Sediment related ecoystem services:
A definition and mapping approach

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„Mapping and assessment of sediment related ecosystem services“

What are sediment related ecosystem services (ES)?

Introduction

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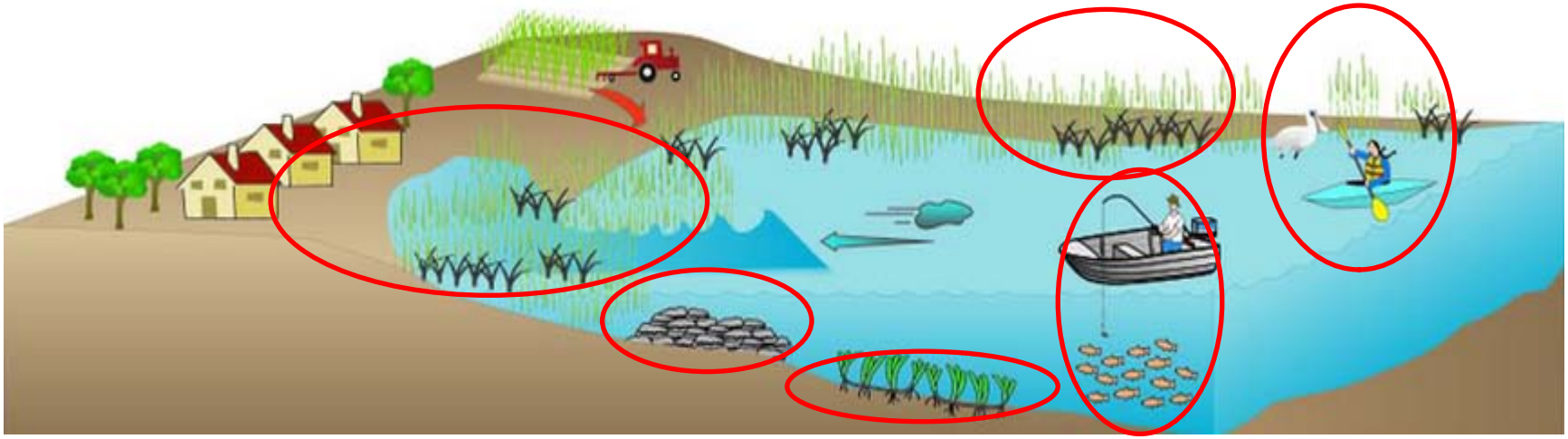
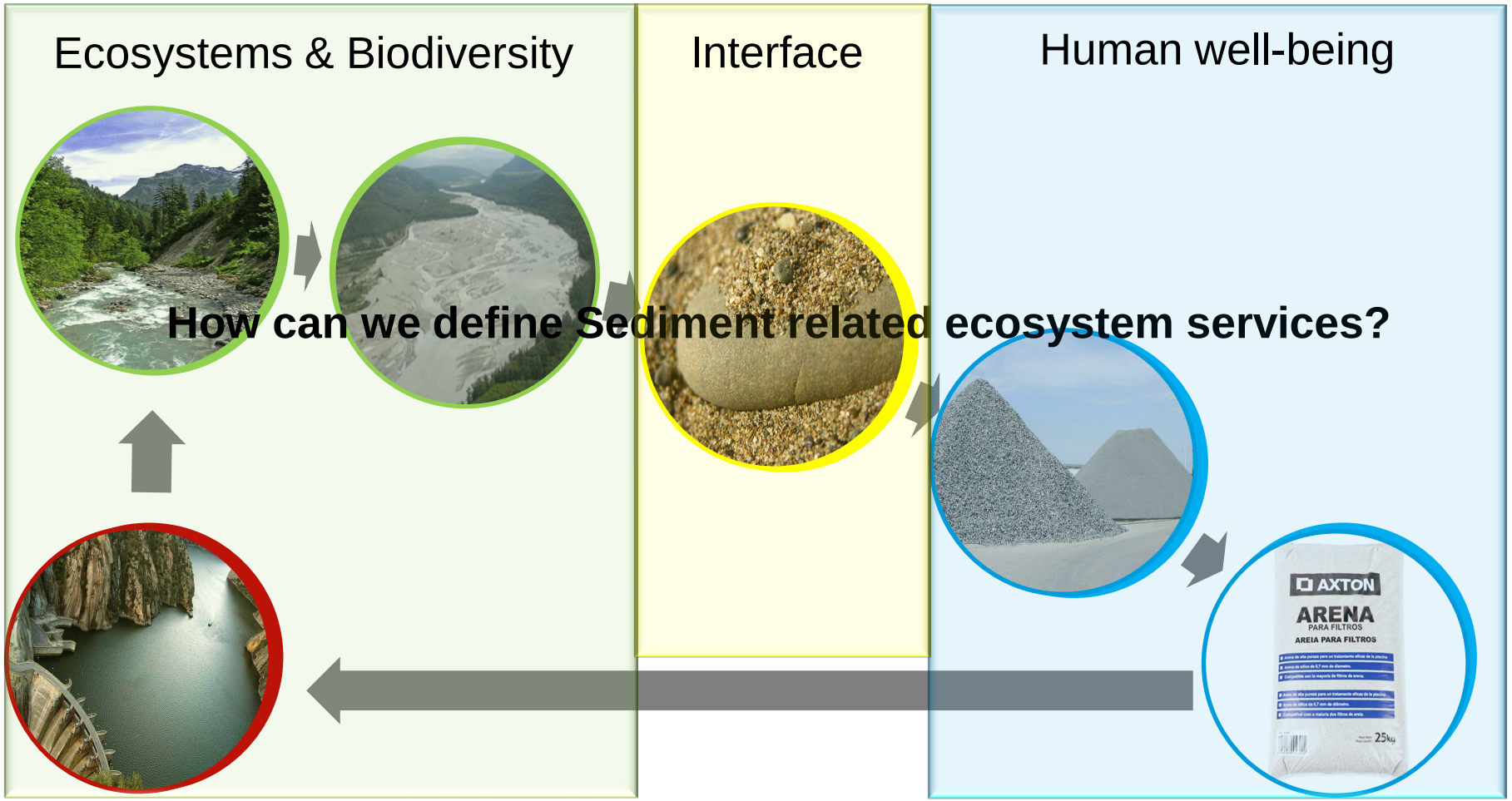
The **benefits** ecosystem provide, (TEEB 2010)



Goal: To **protect** ecosystems and **conserve** biodiversity

A conceptual framework – The services cascade



Adapted from Haynes-Young and Potschin (2010) and Maltby (2009)

The role of sediments

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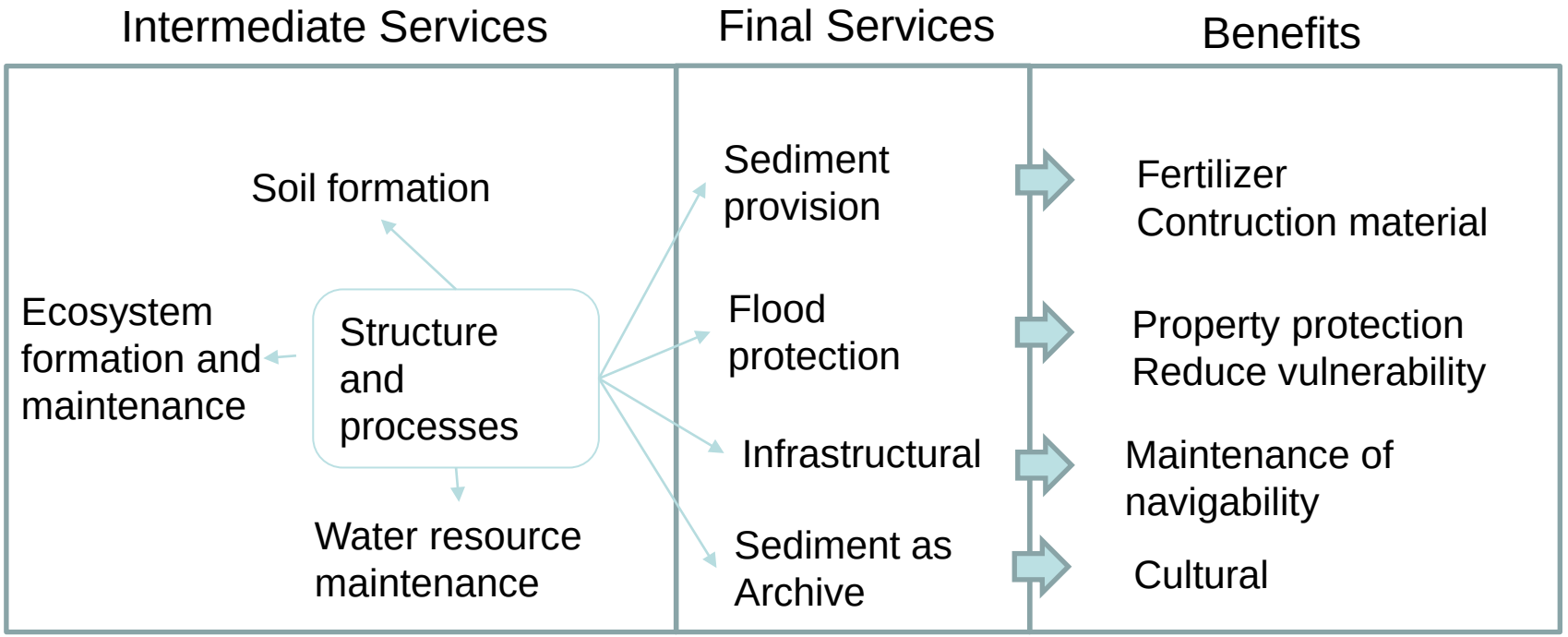
Landscape and ecohydrologic processes	Soil / sediment attributes	Soil/sediment role	Service
Natural source Soil vulnerability Landscape connectivity	Quality Quantity Transport Location	Habitat/substrate Resource/waste Archive/carrier Stressor Indicator Transport Security Hydrologic services	**Diverted sediment supply** fertilizer, construction material **In situ sediment supply** recreation, maintenance of navigability **Damage mitigation** flood protection, coastlines protection **Supporting:** Water resource maintenance, contaminant confinement, Ecosystem protection and maintenance

Adapted from Apitz 2012.

Is everything an ecosystem service?

An ecosystem function is only an ecosystem service if is directly consumed or utilised by humans



Adapted from Fisher and Turner, 2009.

Avoid double-counting

The Importance of Intermediate Services

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Intermediate Service = Supporting Services (MA) = Ecological Function

→ The **provision** of one or many ES depends on the "well-function" from the Intermediate Service(s) sediments provide

→ The **impact** of ecosystem use affects directly the intermediate services

→ The **pathways** in which sediments support final ecosystem services are to be taken into account in decision making process

Importance of Intermediate Services

We can relate sediments with human well being through the services cascade

Intermediate Service = Supporting Services (MA) = Ecological Function

Sediments status and their role in the ecosystem can define posible services

→ The **provision** of one or many ES depends on the "well-function" from the Intermediate Service(s) sediments provide

We must difer between final ecosystems services and intermediate ecosystem services to avoid double counting

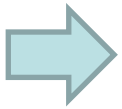
→ The **impact** derived from a differ of change could be positive or negative, depending on the location and the stakeholders interests

Sediment related intermediate services or supporting services are important because of their impact on the well function of the ecosystem

→ The **pathways** in which sediments supports final ES are to be taken into account in decision making process, to infer in optimised set of objectives for an ecosystem

Final services: What should we consider?

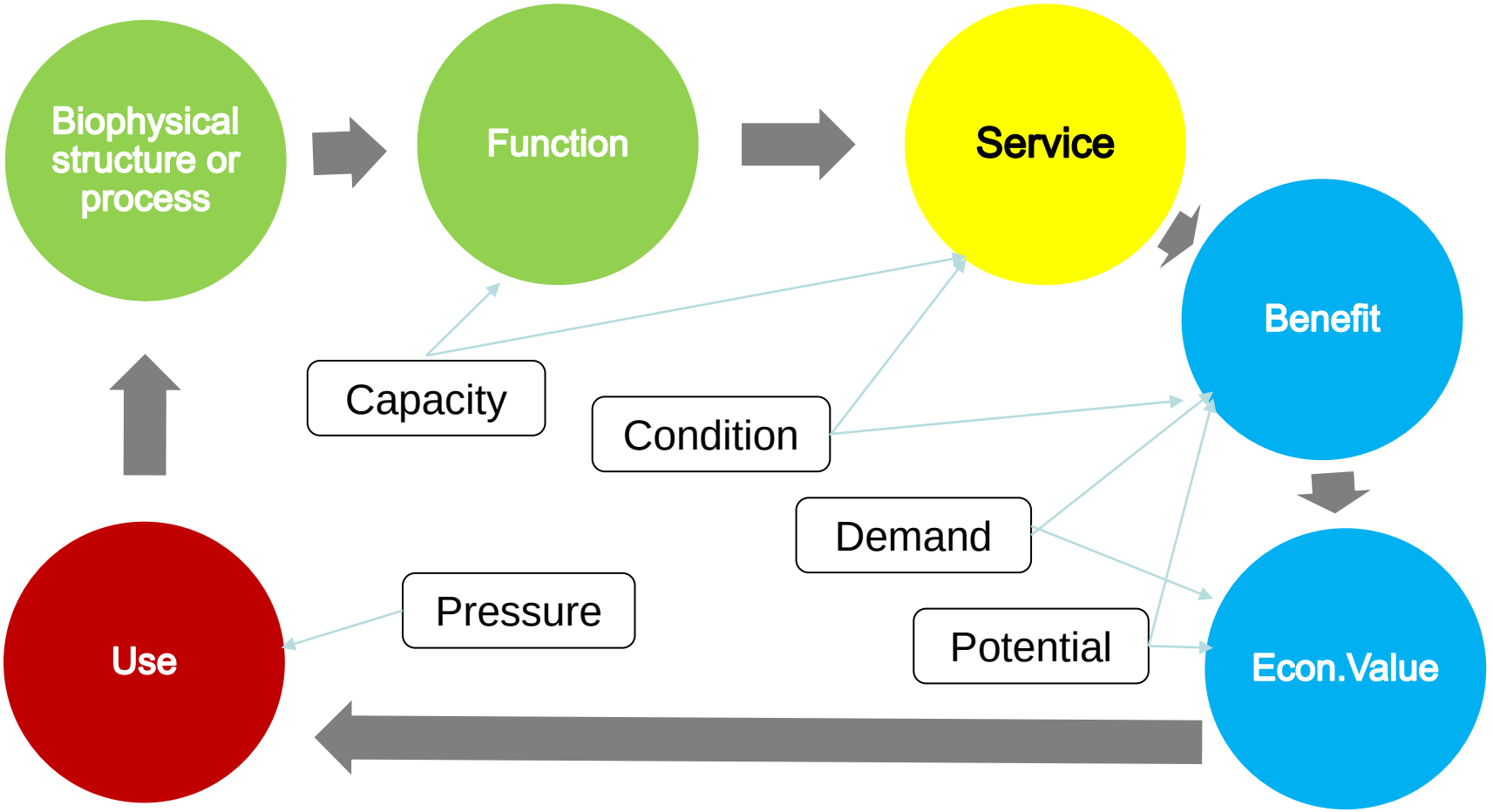
- Are sediments involved in a biophysical process or structure?
- Is there a service provision?
- Is it consumed or utilized directly by humans?
- Is there an interest/demand?
- Is there a potential service?



Final services (e.g.)

- Provision of sediment as fertilizer
- Provision of contruction materials (sand, gravel)
- Flood/coastal protection (Dunes, wetlands)

A mapping approach - Indicators



Adapted from Haynes-Young and Potschin (2010) and Maltby (2009)

Indicators for intermediate services

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Why?

- Create a link between ecosystem Intermediate and final services
- Helps visualize the impact of sediments in ecosystem services
- By assessing and protecting desirable sediment status, a set of final services are being protected as well, Apitz, 2012

→ **Better knowledge input = Better policy making**

How?

Defining quantificable criteria for sediment status for different ecosystems and conditions

$$Status(t) = Quality(t) + Quantity(t) + Transport(t) + Location(t)$$

But why?

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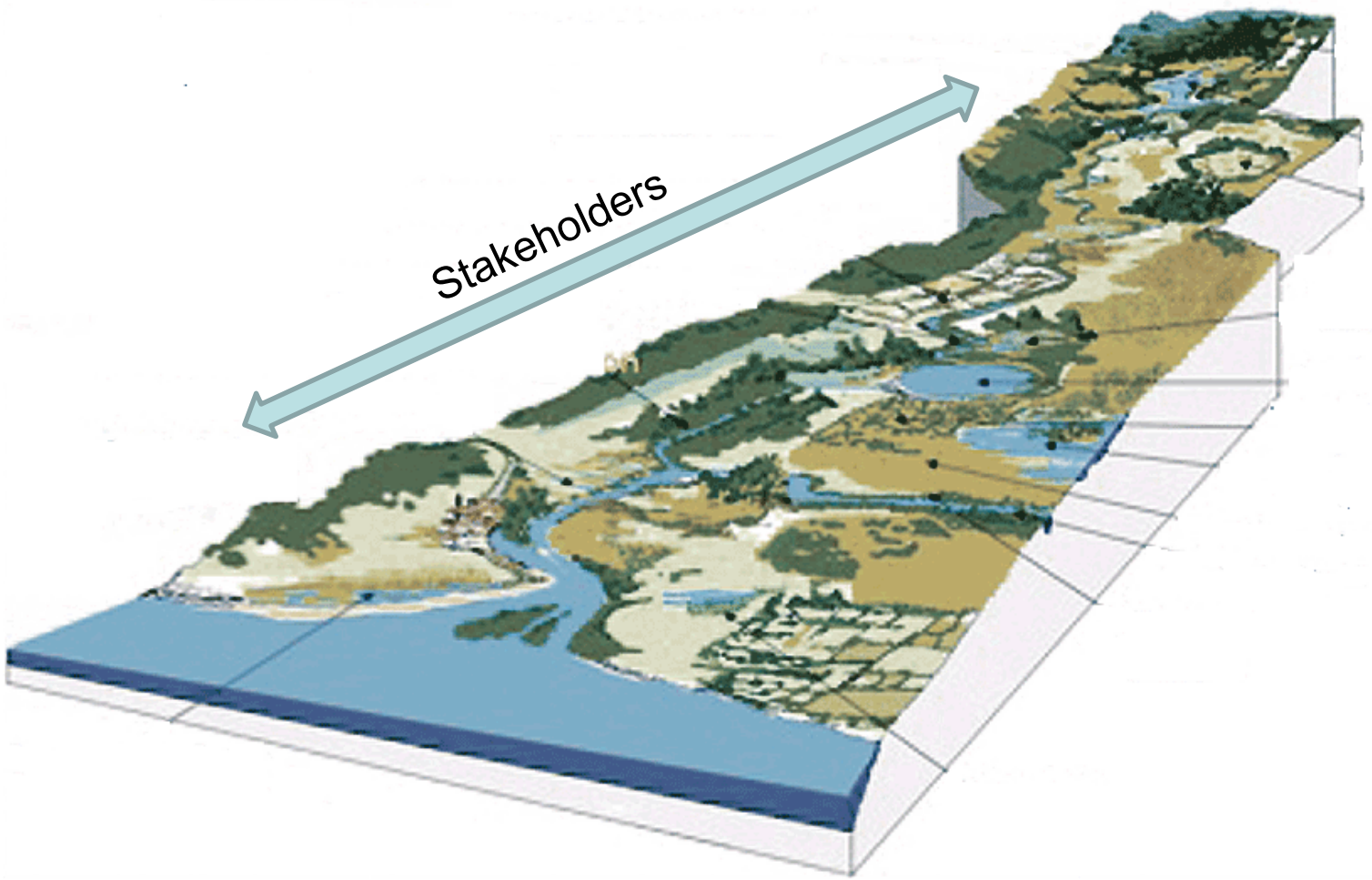

The mapping approach

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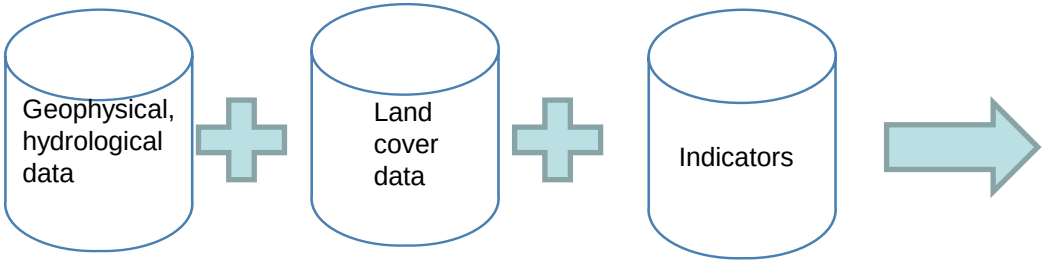
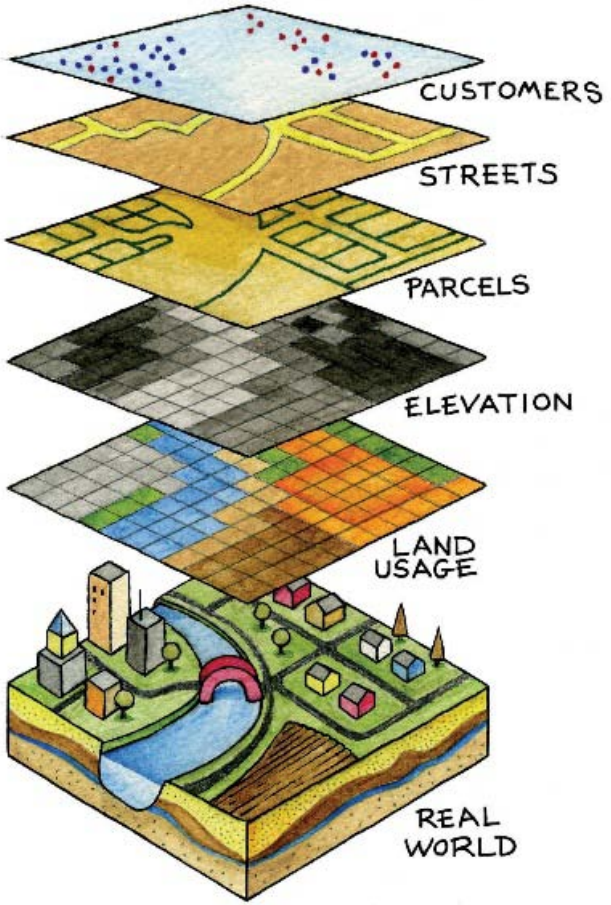
Why mapping?

1. Locate habitat / ecosystems
2. Locate ecosystem services
3. Recognise & link Providers/Users/Stakeholders
4. Limit decision framework

   → the scale (ecosystem, river basin, watershed)

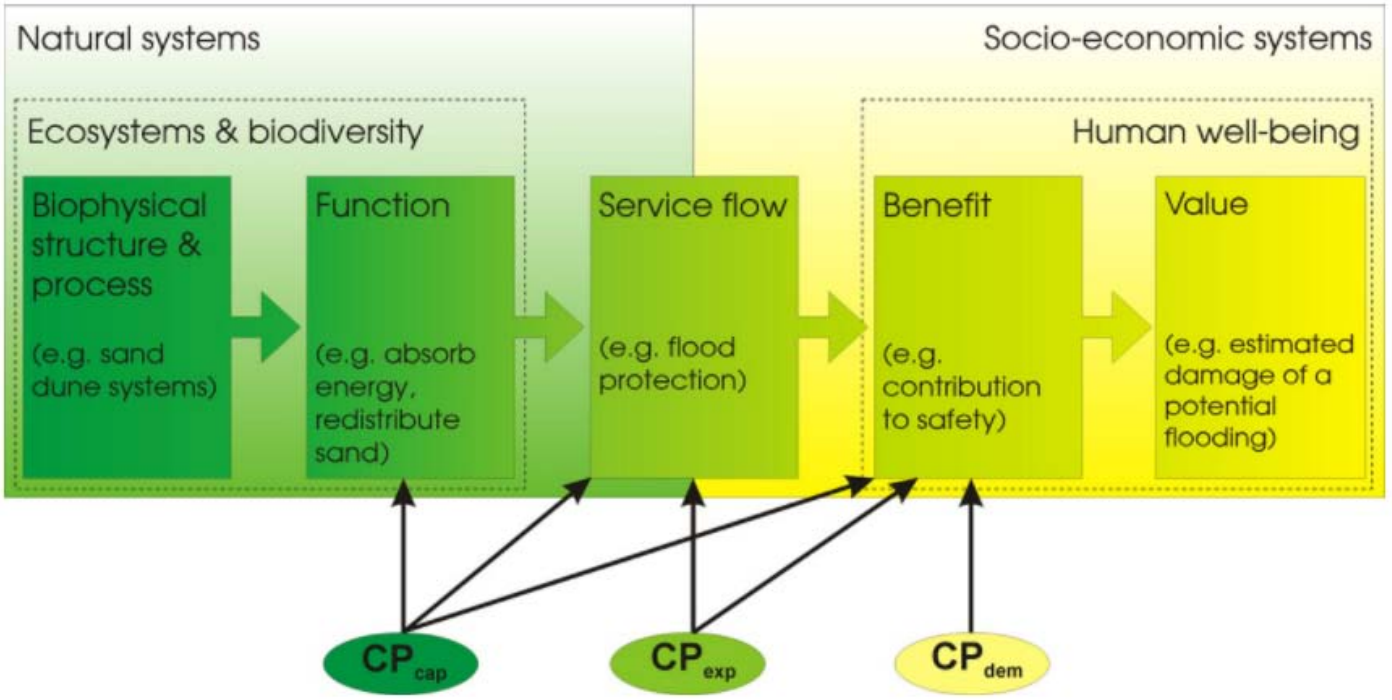
How?



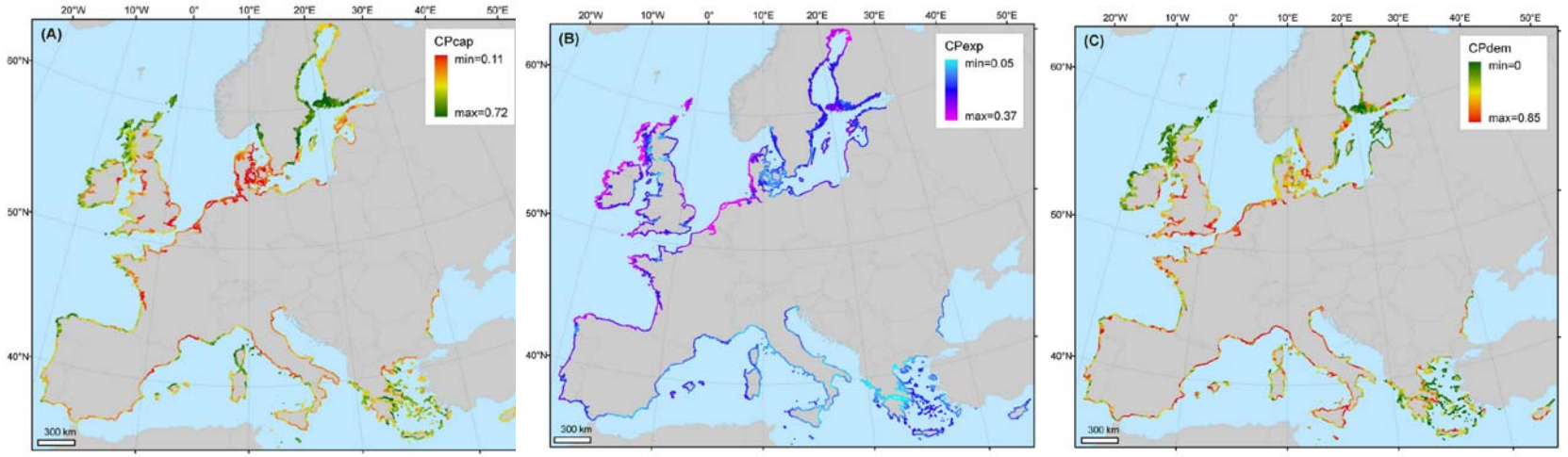


Case study - Flood protection

Assessment of coastal protection as ecosystem service (Liquete et al., 2013)



Case study - Flood protection



Assessment of coastal protection as ecosystem services, (Liquete et al., 2013)

The road so far…

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- Sediment related ecosystem services are the sum of all benefits that sediments infer directly or indirectly to human well-being.
- There are intermediate and final sediment related ecosystem services
  - Final services: Important to assess their value
  - Intermediate services: Important to assess their impact on ecosystems
- Mapping sediment related ecosystem services help to link ecosystems services, users and providers
- Using ecosystem services at the proper scale set a communication hoghway between stakeholders, providing a tool for an integrated approach.

Next steps

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- sediment related final services and indicators to map assess them
- sediment related intermediate service and indicators to map assess them
- Check data availability and quality
- Map and assess sediment related ecosystem services

Thank you ver much for your attention

Back up slides

The ecosystem service approach

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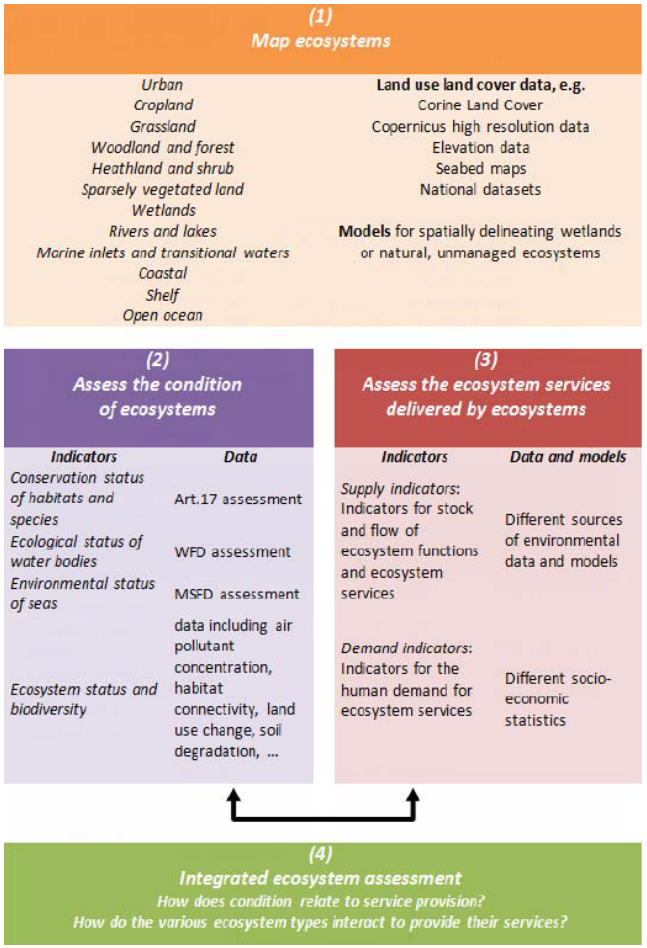
Benefits of Ecosystem Services Approaches for Biodiversity Conservation

- Broadening Constutencies for Conservation and Informing Decision-making
- Opportunity to Increase the value of areas prioritized for Biodiversity
- Opportunity to support sustainable Management of Ecosystems Outside protected areas

Challenges Associated with using ES approaches for Biodiversity conservation

- ES approaches may not capture critical species
- ES approaches may not prioritize ecologial processesthat do no deliver benefits to people
- Optimizing single service may undermine biodiversity or critical ecological functions

4. Steps process to map and asses ecosystem services



Typology of ecosystems (MAES)

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Typology	Ecosystem	Description
Terrestrial	Inland wetlands	Natural or modified mires, bogs, fens, peat extraction sites
Freshwater	Rivers and lakes	Permanent freshwater inland surface waters
Marine	Marine inlets and transitional waters	Coastal wetlands, lagoons, estuaries, an other transitional waters, fjords, sea lochs, embayments
	Coastal areas	Refer to coastal, shallow, marine systems that experience significant land-based influences. These systems undergo diurnal fluctuations in temperature, salinity and turbidity, and are subject to wave disturbance. Depth is between 50 and 70 m
	~~Shelf~~	~~Not included in this study~~

Sources and papers

(MAES, 2014) Indicators for ecosystem assessments under Action 5 of the EU Biodiversity Strategy 2020 – Final report 2014

(MAES, 2013) MAES -An analytical framework for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020 – Discussion paper, Final 2013

(TEEB,2011) The Economics of Ecosystems and Biodiversity

(S.Apitz, 2011) Conceptualizing the role of sediment in sustaining ecosystem services:Sediment-ecosystem regional assessment

(Grêt-Regamey et al, 2014) A tiered approach for mapping ecosystem services [Grêt-Regamey et al, 2014]

ES and the MAES initiative

Definition: “The benefits human populations, derive, directly or indirectly, from ecosystem funtions” (Constanza et al., 1997)

Action 5 of the EU Biodiversity Strategy to 2020 calls Member States to map and assess the state of ecosystems and their services in their national territory with the assistance of the European Commission (MAES,2013)

There are three main classifications for ES mapping and assessment: TEEB, MA and CICES.

Provisioning Services

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MA categories	TEEB Categories		CICES v4.3 group
Food (fodder)	Food	**Provisioning services**	Biomass (Nutrition)
			Biomass (Materials from plants, algae and animals for agricultural use)
Fresh water	Water		Water (fro drinking purposes) (Nutrition)
Fibre, timber	Raw Materials		Water (for non drinking purposes) (materials)
Genetic resources	Genetic resources		Biomass (fibres and other materials from plants, algae and animals for direct use and processin)
Biochemicals	Medicinal resources		Biomass (genetic materials from all biota)
Ornamental resources	Ornamental resources		Biomass (fibres and other materials from plants, algae and animals for direct use and processing)
			Biomass (fibres and other materials form plants, algae and animals for direct use and processin)
			Biomass based energy sources
			Mechanical energy (animal based)

Regulating Services

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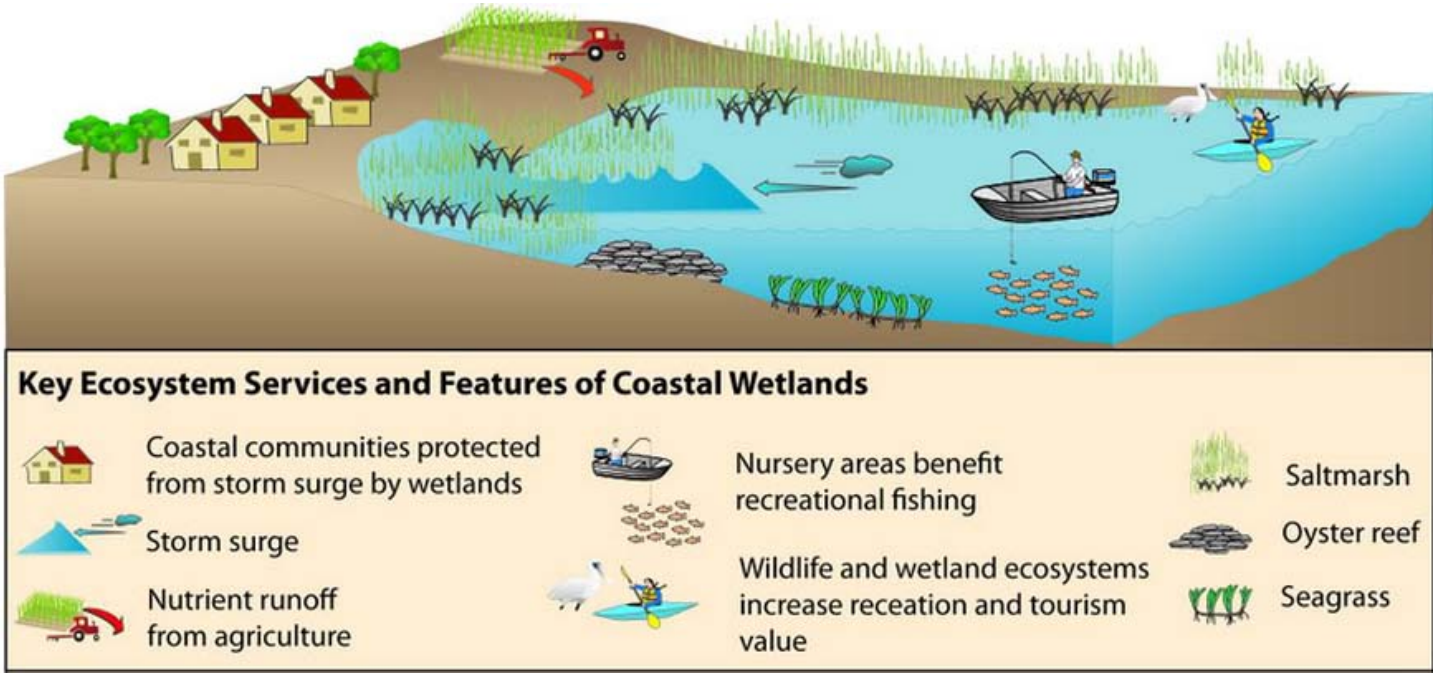
MA categories	TEEB Categories		CICES v4.3 group
Air quality regulation	Air quality regulation	**Regulating services (TEEB) Regulating adn supporting services (MA) Regulating and maintenance services (CICES)**	(Mediation of) gaseous/ air flows
Water purification and water treatment	Waste treatment (water purification)		Mediation (of waste, toxics and other nuisances) by biota
			Mediation (of waste, toxics and other nuisances) by byota
Water regulation	Regulation of water flows		(Mediation of)liquid flows
	Moderation of extreme events		
Erosion regulation	Erosion prevention		(Mediation of) mass flows
Climate regulation	Climate regulation		Atmospheric composition and climate regulation
Soil fomration (supporting service)	Maintenance of soil fertility		Soil formation and composition
Pollinatino	Pollination		Lifecycle maintenance, habitat and gene pool protection
Pest regulation	Biological control		Pest and disease control
Disease regulation			
Primary production Nutrient cycling (supporting services)	Maintenance of cycle of migratory species (incl. Nursery service)		Lifecycle maintenance, habitat and gene pool protection
			Soil formation and composition
			(Maintenance of) water conditions
	Maintenance of genetic diversity (especially in gene pool protection)		Lifecycle maintenance, habitat and gene pool protection

Cultural Services

MA categories	TEEB Categories		CICES v4.3 group
Spiitual and religious values	Spiritual experience	Cultural Services	Spiritual and/or emblematic
Aesthetic values	Aesthetic information		Intellectual and representational interactions
Cultural diversity	Inspiration for culture,art and design		Intellecturaland representational interactions
			Spiritual and/or emblematic
Recreation and ecotourism	Recreation and tourism		Physical and experiential interactions
Knowledge systems and educational values	Information for cognitive development		Intellectual and representational interactions
			Other cultural outputs (existence, bequest)


Key Ecosystem Services and Features of Coastal Wetlands
Coastal communities protected from storm surge by wetlands
Storm surge
Nutrient runoff from agriculture
Nursery areas benefit recreational fishing
Wildlife and wetland ecosystems increase receation and tourism value
Saltmarsh
Oyster reef
Seagrass