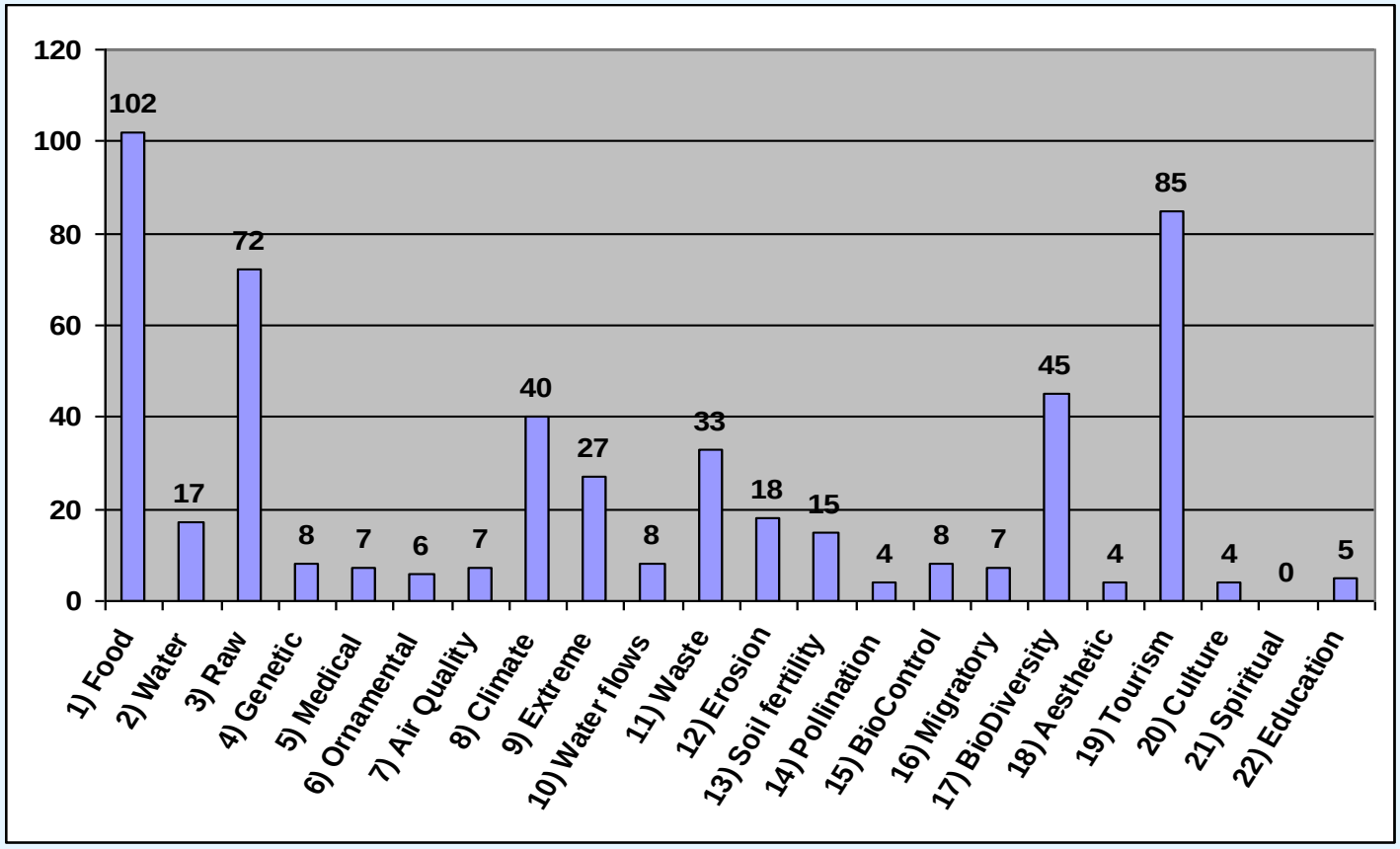
- The estimated benefit range is **£10.3 billion to £22.7 billion** (at least seven times estimated costs)
- This is an under-estimate and does not include several benefit categories
- Importance of defining clear scenarios and counterfactual
- *Ad hoc* methodology – in the absence of production functions we have to make assumptions (score) about how designation produces goods and services
- Developments in FP7 project **O**ptions for **D**elivering **E**cosystem-Based **M**arine **M**anagement [ODEMM]

TEEB and ‘operationalising’ the Ecosystem Approach

- Can such examples *inspire* change?
- Can we *transfer* benefit estimates?
- Can we understand the needs of different TEEB stakeholders at different levels?

TEEB database: ecosystem services

Distribution of 522 data points over services

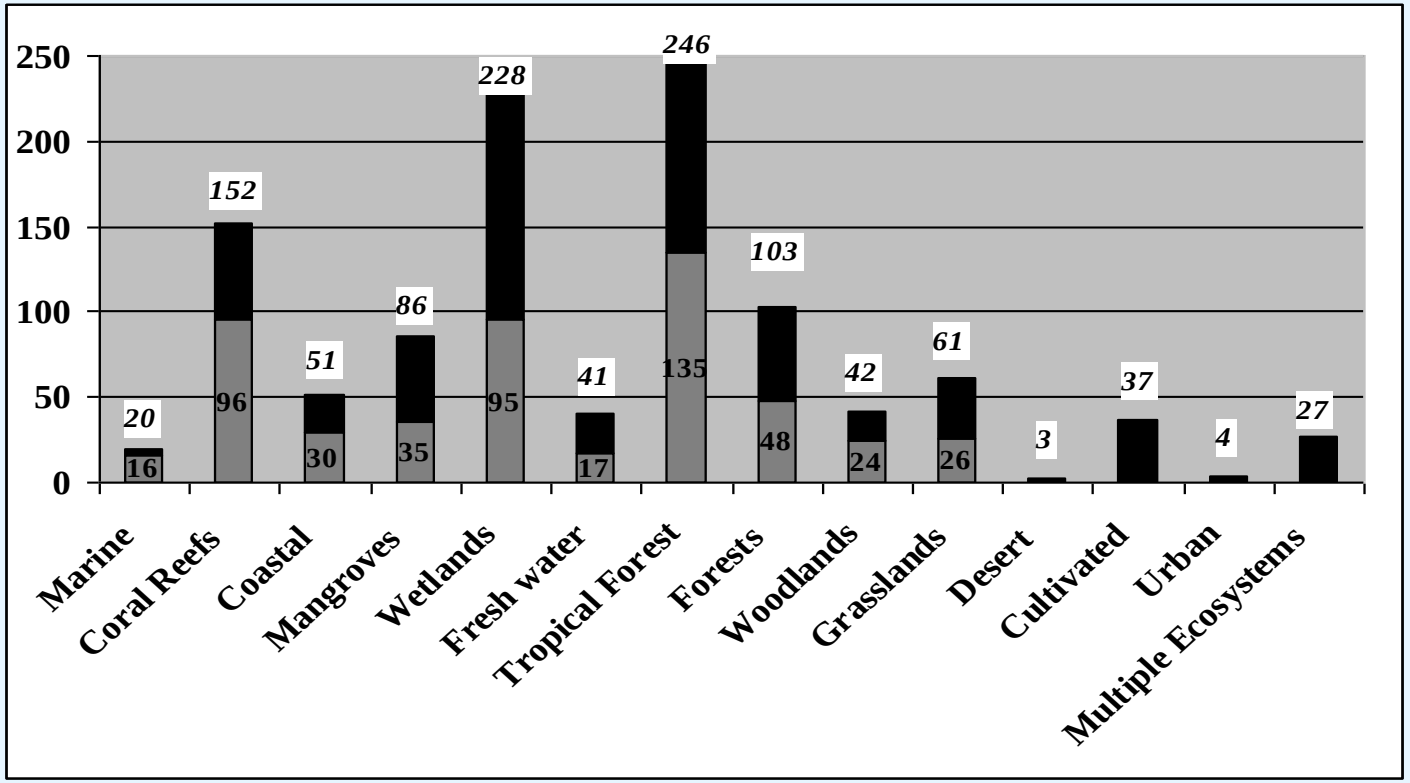


Most data:
Food
Tourism
Raw materials

Least data
Pollination
Aesthetics
Cultural insp.
Spiritual

TEEB database: biomes

Distribution of 522 data points over biomes



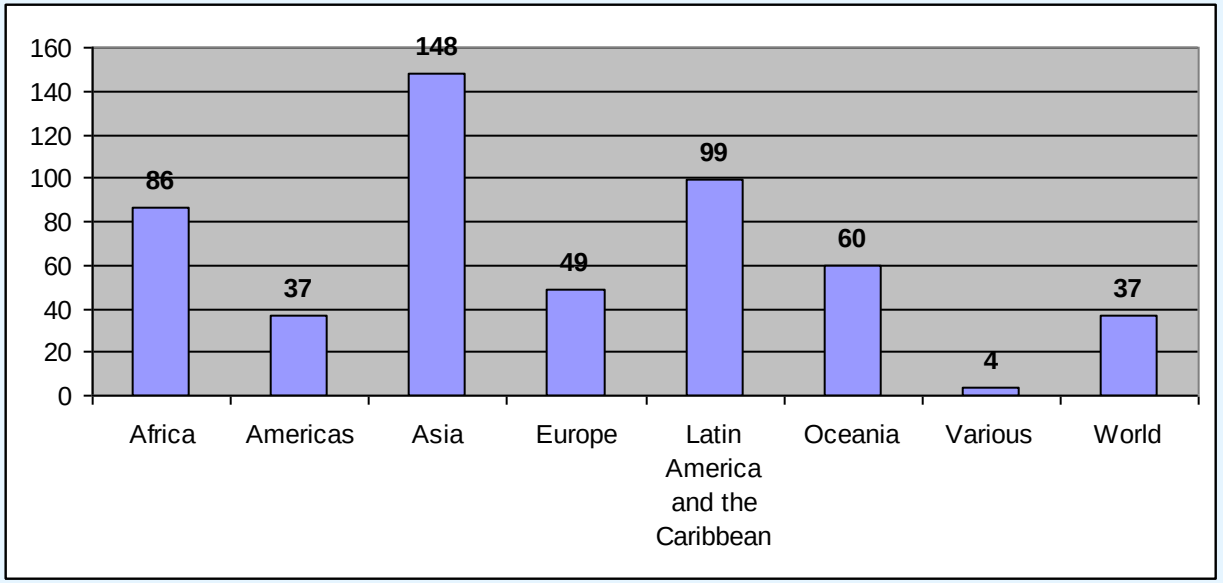
Most data:
Trop. Forest
Wetlands
Coral reefs

Least data
Marine
Urban
Desert

Grey = used for Total Value Matrix

TEEB database: data sources

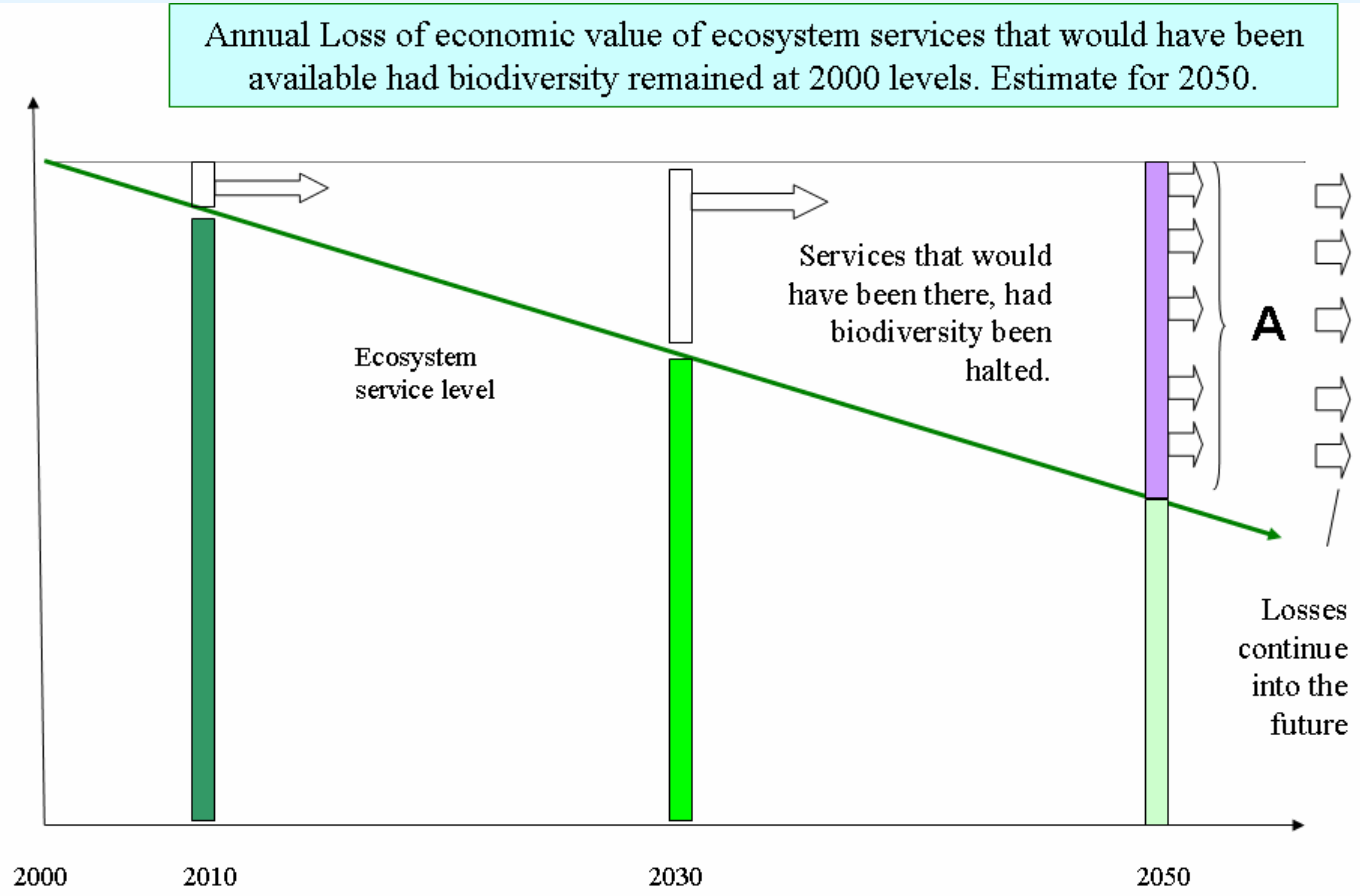
Origin of values per continent (& country)



Asia (148) : **China (42);** India (25); Philippines (24)
Lat.Am. & Carib. : **Brazil (25**); Mexico (23); Ecuador (9)
Africa : South africa (19); Tanzania (16); Uganda (13)
Oceania : **Australia (29**); Samoa (25); New Zealand (4)
Europe : Spain (12); Netherlands (9); Austria (7)
Americas : USA (22); Canada (13); Costa Rica (2)

Macro scaling: Interim Report

50-year impact of inaction or 'business as usual'



Welfare losses equivalent to 7 % of GDP, horizon 2050

Source: Braat & ten Brink (Eds., 2008): ***Cost of Policy Inaction***

TEEB Quantitative Assessment

CHANGES TO PRODUCTION PRACTICES

1. *Closing the agricultural yield gap versus failure to increase future yields*
2. *Liberalisation of trade in agricultural products*
3. *Aquaculture partly replacing marine capture fisheries*
4. *Reducing post-harvest loss*

CONSERVATION POLICIES

5. *Sustainable forest management*
6 *Expansion of protected areas to 20% and 50% per biome per region*

POLICIES TARGETED AT CLIMATE CHANGE MITIGATION

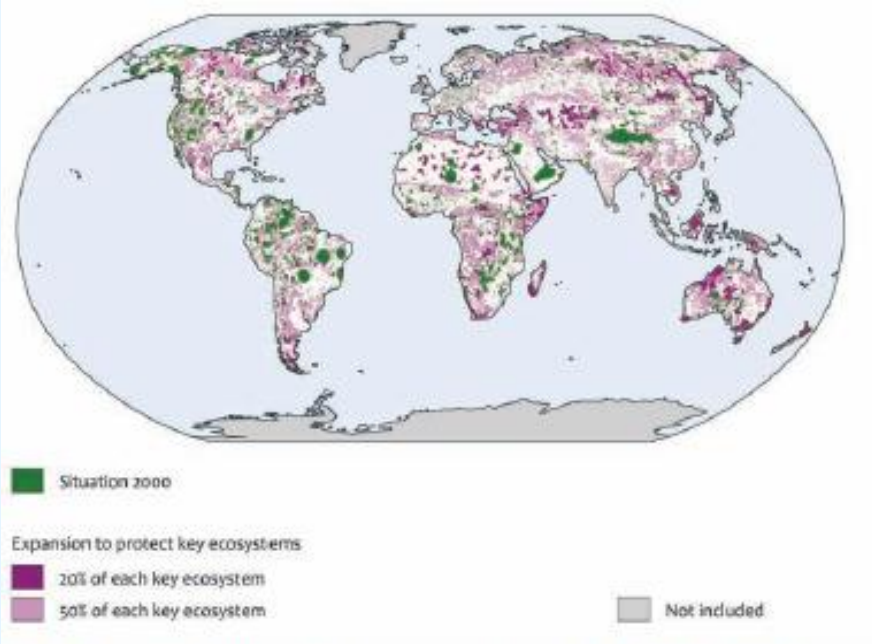
7. *Reducing emissions from Deforestation and Forest Degradation (REDD)*
8. *Climate change mitigation by bio-energy and forest plantations*

CONSUMER BEHAVIOUR

9. *Dietary change (reducing / not increasing consumption of animal proteins, healthy diet)*

Expanding protected areas

- Currently 14.6% of terrestrial area is ‘protected’
- Pre-Nagoya CBD target of 10% has not been met:
  - 11 out of 14 biomes
  - 50% of eco-regions
- Two option scenarios:
  - Expand protected areas to 20% and 50% of all 825 eco-regions

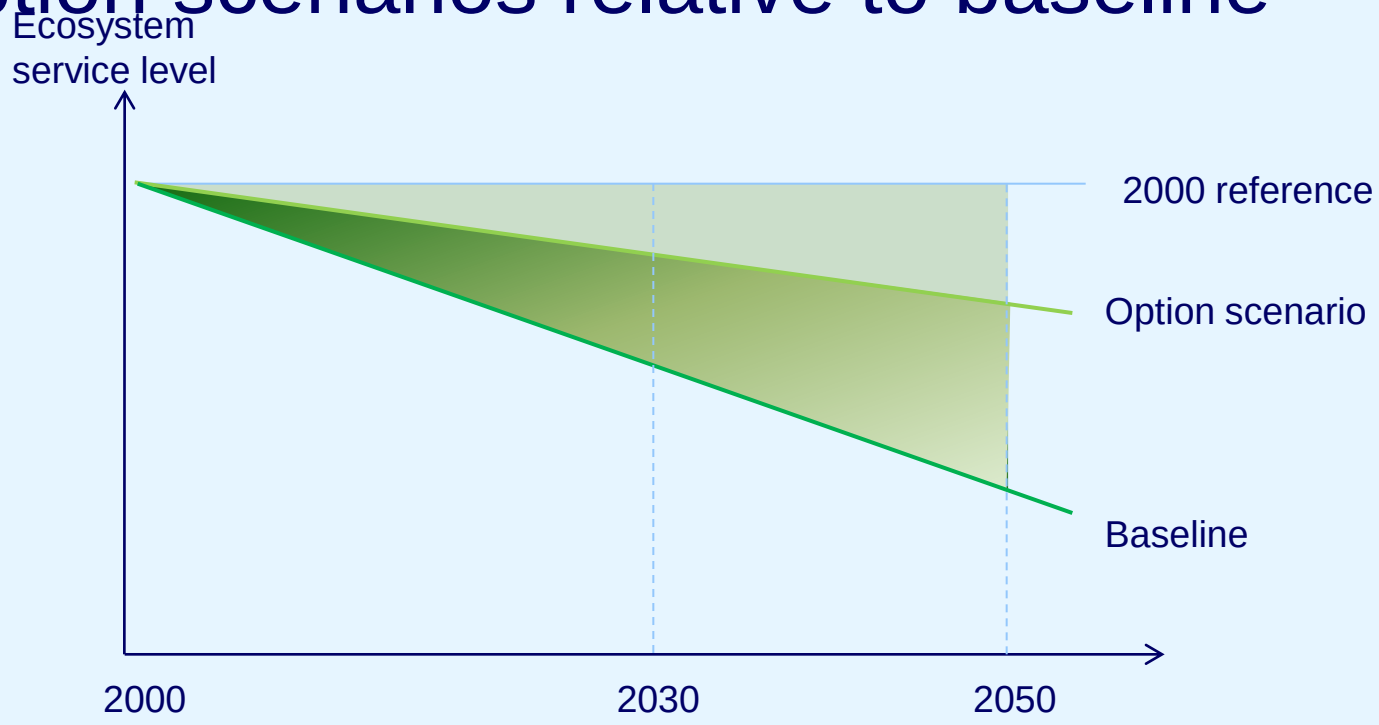


Current protected areas (baseline), and protected areas (options) for expansion of the current protected areas to at least 20% and 50% of each key ecosystem.

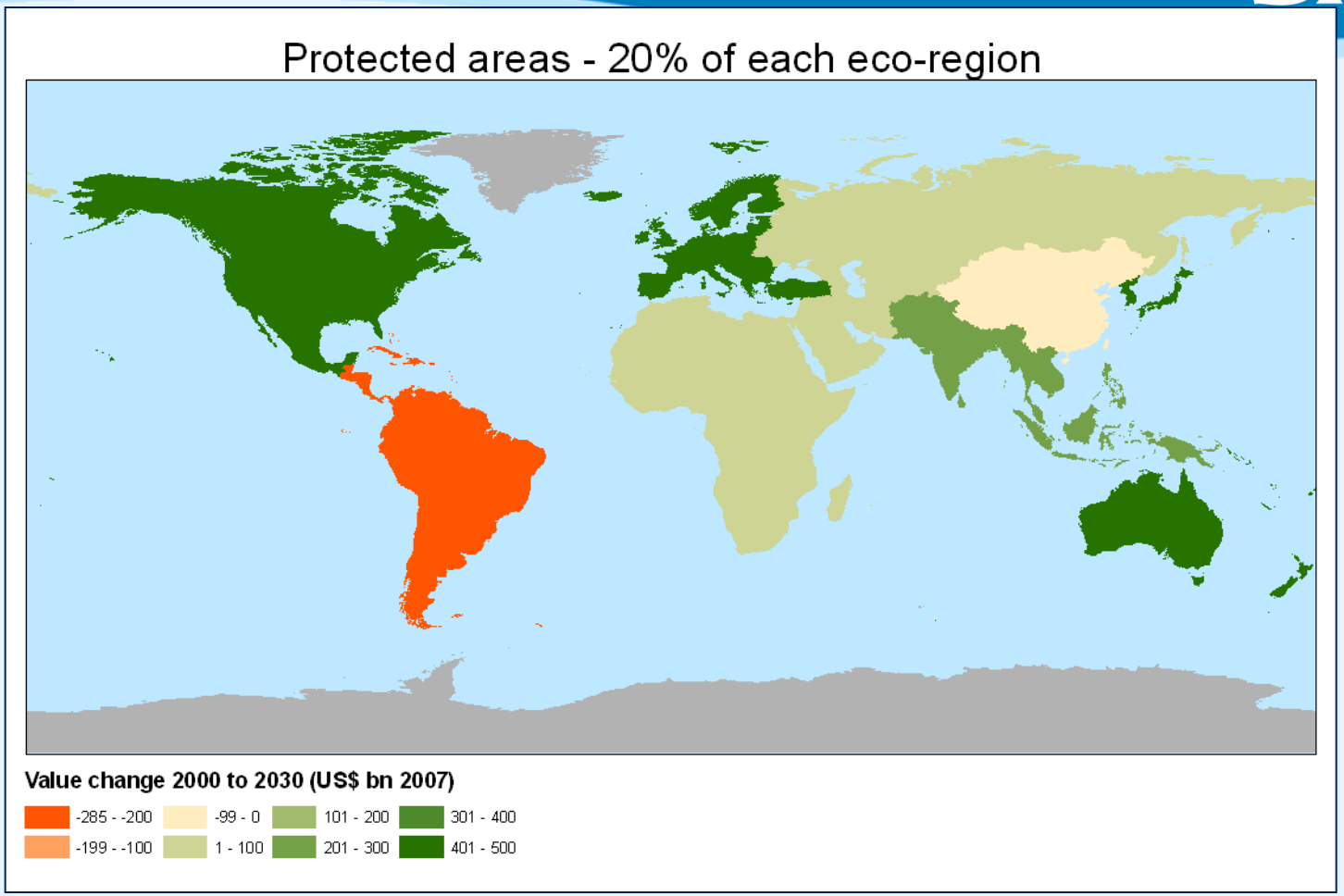
Source: PBL (2010)

TEEB Quantitative Assessment

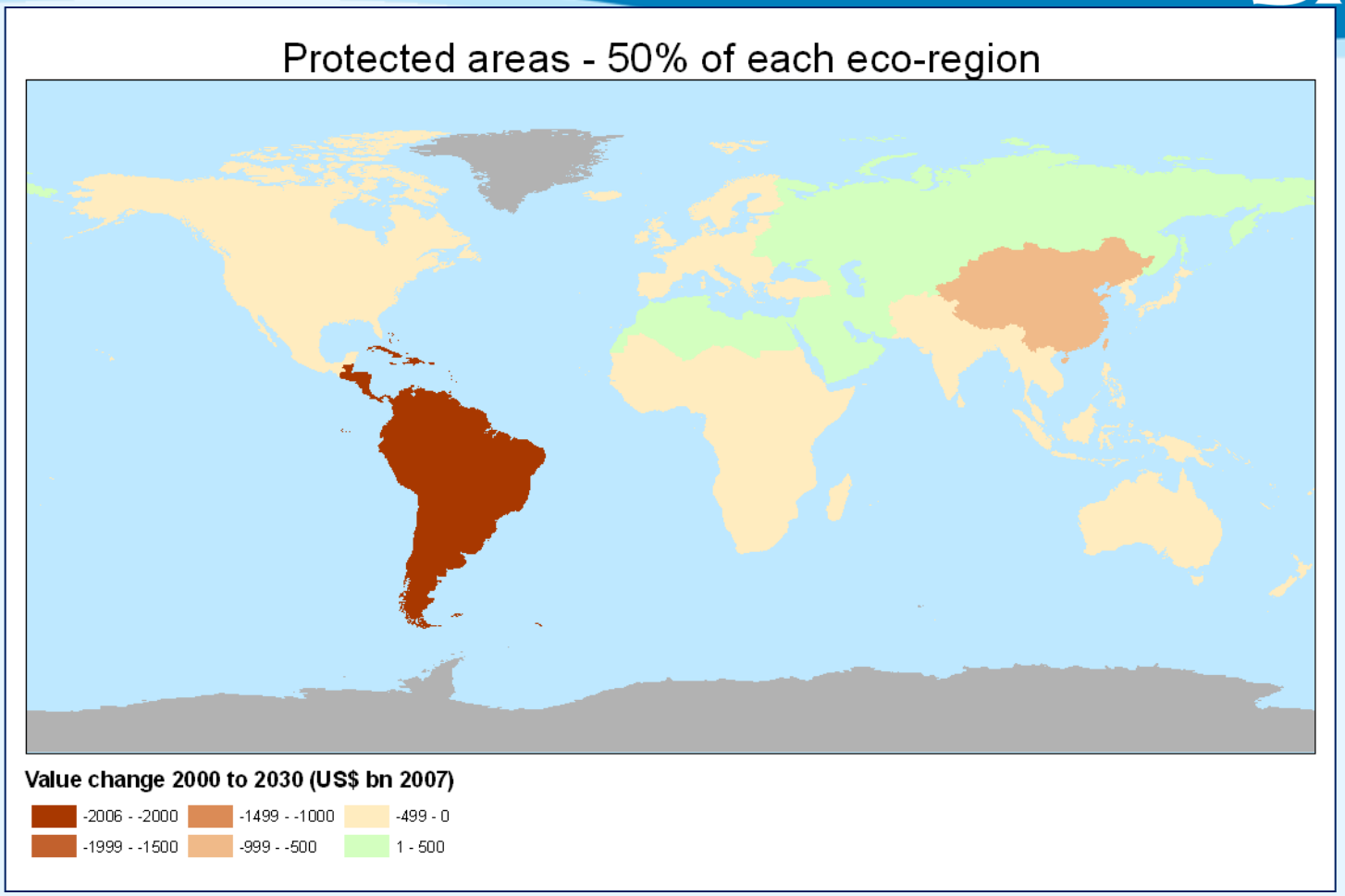
- QA intends to measure costs and benefits of option scenarios relative to baseline



Aggregate benefit distribution: 20% PA



Aggregate benefit distribution: 50% PA



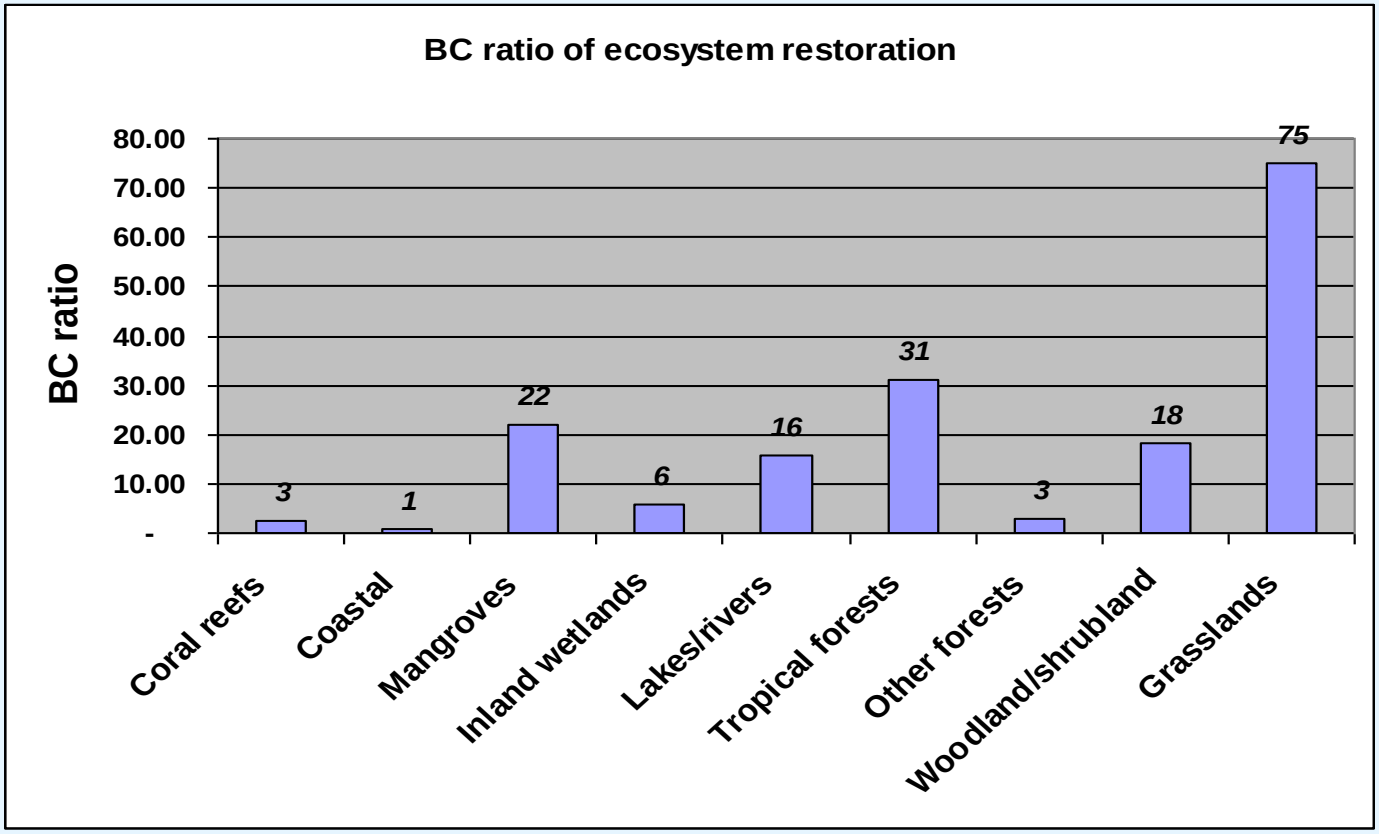
Benefit cost ratios

20% Protected Areas		Discount rate		
		0%	1%	4%
Benefits (bn US$2007)		532.7	436.3	250.2
Carbon values (bn US$2007)	SCC	367.1	367.1	367.1
Costs (bn US$2007)	Mid	465.1	400.4	269.0
	Upper	1 995.7	1 717.1	1 151.3
Benefit/cost ratios				
No carbon value	Mid	**1.1**	**1.1**	0.9
	Upper	0.3	0.3	0.2
Social Cost of Carbon	Mid	**1.9**	**2.0**	**2.3**
	Upper	0.5	0.5	0.5

50% Protected Areas		Discount rate		
		0%	1%	4%
Benefits (bn US$2007)		-4 388.3	-3 593.8	-2 060.6
Carbon values (bn US$2007)	SCC	2 844.0	2 844.0	2 844.0
Costs (bn US$2007)	Mid	1 853.8	1 595.1	1 069.5
	Upper	7 972.9	6 859.0	4 596.5
Benefit/cost ratios				
No carbon value	Mid	-2.4	-2.3	-1.9
	Upper	-0.6	-0.5	-0.4
Social Cost of Carbon	Mid	-0.8	-0.5	0.7
	Upper	-0.2	-0.1	0.2

TEEB: Benefit-Cost ratios

(screened: 20.000 -> 95 relevant -> 18 used for TEEB)



Assumptions: high cost scenario, average benefit scenario, time horizon = 40 years (including 10% annual operation costs; discount rate = 1 %)

TEEB Phase III

- Conference in Leipzig, Germany in Spring 2012
- TEEB for Business
- Publication and dissemination of Quantitative Assessment
- TEEB for India, Brazil, *etc*.

TEEB - summary

- TEEB is meant to inspire and ‘operationalise’ change
- It is ‘field tested’ [TEEB D2] with stakeholders
- The report structure [TEEB D0-D4] is set up so as to facilitate engagement with and use of the end products

SAC

Success through Knowledge