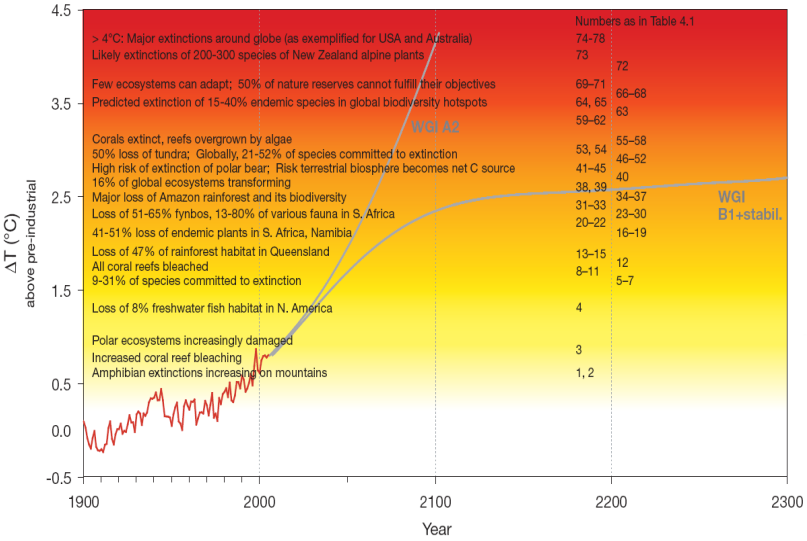
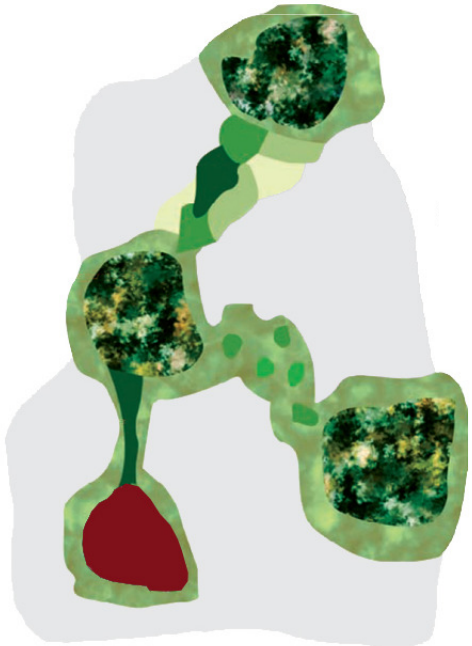
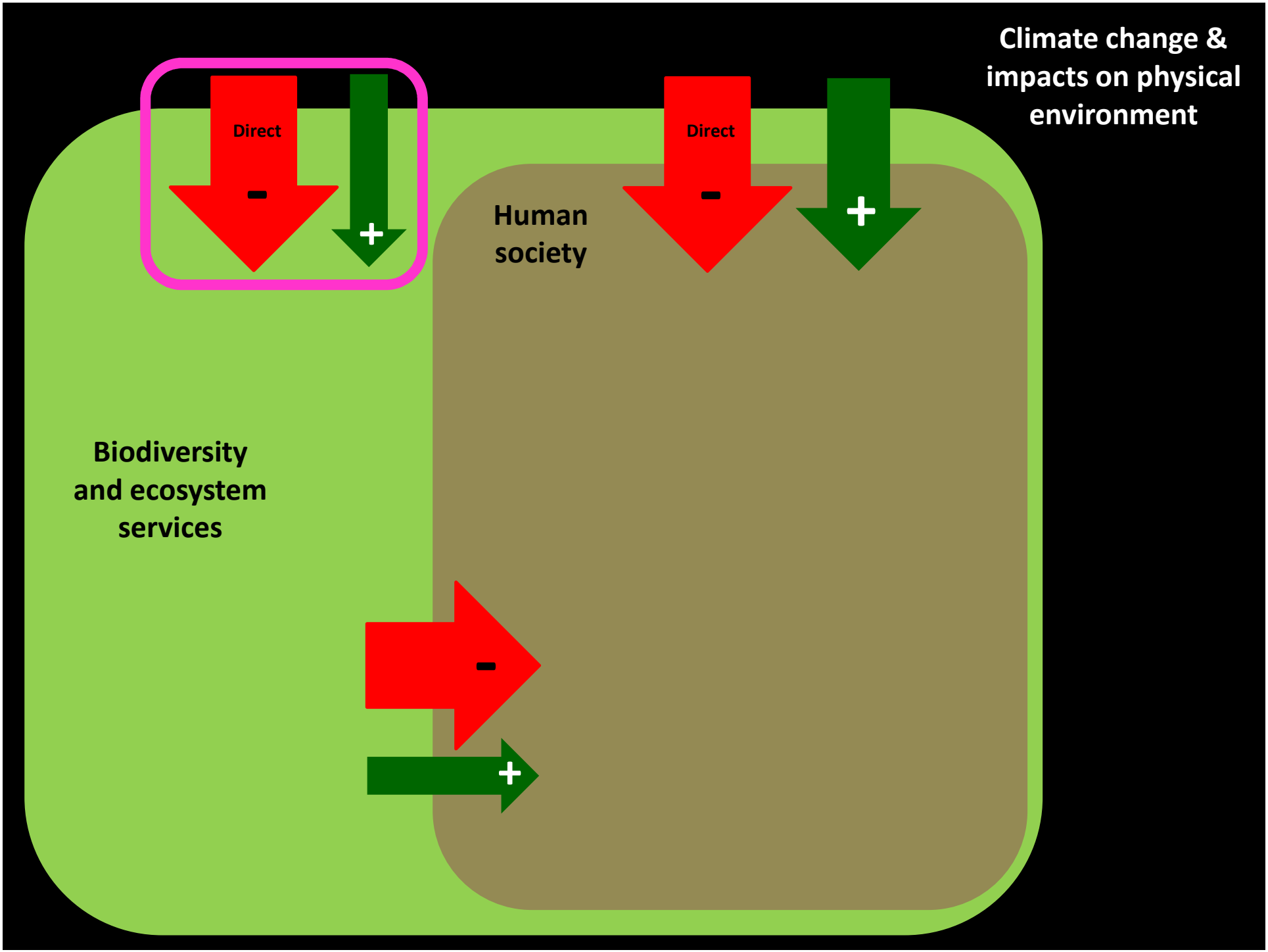
Protected areas, biodiversity and climate change in Europe: challenges, opportunities and potential responses

Yves de Soye, January 2010

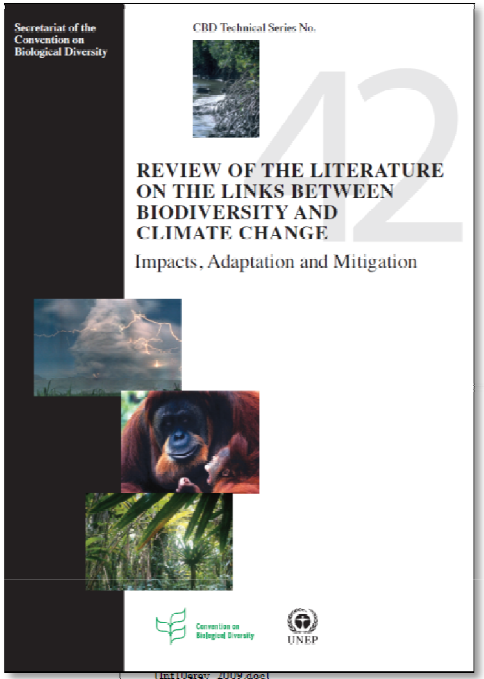


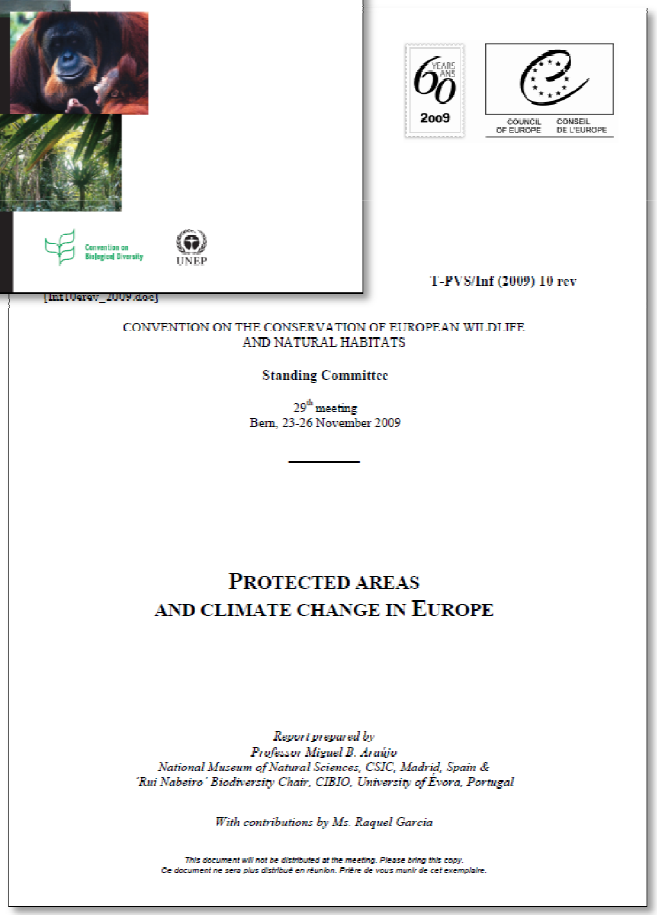


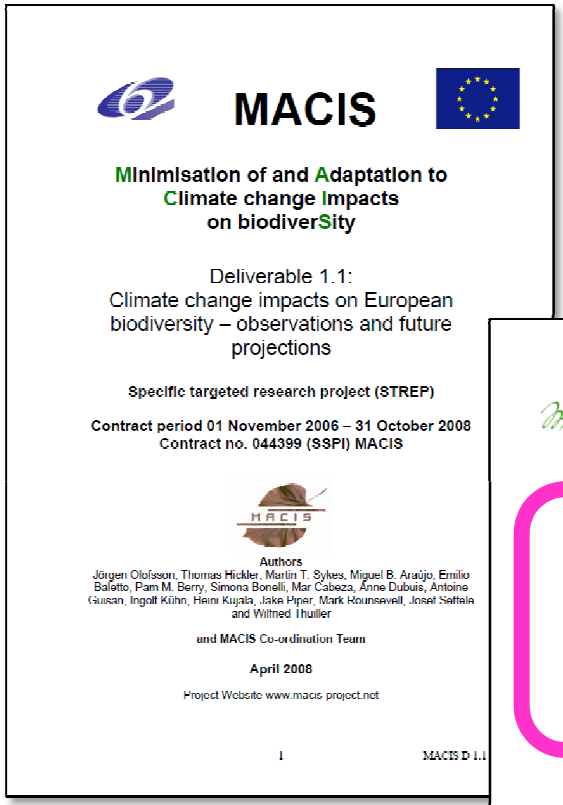

Climate change & impacts on physical environment
Direct
-
+
Direct
-
+
Human society
Biodiversity and ecosystem services
-
+

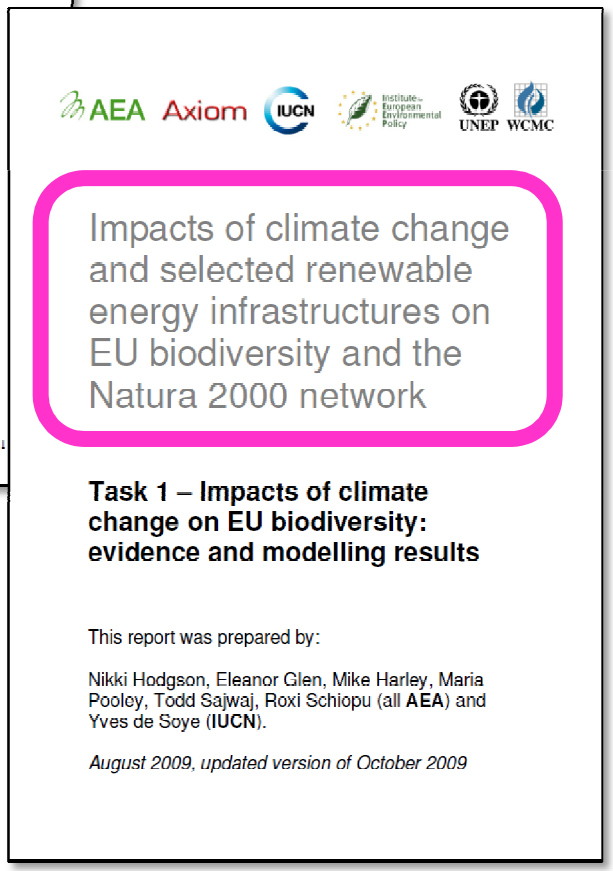
Direct impacts of climate change on biodiversity in Europe

Reviews in 2008 - 2009





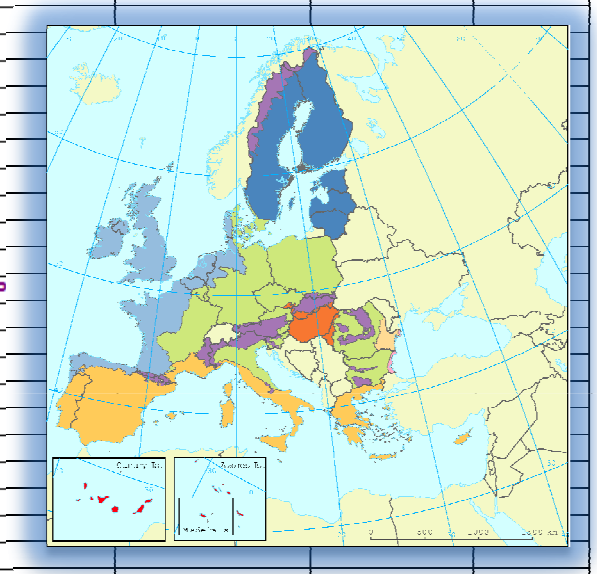




Task 1: Climate change impacts: evidence & models

Biogeographic zone / Impact category	Alpine	Atlantic	Black Sea	Boreal	Continental	Macaronesian	Mediterranean	Pannonian	Steppic
Physical effects									
Increase in sea level and coastal flooding	N/A	OE MP		CM		OE			
Increase in annual average temperature	OE MP	OE MP	OE	OE MP	OE	OE MP	OE MP	OE MP	
Increase in extreme weather events		OE MP		MP	OE			MP	
Increased drought	OE MP	OE	OE		OE	OE MP	C MP	OE MP	
Increased precipitation, run-off and flooding	OE MP		OE	OE MP	OE				
Change in snowlines and duration	OE MP	MP							
Increased carbon dioxide		OE MP		OE MP		OE			
Increased forest fire	OE MP			OE	CO				
Increased disease and infestation	OE MP			OE MP					
Increased rate of change in temperature	OE								
Shifts in water quantity and quality			OE		OE				
Decreased river discharge			OE MP						
Increased biomass and carbon sequestration				OE MP	OE MP				
Decreased plant productivity						OE			
Increased humidity						OE MP			
Increased ocean acidification						OE			
Effects on biodiversity and ecosystems									
Altitudinal movement of plants/animals/habitats	OE MP	MP			OE MP	OE			
Latitudinal movement of plants/animals/habitats		OE MP		MP	OE MP				
Seasonal changes in plants		OE							
Changes in limiting resources									
Increase in species richness	OE MP			OE MP					
Earlier life cycle events		OE	OE	CO					
Decreased life cycle events						OE			
Longer growing season		OE	OE	OE	OE				
Range contraction and extinction	OE MP				OE MP	OE	OE		
Gain in climate space	OE MP	OE MP		MP	OE MP	OE			
Loss in climate space	OE MP	OE MP							
Loss of glacial extent	OE								
Land use constraints		OE							
Breeding decline and sea level rise		OE							
Increase in species competitive advantage									
Increased invasive species									
Loss of wetlands									
Decoupling of species interactions		OE							
Increased species mixing									
Vulnerability									
Identification of vulnerable species and/or habitats	OE	OE MP							
Identification of resilient species and/or habitats									

KEY
Observed evidence exists and showing impact - **OE**
Model prediction exists and showing impact – **MP**
Contradiction in observed literature **CO**
Contradiction in modelled literature **CM**
Not applicable N/A



Data gaps :

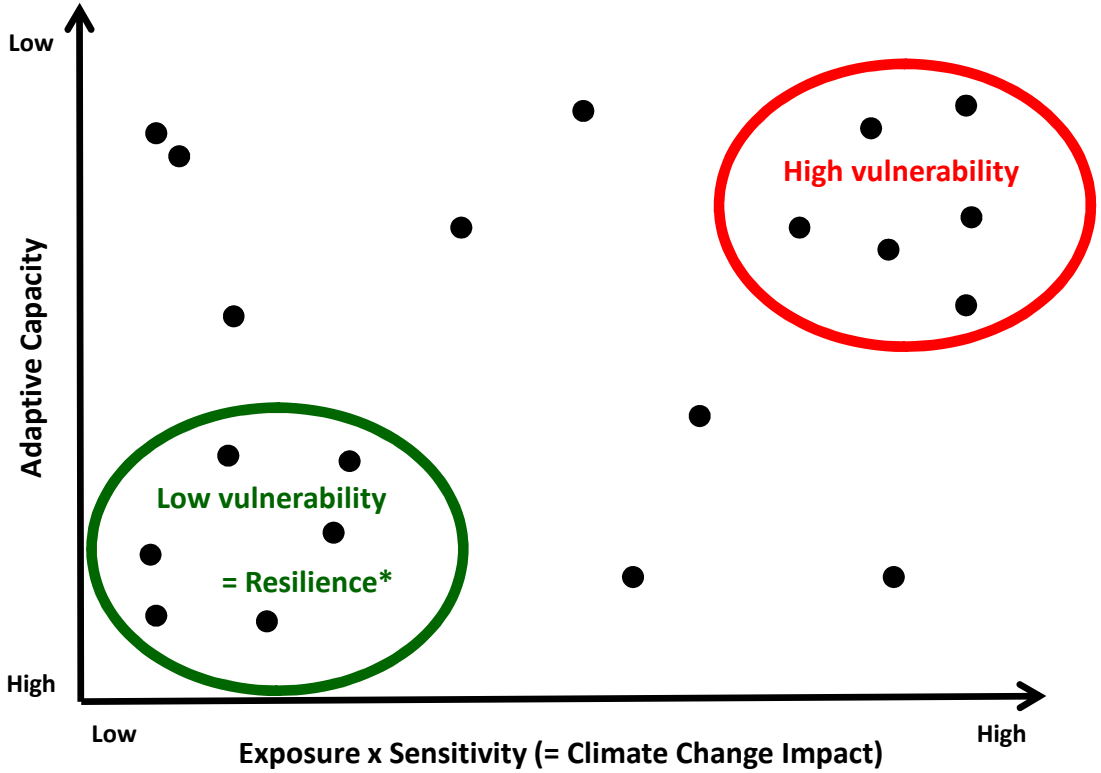
- Macaronesia, Mediterranean & Eastern EU
- Majority of EU species, esp. species of Community Interest
- Habitats and species interactions
- **Vulnerability** of species and habitats

Vulnerability assessment - necessary terminology (IPCC AR4, 2007):

- Impact - a function of exposure and sensitivity;
- Adaptive capacity - stay and adapt, or track changing climate;
- Vulnerability - a function of exposure, sensitivity, and adaptive capacity.

⇒ ***Vulnerability = Impact / Adaptive Capacity***

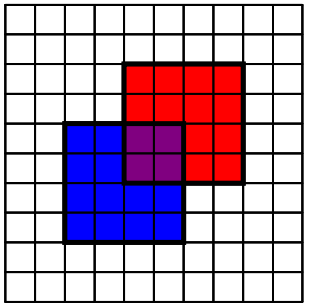
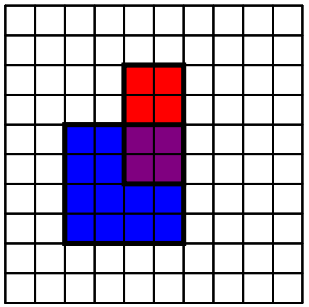
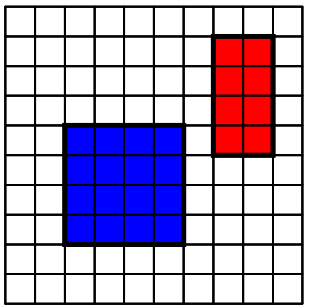
⇒ ***Vulnerability = Exposure x Sensitivity / Adaptive Capacity***



Task 2a and 3a: N2000 species & network vulnerability

Vulnerability = Exposure x Sensitivity / Adaptive Capacity:

Changes in potential suitable climate space: Overlap & Ratio

	Climate space change	Overlap	Ratio
Example 1		$\frac{\text{(no. cells overlap)}}{\text{(no. cells current)}} = \frac{4}{16}$ **25%**	$\frac{\text{(no. cells projected)}}{\text{(no. cells current)}} = \frac{16}{16}$ **100%**
Example 2		$\frac{\text{(no. cells overlap)}}{\text{(no. cells current)}} = \frac{4}{16}$ **25%**	$\frac{\text{(no. cells projected)}}{\text{(no. cells current)}} = \frac{8}{16}$ **50%**
Example 3		$\frac{\text{(no. cells overlap)}}{\text{(no. cells current)}} = \frac{0}{16}$ **0%**	$\frac{\text{(no. cells projected)}}{\text{(no. cells current)}} = \frac{8}{16}$ **50%**

Task 2a and 3a: N2000 species & network vulnerability

Vulnerability = Exposure x Sensitivity / Adaptive Capacity:

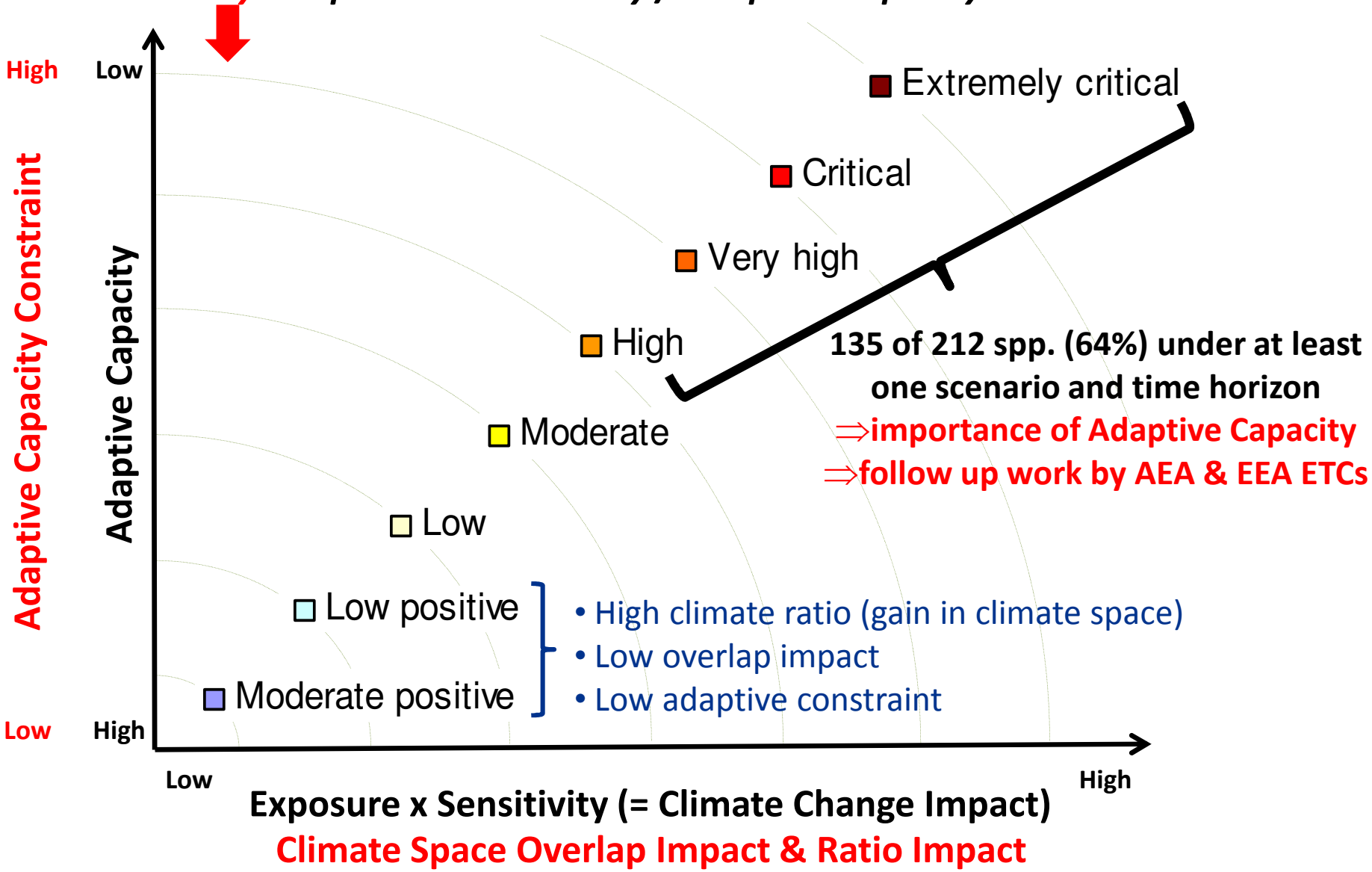
0 = no constraint on adaptation
1 = moderate constraint
2 = severe constraint

Adaptive Capacity Restriction	Ecological Trait	Adaptive Capacity Constraint
General restrictions	Small population and/or range in Europe	
	Low survival and/or productivity rates	
	Long generation times	
	Declining population in Europe	
	Low genetic diversity	
	Specialised and uncommon habitat requirements	
	Narrow niche	
	Critical association with another vulnerable species	
	Subtotal	
If **Climate Overlap Impact Score** is Moderate, High or Very High, add scores for: **Colonisation restrictions**	Barriers to dispersal (e.g. water, topography and man-made barriers)	
	Limited dispersal and/or colonisation ability	
	Mainly distributed in fragmented habitats that limit dispersal	
	Subtotal	

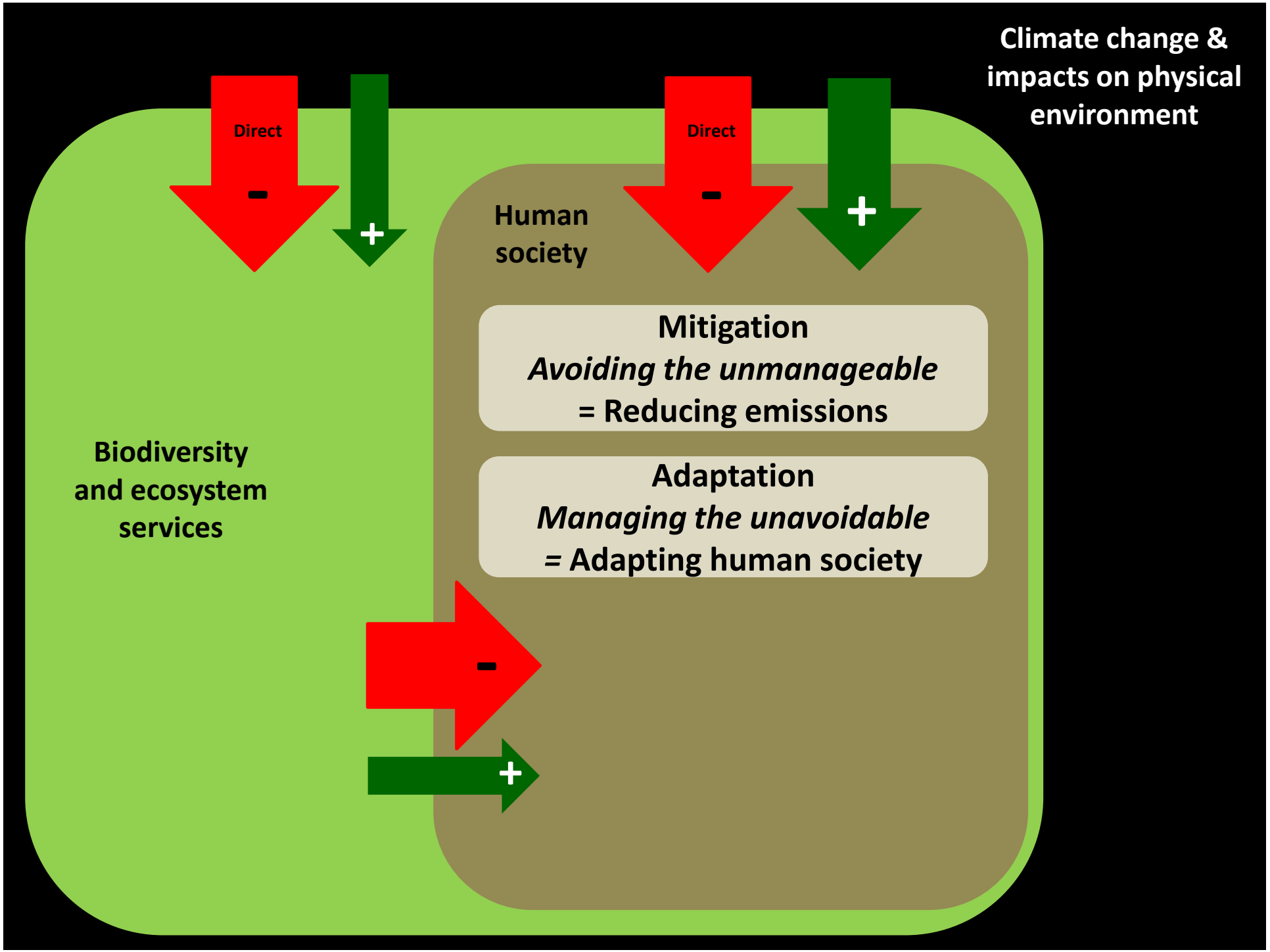
Total Adaptive Capacity Constraint Score

Task 2a and 3a: N2000 species & network vulnerability

***Vulnerability** = Exposure x Sensitivity / Adaptive Capacity:*



*: Resilience – amount of change a system can undergo without changing state (IPCC AR4, 2007)


Climate change & impacts on physical environment
Direct
-
+
Direct
-
+
Human society
Mitigation
Avoiding the unmanageable
= Reducing emissions
Adaptation
Managing the unavoidable
= Adapting human society
Biodiversity and ecosystem services
-
+

Climate change & impacts on physical environment

Direct

-

+

Direct

-

+

Human society

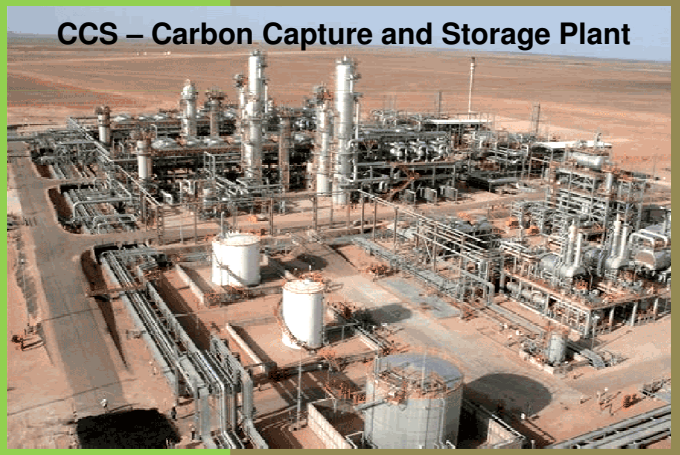
-

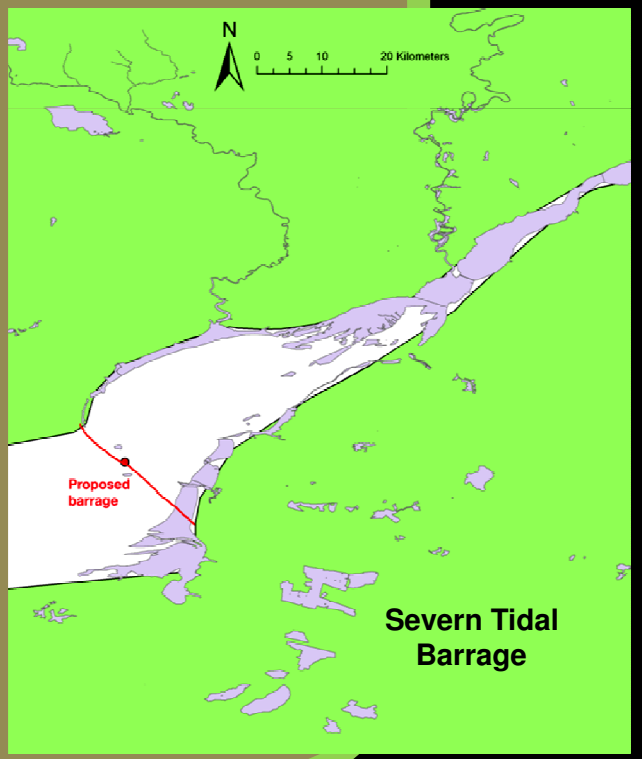
Hard engineered mitigation solutions

+

Biodiversity and ecosystem services

CCS – Carbon Capture and Storage Plant





Climate change & impacts on physical environment

Direct

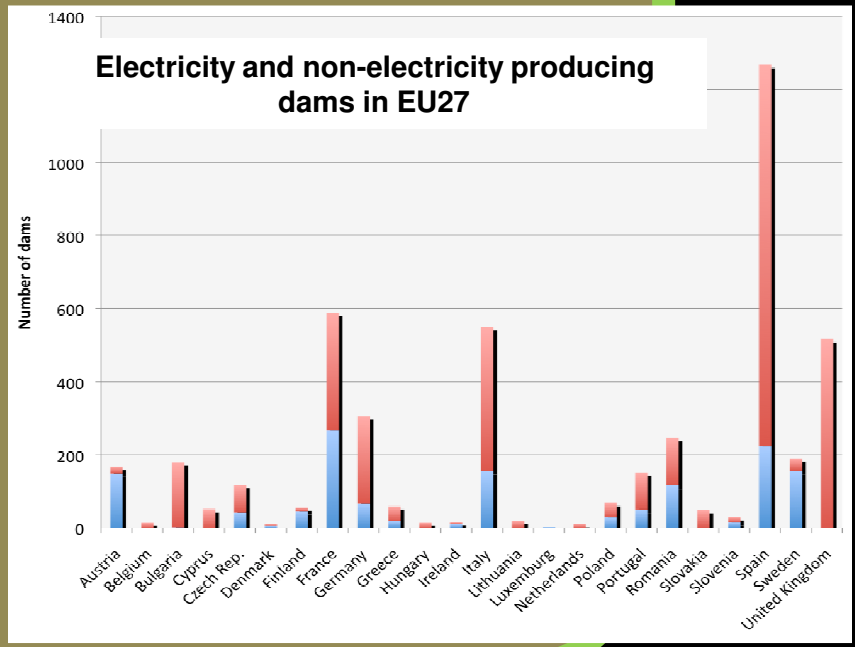
Direct

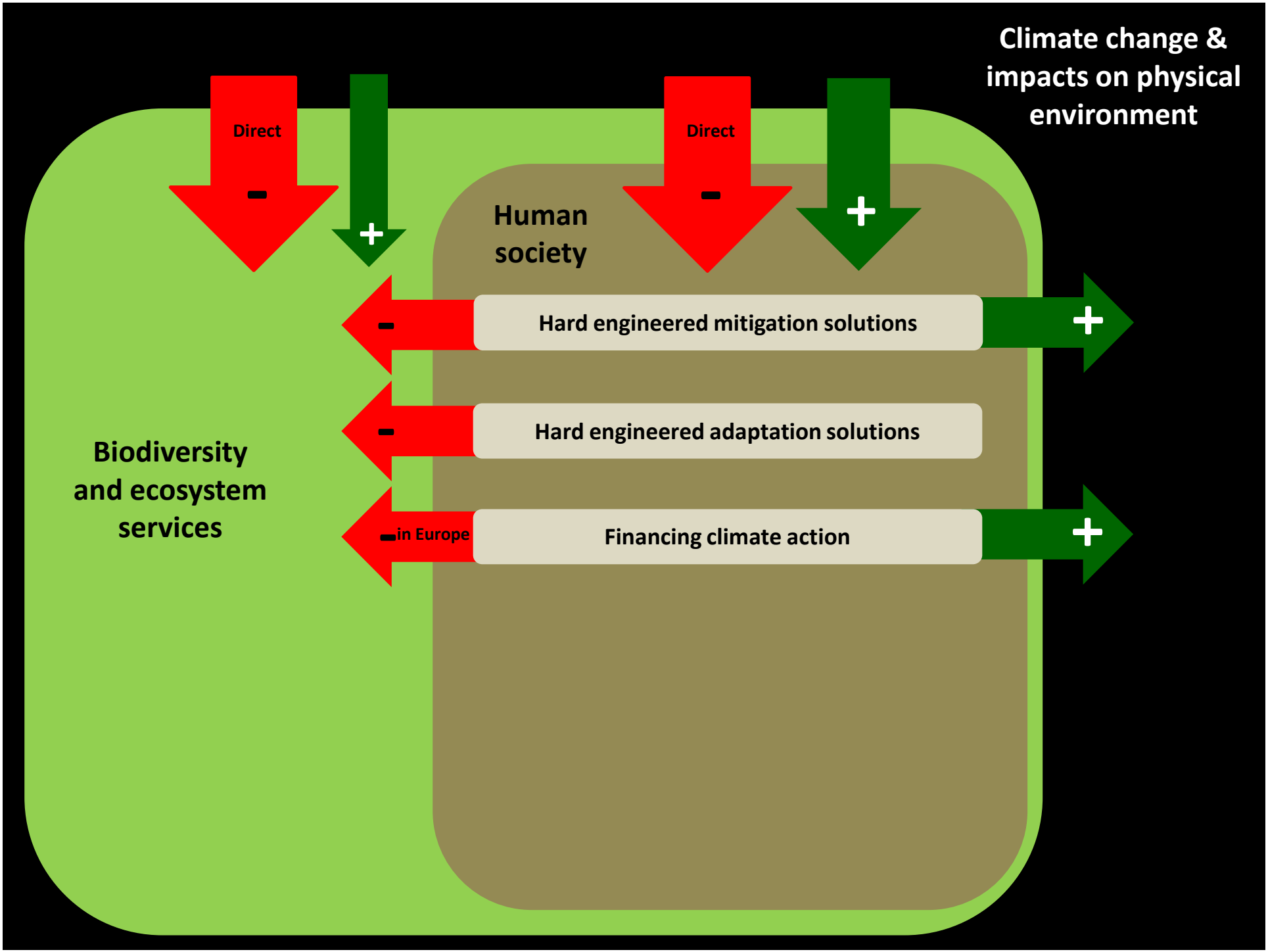
Human society

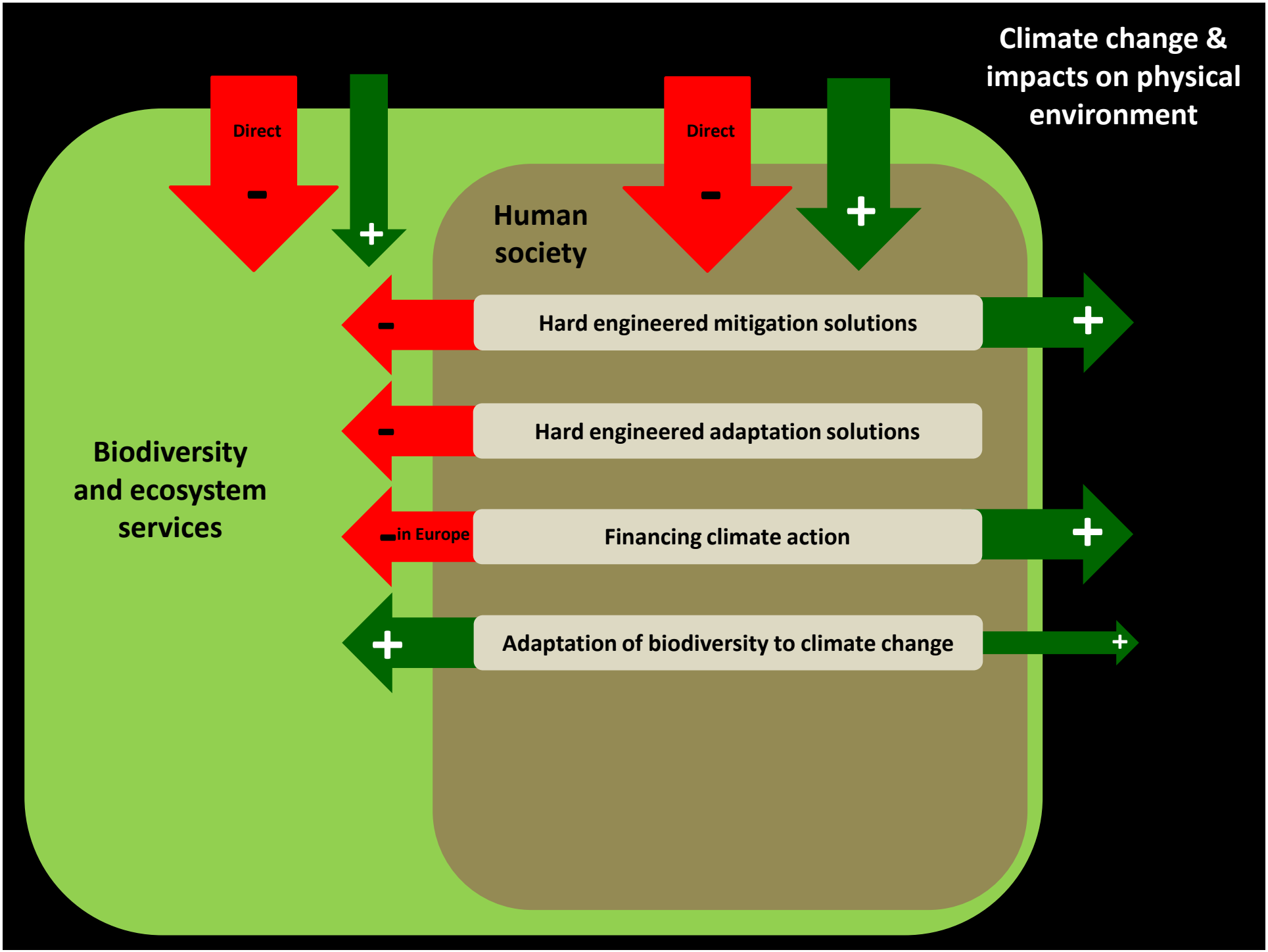
Hard engineered mitigation solutions

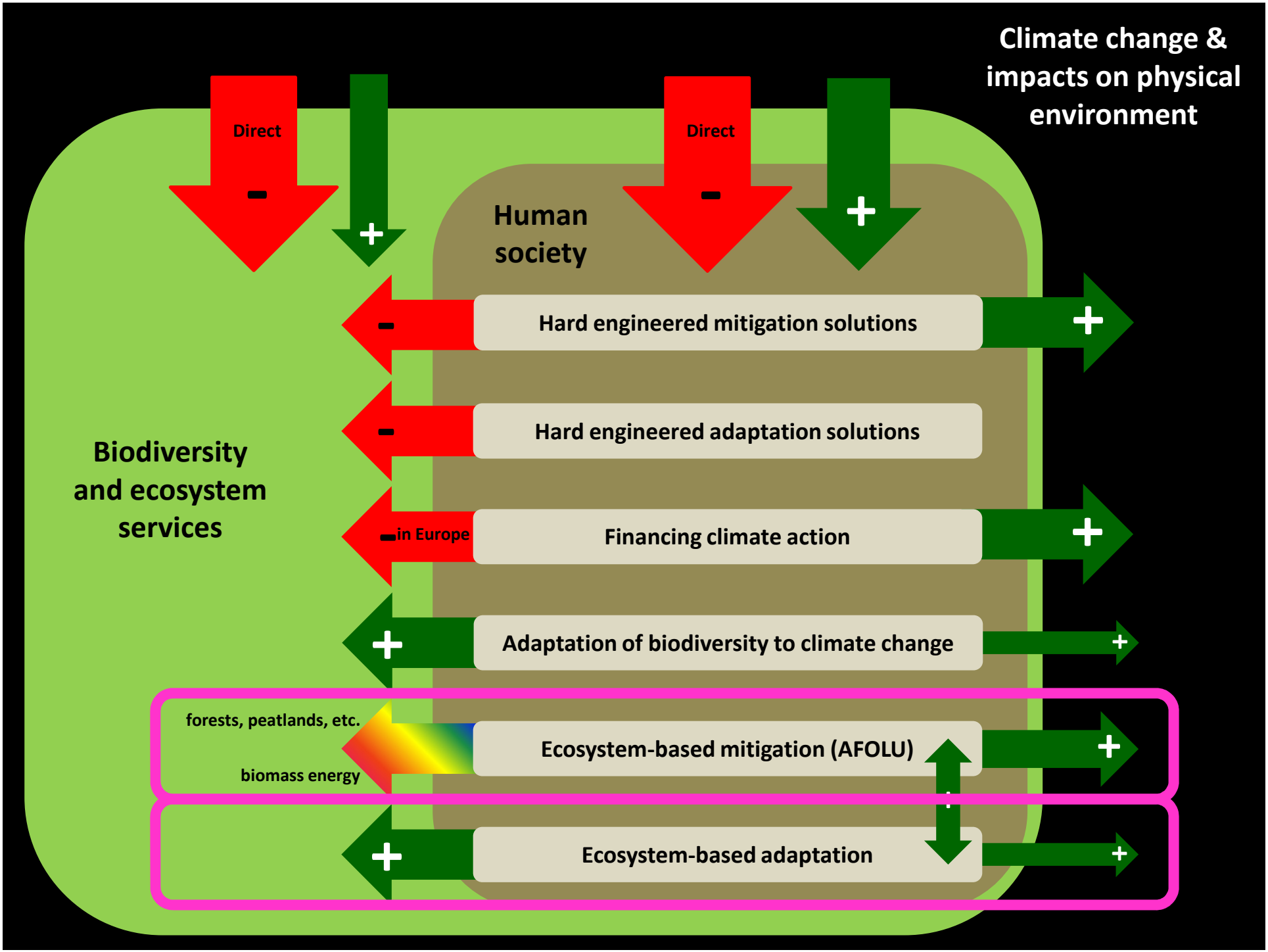
Hard engineered adaptation solutions

Biodiversity and ecosystem services

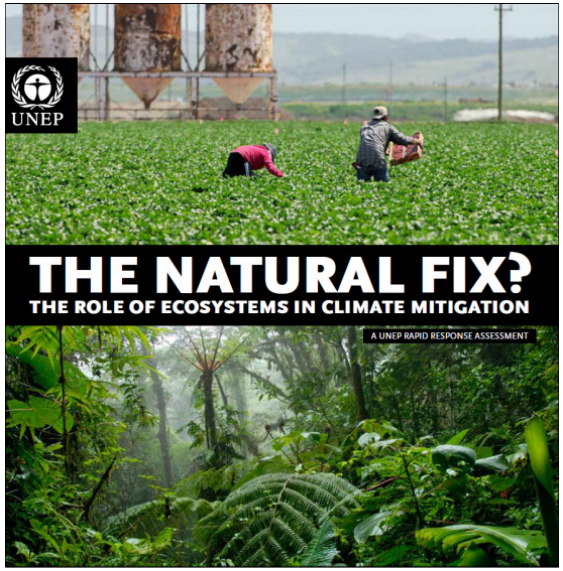


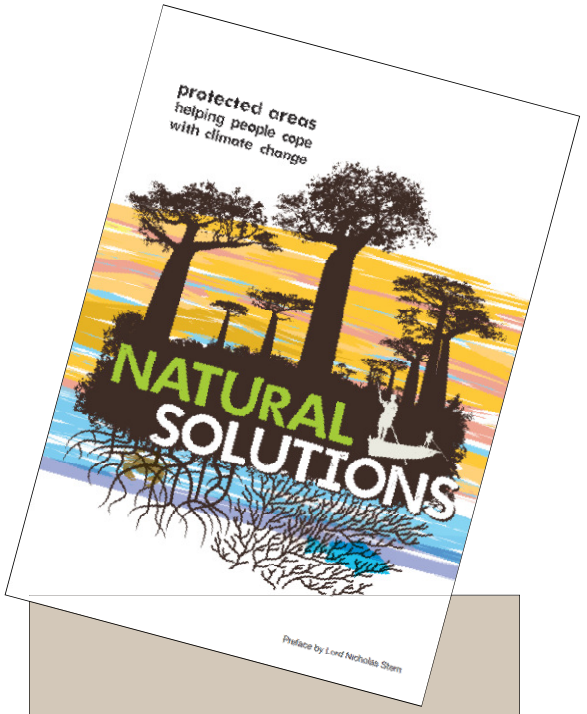

Climate change & impacts on physical environment
Direct
-
+
Direct
-
+
Human society
-
Hard engineered mitigation solutions
+
-
Hard engineered adaptation solutions
Biodiversity and ecosystem services
-
in Europe
Financing climate action
+

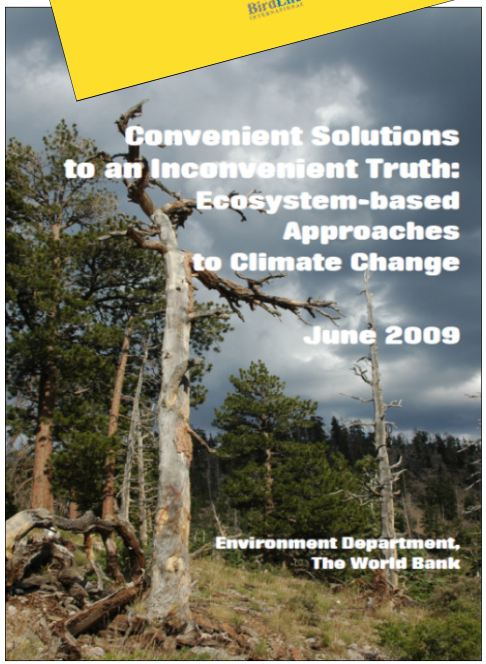

Climate change & impacts on physical environment
Direct
Direct
Human society
Hard engineered mitigation solutions
Hard engineered adaptation solutions
Financing climate action
Adaptation of biodiversity to climate change
Biodiversity and ecosystem services
in Europe

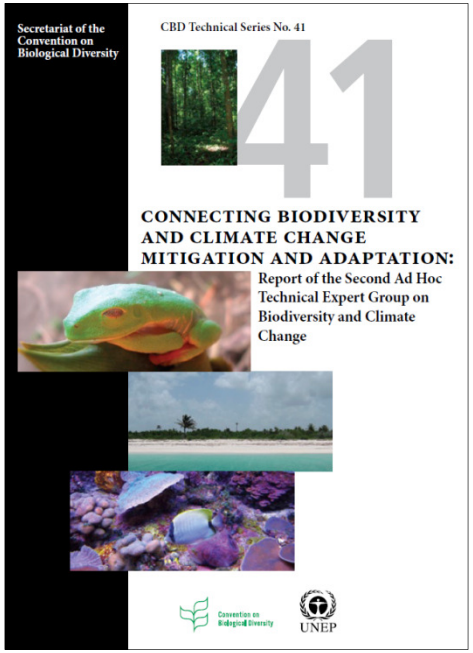

Climate change & impacts on physical environment
Direct
Direct
Human society
Biodiversity and ecosystem services
Hard engineered mitigation solutions
Hard engineered adaptation solutions
in Europe
Financing climate action
Adaptation of biodiversity to climate change
forests, peatlands, etc.
biomass energy
Ecosystem-based mitigation (AFOLU)
Ecosystem-based adaptation

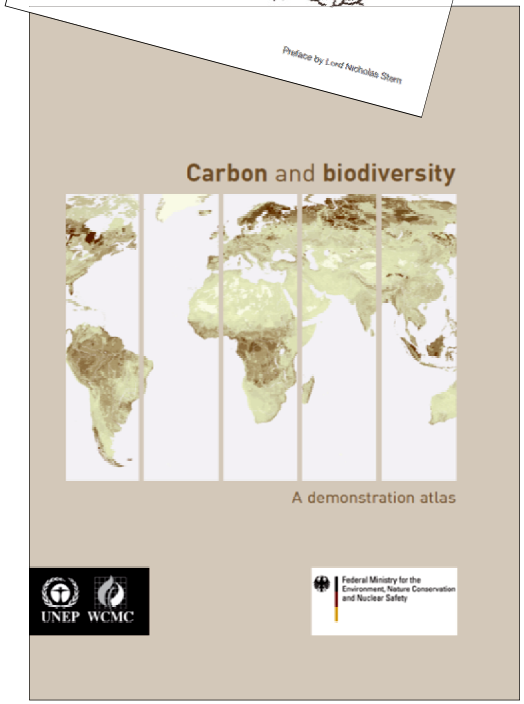
Ecosystem-based approaches – Natural Solutions









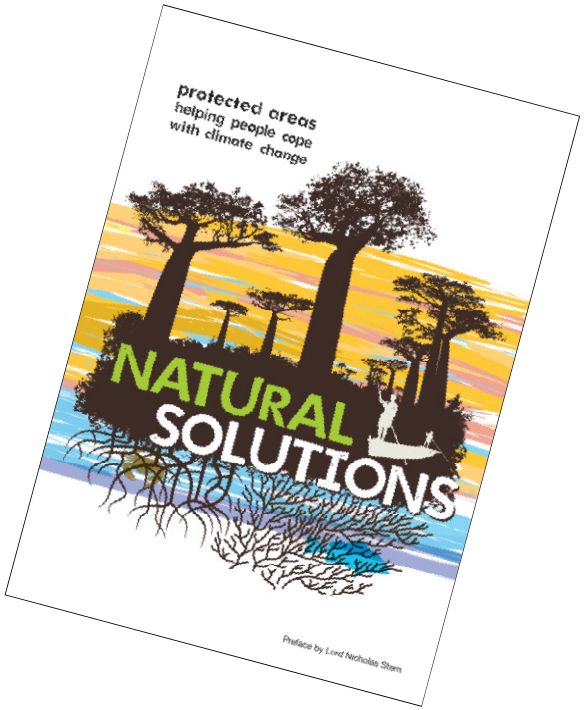


Ecosystem-based approaches – Natural Solutions

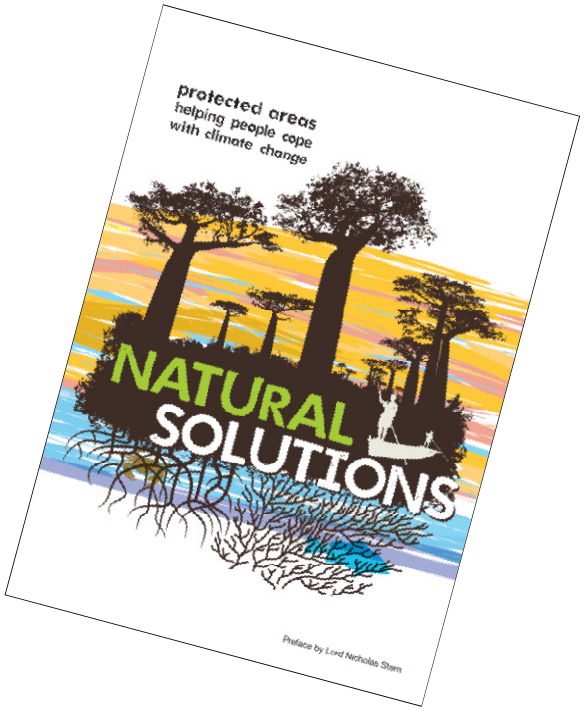
PACT 2020 - Protected Areas and Climate Turnaround Initiative

IUCN-World Commission on Protected Areas

November 2009 Workshop,
hosted by the Government of Andalucía in Granada



Ecosystem-based approaches – Natural Solutions

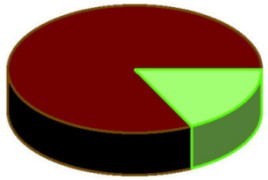


European Council Conclusions - December 2009

"10. HIGHLIGHTS the mitigation and adaptation potential of resilient wetlands, oceans, forests, peatlands and grasslands and other ecosystems, and that conservation, restoration and sustainable use of these ecosystems result in carbon emission reductions, carbon storage and increased adaptation potential; **RECOMMENDS the development and use of ecosystem-based approaches for the mitigation of and adaptation to climate change**"

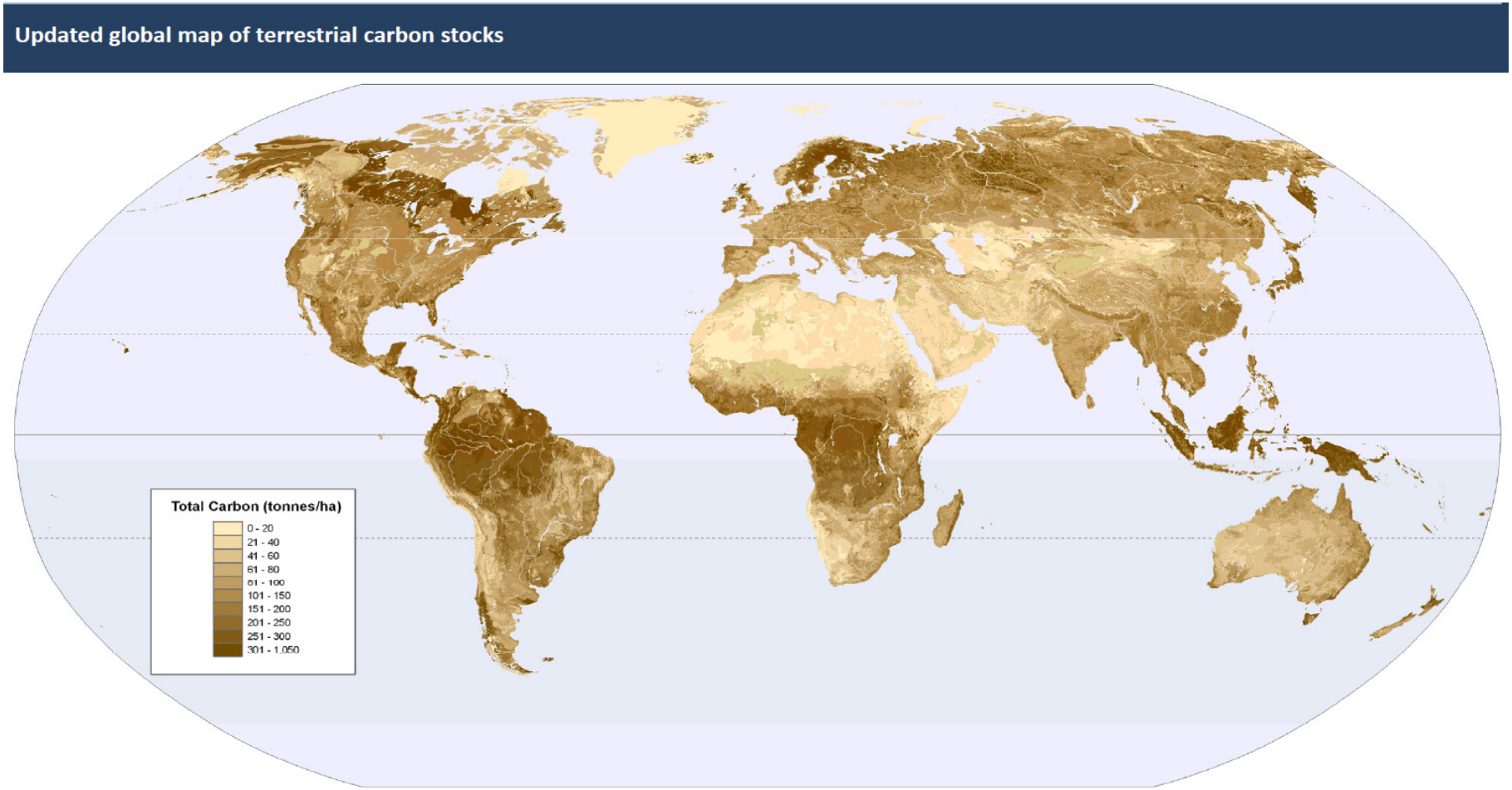
Terrestrial carbon stores in soils & biomass

85% outside protected areas



15% inside protected areas

19% of the world's forests inside protected areas



http://www.unep-wcmc.org/climate/pdf/copenhagen/42Global%20C%20poster%20091215_finalfinal.pdf

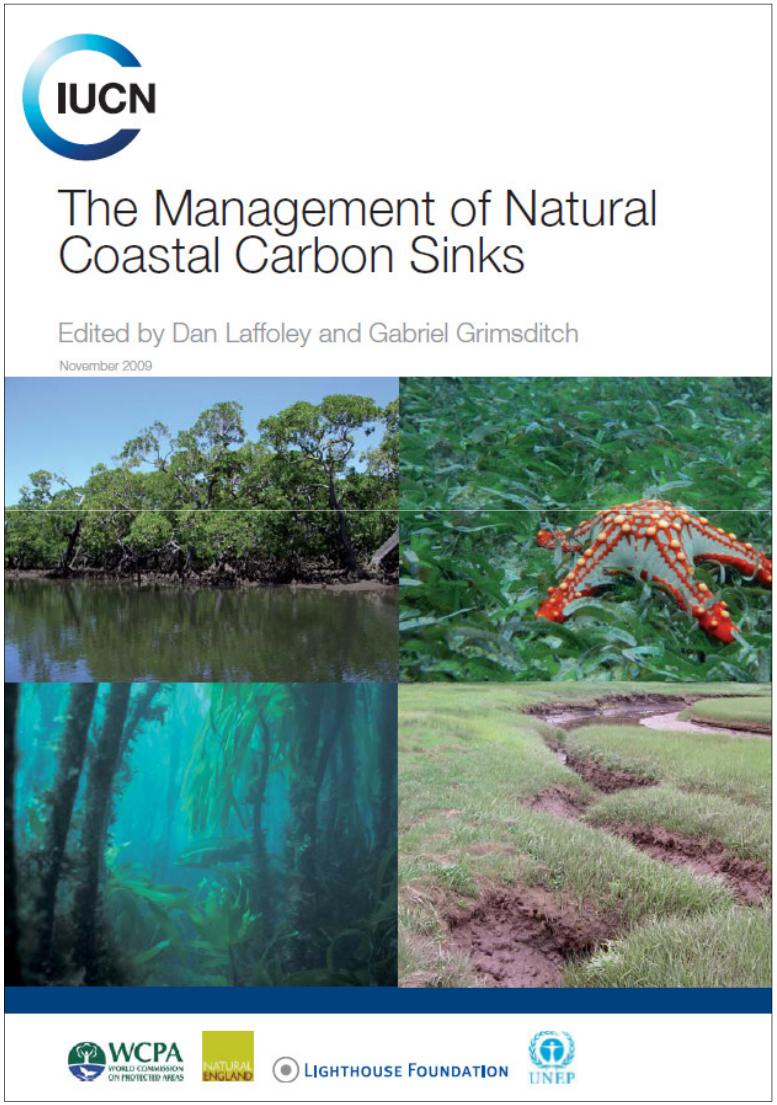
Ecosystem-based mitigation

Two elements:

1. Sequester: withdraw carbon from the atmosphere
   - In Europe: improved carbon management on agricultural lands!
   - With increasing temperature, carbon sinks could turn into carbon sources

2. Store: maintain existing carbon stores (or counter their degradation)
   - Mainly in natural ecosystems as carbon in modified ecosystems degraded
   - In Europe: temperate & boreal forests; peatlands; primarily in soils

Marine coastal ecosystems: the missing carbon sink?



- Salt marshes, mangroves and sea grass beds (esp. *Posidonia*) highly effective in carbon sequestration per unit area
- Start considering also marine ecosystems in ecosystem-based mitigation
- Context: ongoing designation of MPAs in Europe

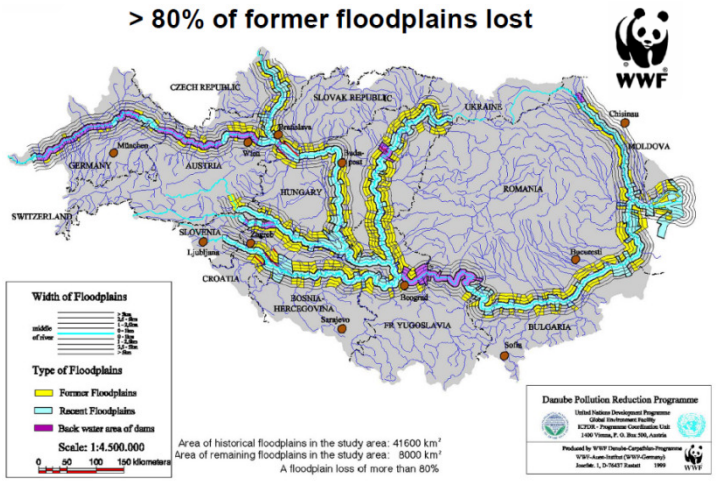
Ecosystem-based <u>adaptation</u>

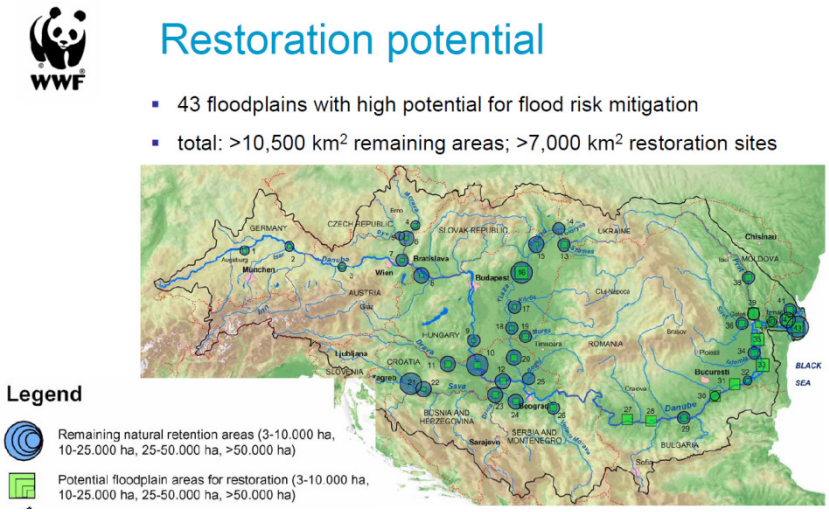
"... as part of an overall adaptation strategy... the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the adverse impacts of climate change."

Report of the CBD's Ad Hoc Technical Expert Group on Biodiversity and Climate Change

- **Two elements:**

1. <u>Protect</u> by reducing the risk from natural disasters, e.g.
   - stabilise soil and snow to prevent landslides
   - provide space for floodwaters





Ecosystem-based adaptation

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Report of the CBD's Ad Hoc Technical Expert Group on Biodiversity and Climate Change

- **Two elements:**

  1. Protect by reducing the risk from natural disasters, e.g.
     - stabilise soil and snow to prevent landslides
     - provide space for floodwaters

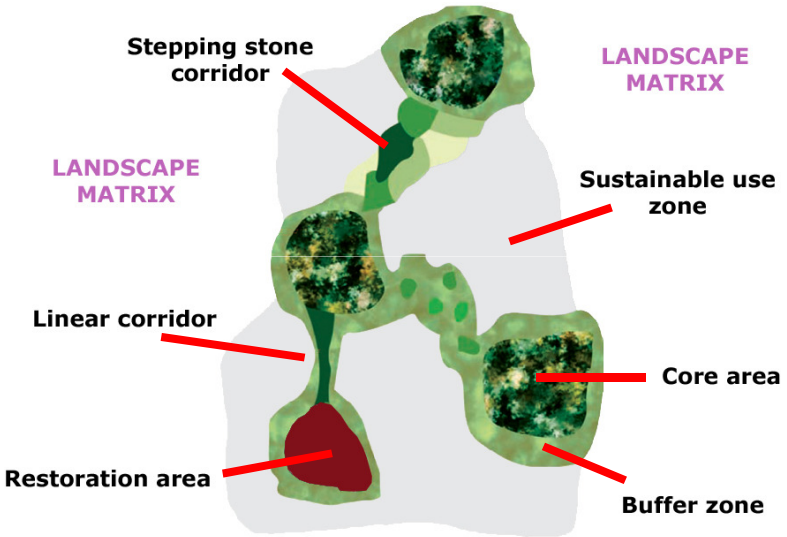
  2. Provide resources and services to human communities, e.g.
     - clean water flows
     - rebuilding fish stocks to maintain sustainable fisheries

A word of caution against failures of adaptations measure – unforgiving as affecting human communities => avoid complacency

Implications of EbM & EbA for biodiversity management and protected area networks in Europe

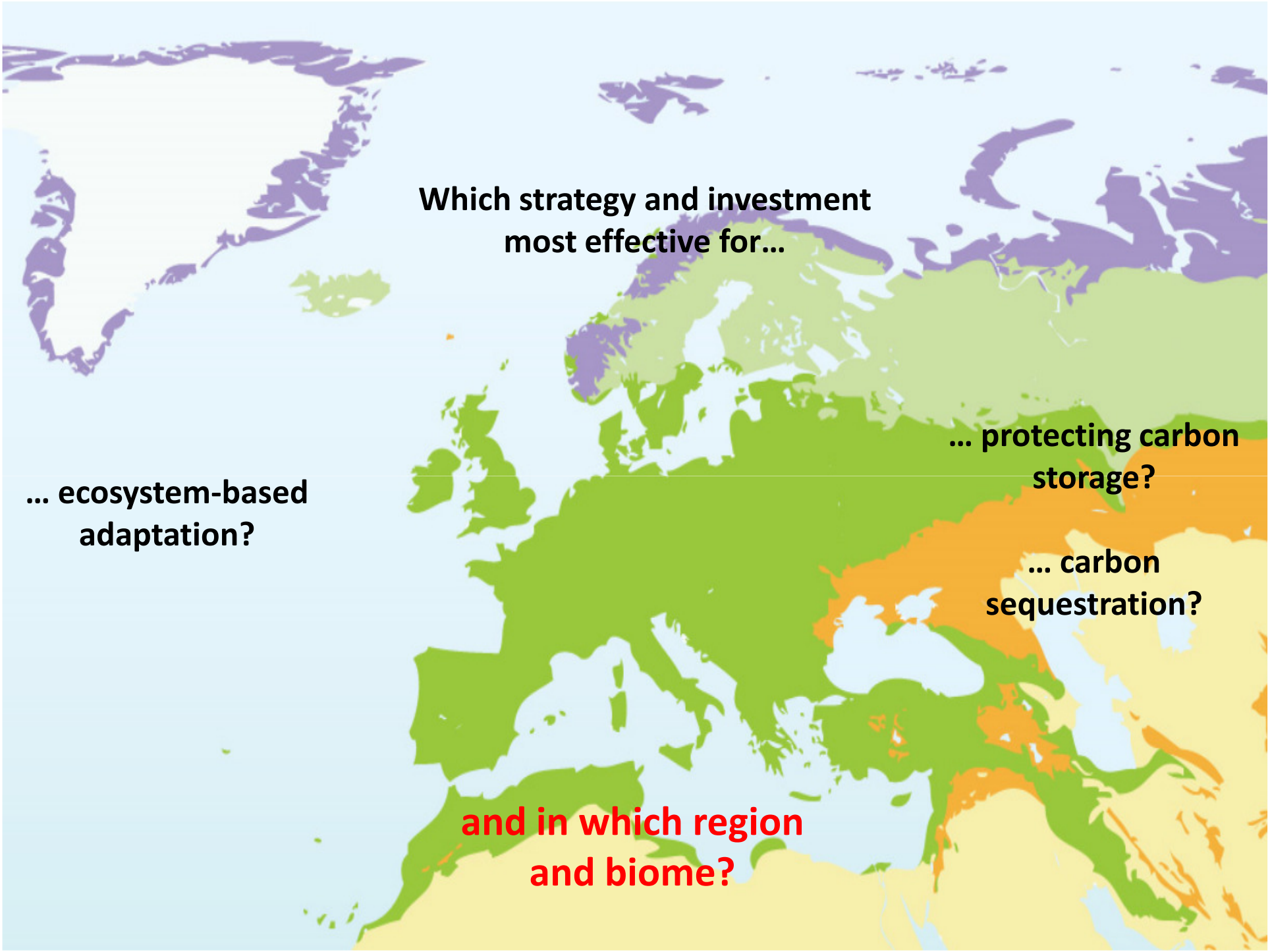
Which strategy and investment most effective for…

… ecosystem-based adaptation?



… protecting carbon storage?

… carbon sequestration?

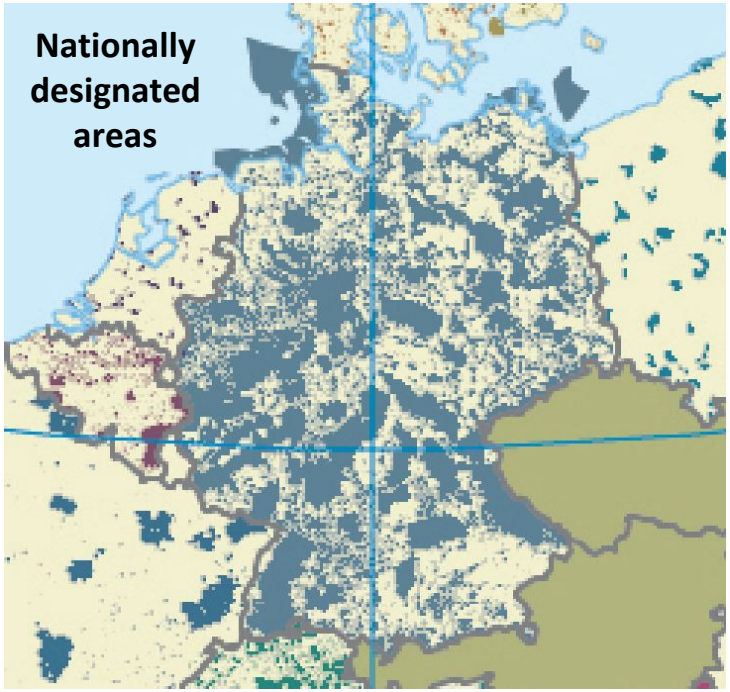

Which strategy and investment most effective for…
… ecosystem-based adaptation?
… protecting carbon storage?
… carbon sequestration?
and in which region and biome?

12 recommendations for biodiversity safeguards, biodiversity adaptation and ecosystem based solutions to climate change

1. Enhance resilience of species and habitats by reducing non-climatic pressures on biodiversity
2. Reduce fragmentation, by enhancing *functional* connectivity through ecological networks and restoration.
    - Further develop Pan-European Ecological Network, complete the designation and begin implementation of terrestrial and marine Natura2000 and other networks.
    - Particular attention to threatened species and habitats that are highly vulnerable to climate change and fragmentation, considering management interventions (assisted colonisation, ...).
    - Make connectivity legally binding in nature legislation
3. Facilitate greater permeability of the wider land- and seascape matrix, especially through the integration of protected area networks into multi-functional landscapes.
4. Deliver conservation management (direct payments, agri-environment measures, cross-compliance, ecosystem services, etc.)
5. Adapt biodiversity conservation planning and management to address direct and indirect climate change impacts.

12 recommendations for biodiversity safeguards, biodiversity adaptation and ecosystem based solutions to climate change

6. Increase and strengthen PA coverage and network to store and sequester more carbon (e.g. focusing on areas of high carbon loss) and to provide climate change adaptation services.
7. Change PA management to store and sequester more carbon and provide more services for human adaptation.
8. If more or larger PAs areas are not an option, although biodiversity and climate objectives are not met, ensure greater effectiveness and raise the degree of protection afforded to existing PAs.



12 recommendations for biodiversity safeguards, biodiversity adaptation and ecosystem based solutions to climate change

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7. Change PA management to store and sequester more carbon and provide more services for human adaptation.
8. If more or larger PAs areas are not an option, although biodiversity and climate objectives are not met, ensure greater effectiveness and raise the degree of protection afforded to existing PAs.
9. Build and apply new concepts for Invasive Species and their interaction with ecological networks. Control harmful invasives as opposed to benign climate migrants.
10. More now than ever: Integrate biodiversity considerations in other sectors (agriculture, forestry, energy, climate change, etc.) to avoid impacts both from both standard practices and from maladaptive climate change adaptation and mitigation responses harmful to biodiversity; recognising the importance of spatial planning and SEA/EIA.
11. Increase and ring-fence funding for biodiversity conservation, protected area management, biodiversity adaptation and biodiversity-friendly measures in other sectors, while reducing subsidies harmful to biodiversity and public goods.

12 recommendations for biodiversity safeguards, biodiversity adaptation and ecosystem based solutions to climate change

12. Research and monitoring: ecological research and inventories in less studied countries, effect of species interactions, determine vulnerability of habitats.
    - Compile the opportunities for linking ecosystem based adaptation and mitigation to PAs and ecological networks in Europe.
    - Fundamental ecological research on biodiversity & global change interactions
    - Higher resolution models of CC impacts
    - Field research: spatial distribution and conservation status of species & habitats in the EU, esp. those of Community Interest & vulnerable to CC, and enter into N2000 database
    - Conduct climate envelope mapping for all taxa groups and habitat types, with a fully standardised methodology (model type, SRES, time horizon)
    - Refine and complete analysis of vulnerable species against Natura 2000 sites to determine species, habitat or site-specific actions.
    - Identify indicator species to warn of climate change impacts in N2000 sites
    - Monitor impacts and cost-effectiveness of biodiversity adaptation measures
    - Identify further ecosystem management measures to help biodiversity adaptation, and climate change mitigation and adaptation; develop policies to support such measures.

Thank you

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