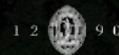


Serviços dos ecossistemas: avaliação e estratégias nas RBs

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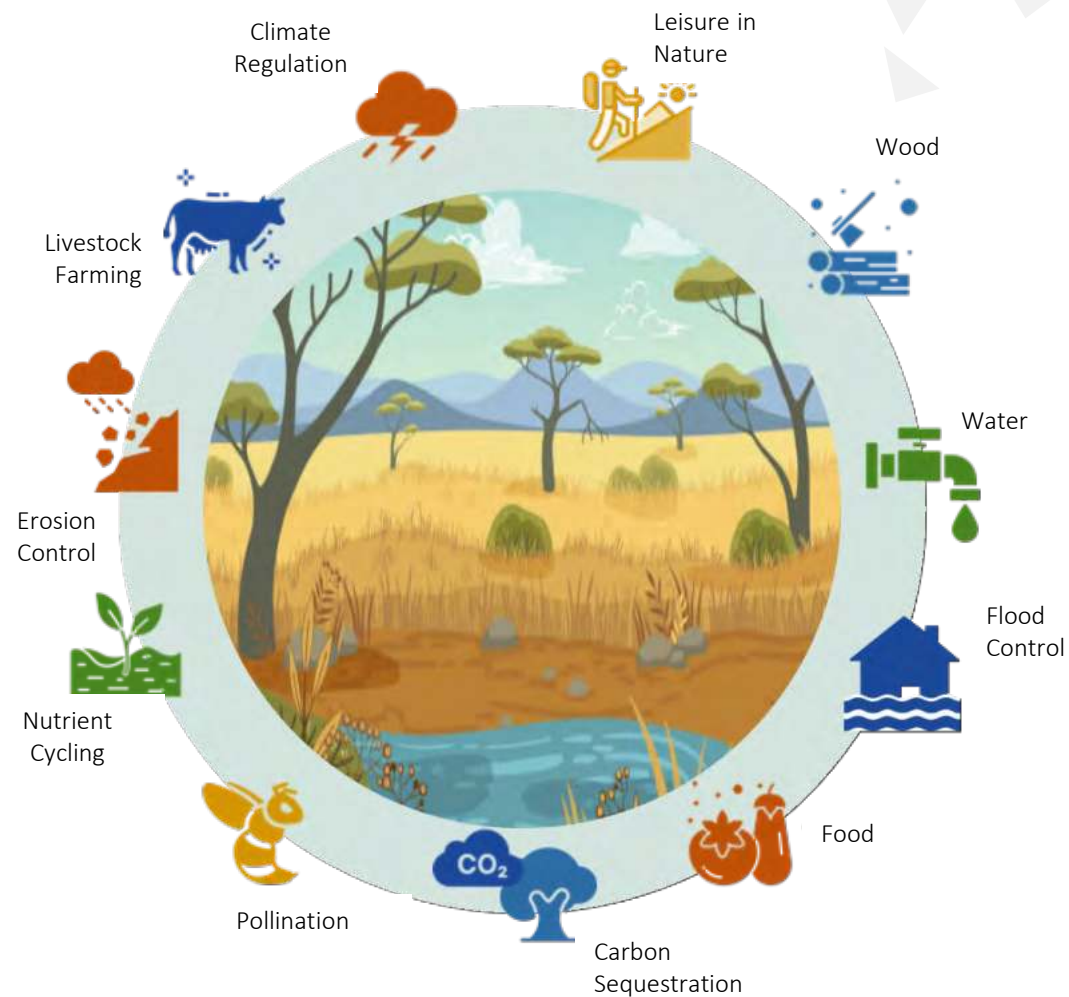


aCtuar
Sistemas Ambientais Sustentáveis



Serviços dos ecossistemas

- Benefícios que as pessoas obtêm dos ecossistemas
- São os bens e serviços da natureza



Serviços dos ecossistemas



Aprovisionamento



Regulação e manutenção



Culturais

Serviços dos ecossistemas

Aprovisionamento

Bens ou produtos produzidos pelos ecossistemas



Regulação

Processos naturais regulados pelos ecossistemas



Culturais

Benefícios não materiais obtidos dos ecossistemas



Suporte

Funções dos ecossistemas que mantêm todos os serviços

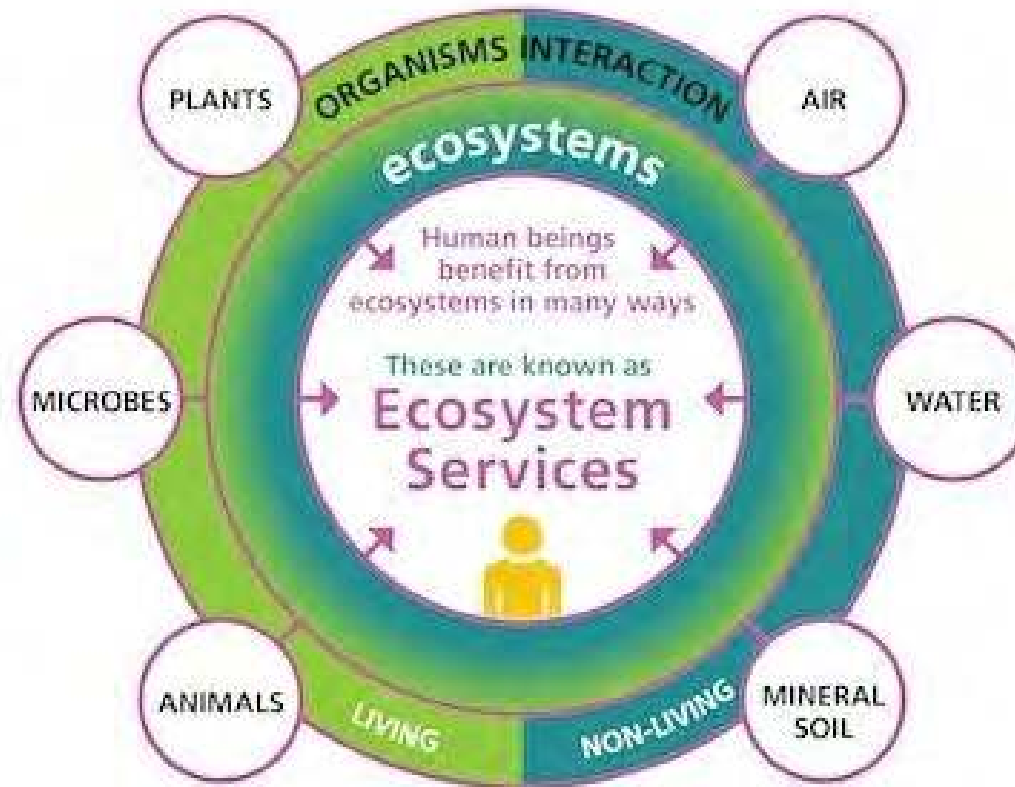


Serviços dos ecossistemas



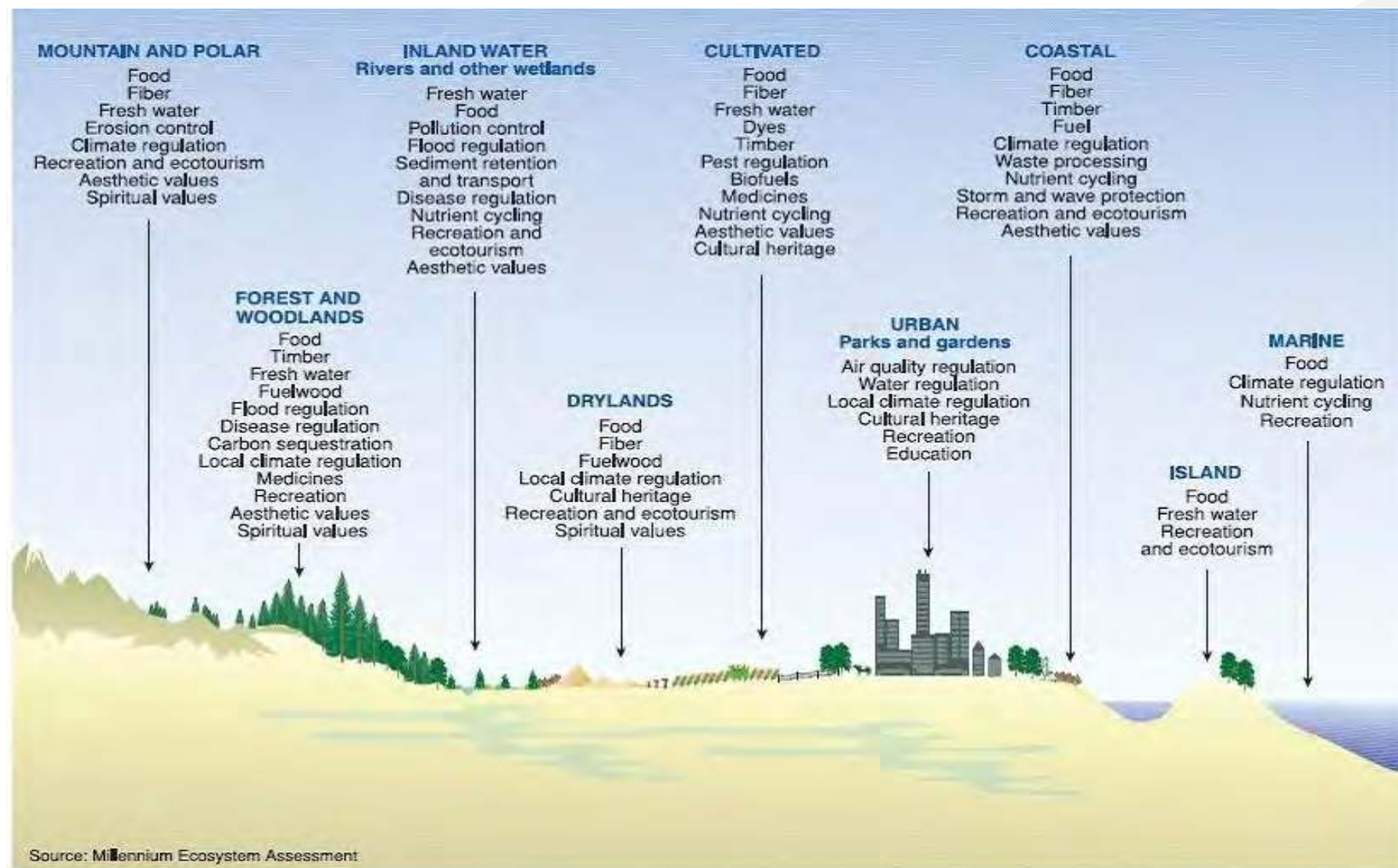
Serviços dos ecossistemas

Pollination ◀
Pest and disease management ◀
Fresh water, food, fibre, habitat and genetic resources ◀
Recreation and tourism ◀
Spiritual health, cultural identity ◀

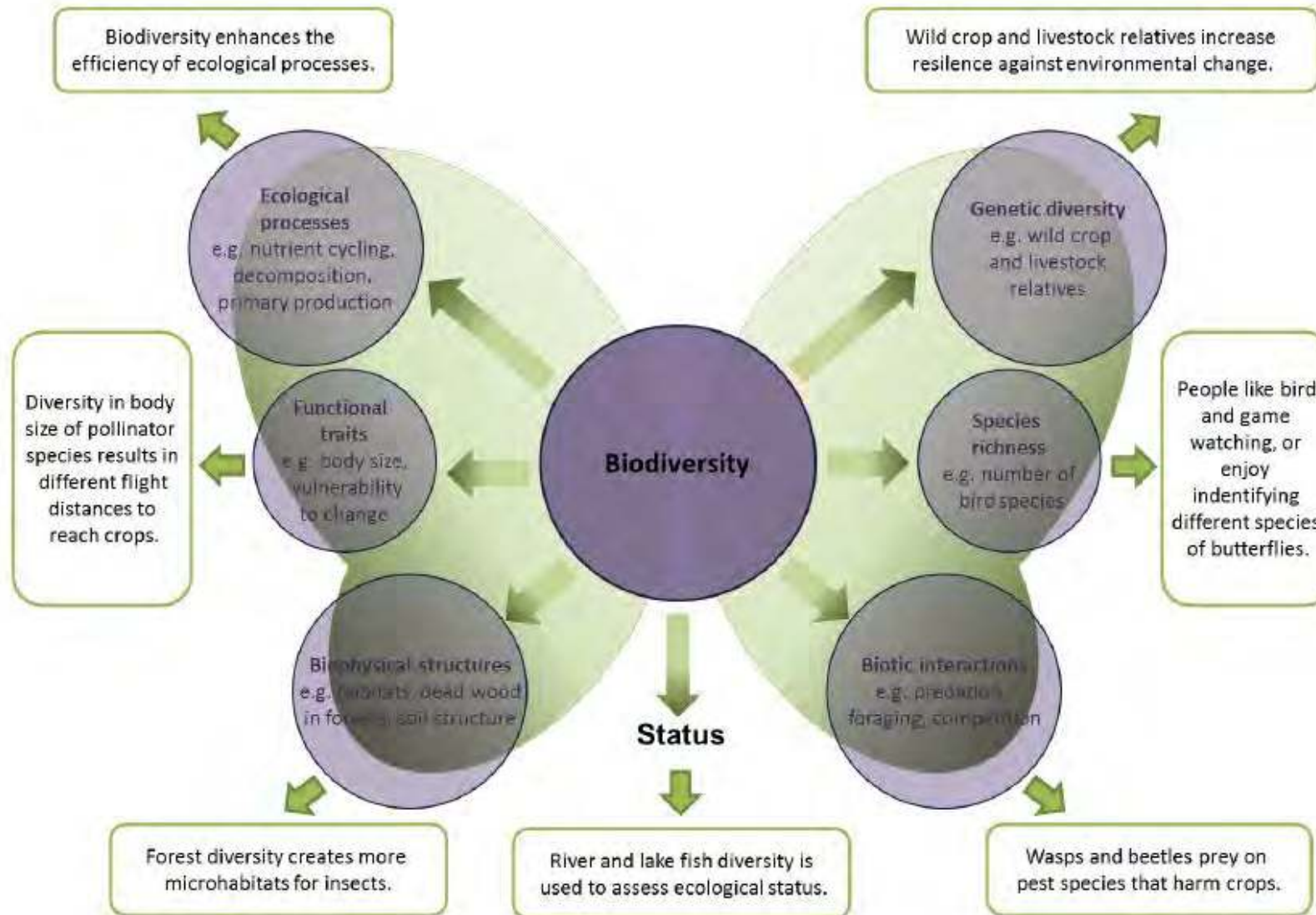


▶ Erosion prevention
▶ Protection from natural disasters
▶ Carbon sequestration and storage
▶ Air and water pollution control
▶ Nutrient cycling and soil fertility

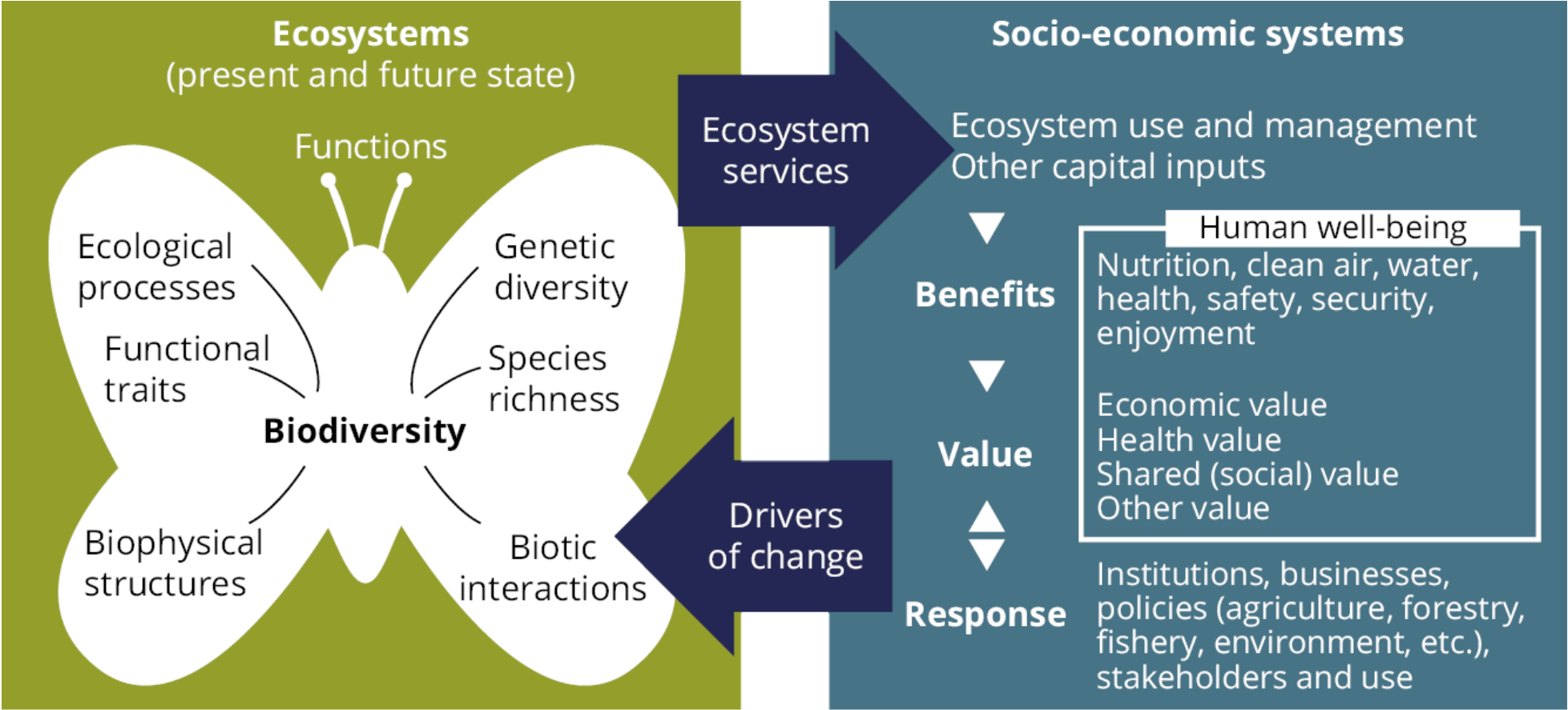
Serviços dos ecossistemas



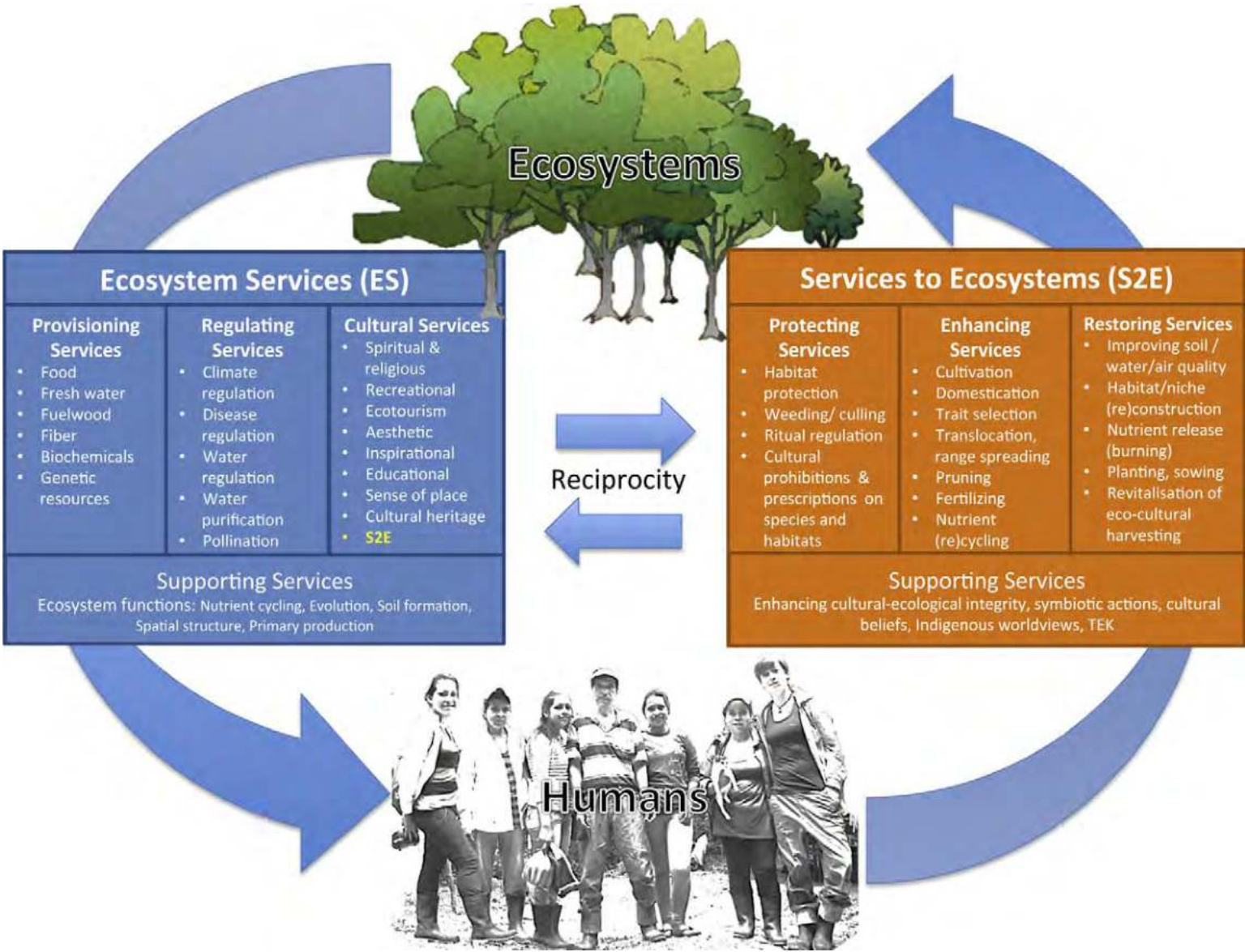
Biodiversidade



Serviços dos ecossistemas



Anthropocentric, instrumental and utilitarian view of nature





Quais os serviços dos ecossistemas considera mais importantes nas RBs?

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Mentimeter

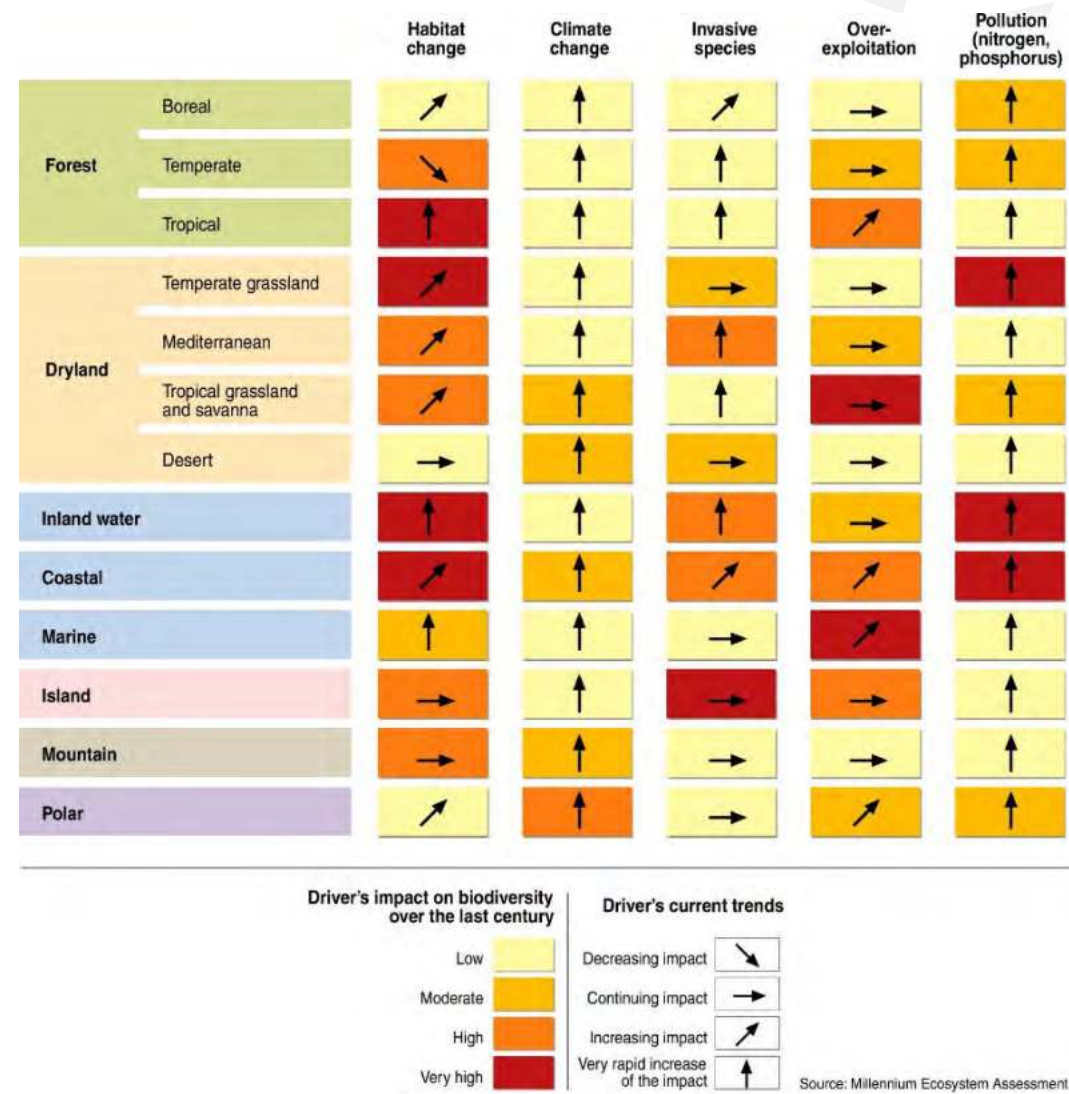
Ameaças aos ecossistemas



Condição dos ecossistemas

Degradação dos ecossistemas

- A maioria dos mecanismos que impulsionam a degradação dos ecossistemas permanecem constantes ou a crescer de intensidade na maioria dos ecossistemas
- 60% dos serviços dos ecossistemas mundiais estão degradados



Condição dos ecossistemas

60% dos serviços dos ecossistemas mundiais estão degradados

Provisioning services		
Food	crops	↑
	livestock	↑
	capture fisheries	↓
	aquaculture	↑
	wild foods	↓
Fiber	timber	+/-
	cotton, silk	+/-
	wood fuel	↓
Genetic resources		↓
Biochemicals, medicines		↓
Water	freshwater	↓
↑ globally enhanced ↓ globally degraded		
Regulating services		
Air quality regulation		↓
Climate regulation – global		↑
Climate regulation – regional and local		↓
Water regulation		+/-
Erosion regulation		↓
Water purification and waste treatment		↓
Disease regulation		+/-
Pest regulation		↓
Pollination		↓
Natural hazard regulation		↓
Cultural services		
Spiritual and religious values		↓
Aesthetic values		↓
Recreation and ecotourism		+/-

Source: Millennium Ecosystem Assessment, 2005.

Condição dos ecossistemas

Serviços dos ecossistemas	Ecossistemas	Indicadores	
		Pressão	Condição
Serviços de Aprovisionamento			
Produtos agrícolas	- Áreas agrícolas - Pastagens - Sistemas Agro-florestais - Zonas húmidas	- Conversão de áreas naturais (%/ano) - Poluição orgânica (Kg(N,P)/ha/ano)	- Atributos estruturais dos ecossistemas (% área agrícola em regime bio, extensivo, HN VF) - Índice de fragmentação dos ecossistemas
Produtos lenhoses (e.g. madeira)	- Sistemas Agro-florestais - Florestas	- Áreas de produção intensiva (%ha/ano) - Erosão dos solos (ha/year)	- Volume de biomassa obtido (m³/ano) - Proporção de área protegida (%)
Serviços de Regulação e Manutenção			
Sequestro de carbono	- Florestas - Zonas húmidas	- Índice de fragmentação/ deflorestação - Reconversão de áreas naturais (ha/ano)	- Quantidade de carbono orgânico no solo (% ou g/kg) - Proporção de área protegida (%)
Polinização e dispersão de sementes	- Áreas agrícolas - Pastagens - Sistemas Agro-florestais - Florestas - Zonas húmidas	- Fragmentação de habitat (%) - Proporção de área agrícola intensiva/extensiva (%)	- Índice de riqueza de espécies polinizadoras (índices de diversidade e abundância) - Espécies protegidas e ameaçadas (ex: RN2000, IUCN)
Controlo de cheias	- Cursos de água naturais - Zonas húmidas	- Área de zonas húmidas em leito de cheia (% ou ha) - Reconversão de zonas ripícolas em zonas artificiais (% ou ha)	- Ocupação e uso do solo em zonas de leito de cheia (%) - Consumo de recursos hídricos (m³ ou %/ano)
Serviços culturais			
Atividades de recreação e lazer na natureza	Múltiplos	- Número de habitantes (pessoas/km²) - Número de visitantes (pessoas/ano)	- Áreas de lazer/recreio naturais (% ou km²) - Diversidade de locais com características naturais emblemáticas (cultos, históricas, educativas, outras)

Quais considera serem as principais ameaças aos SE nas RBs?

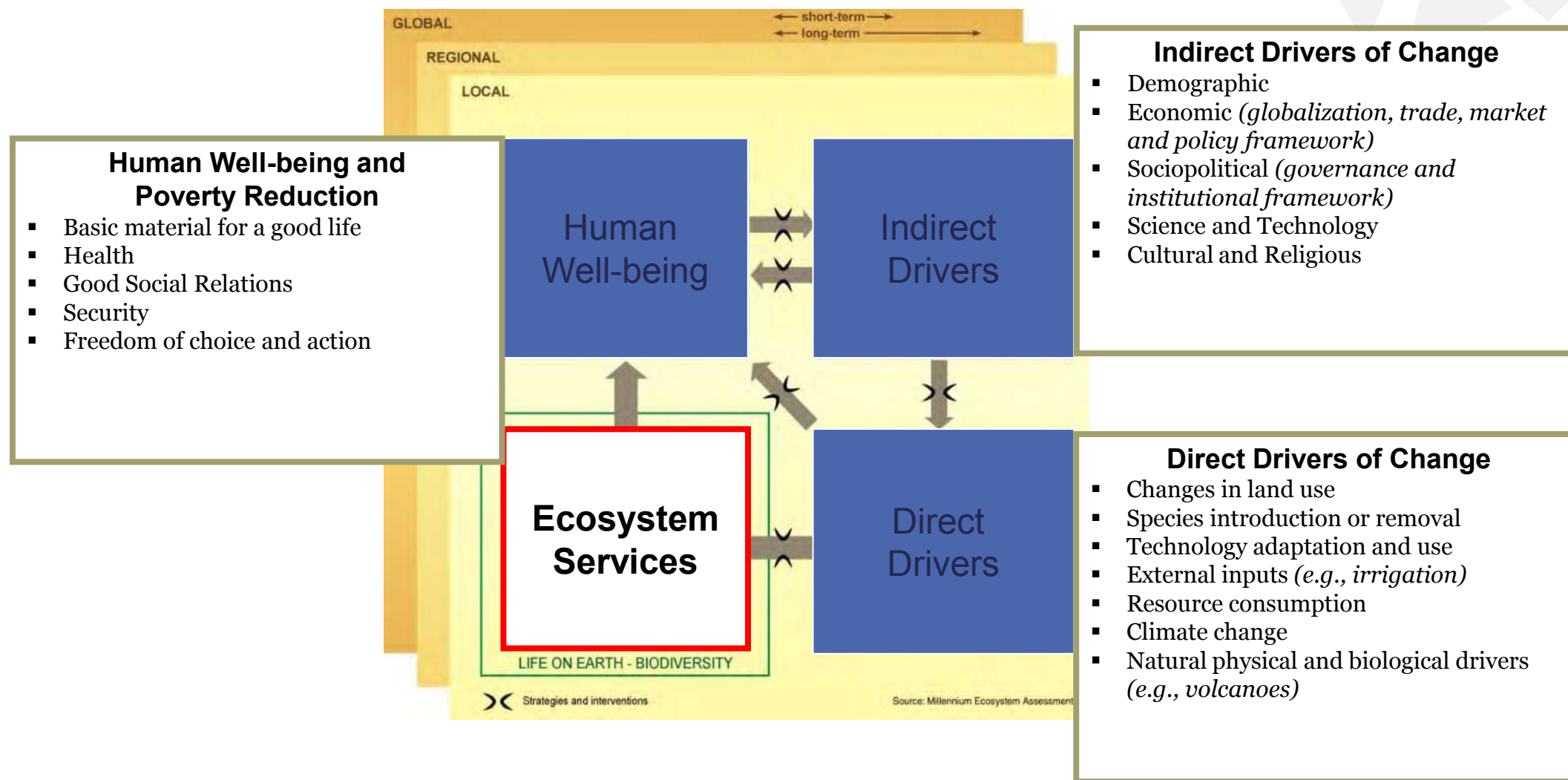
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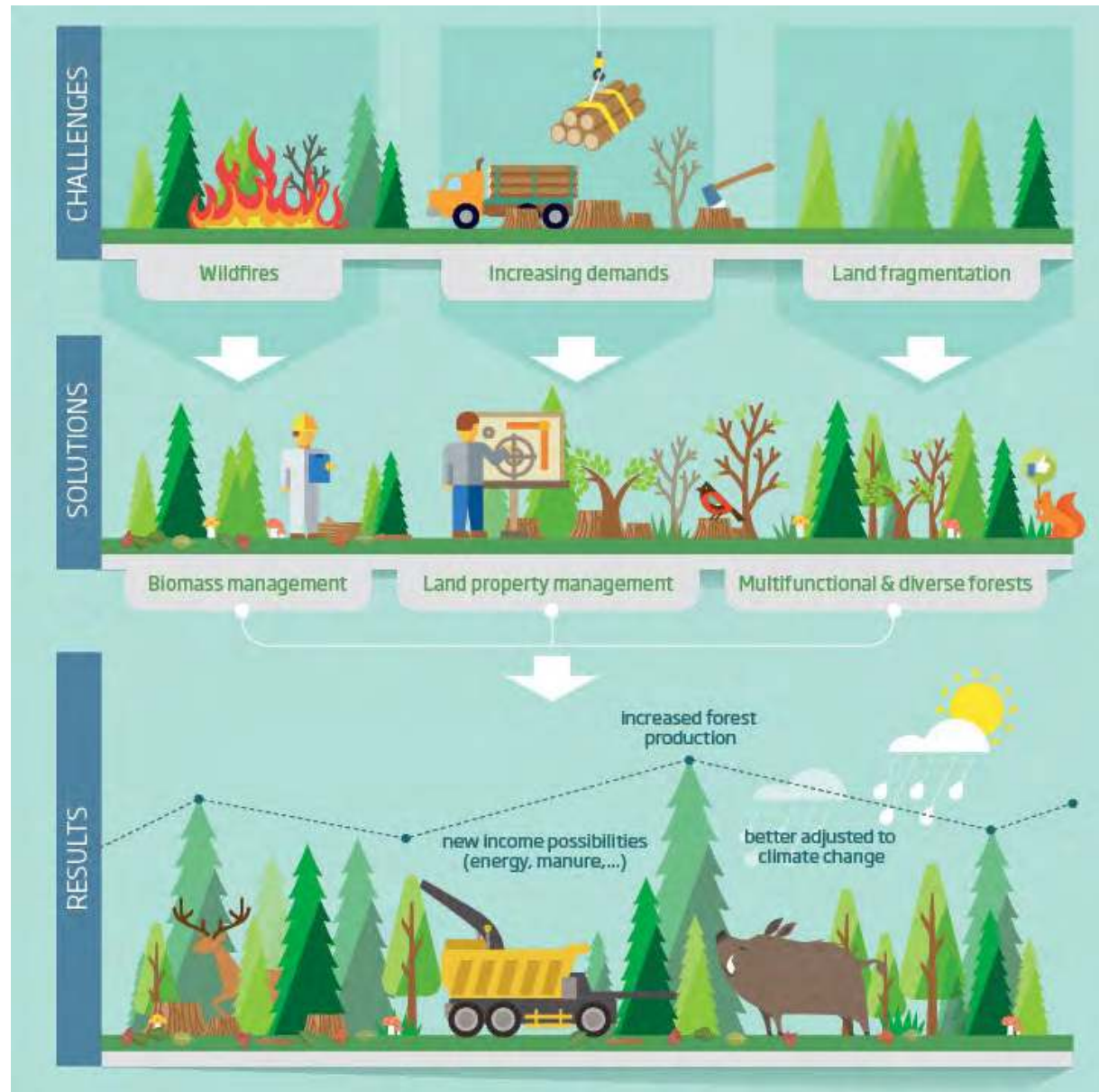


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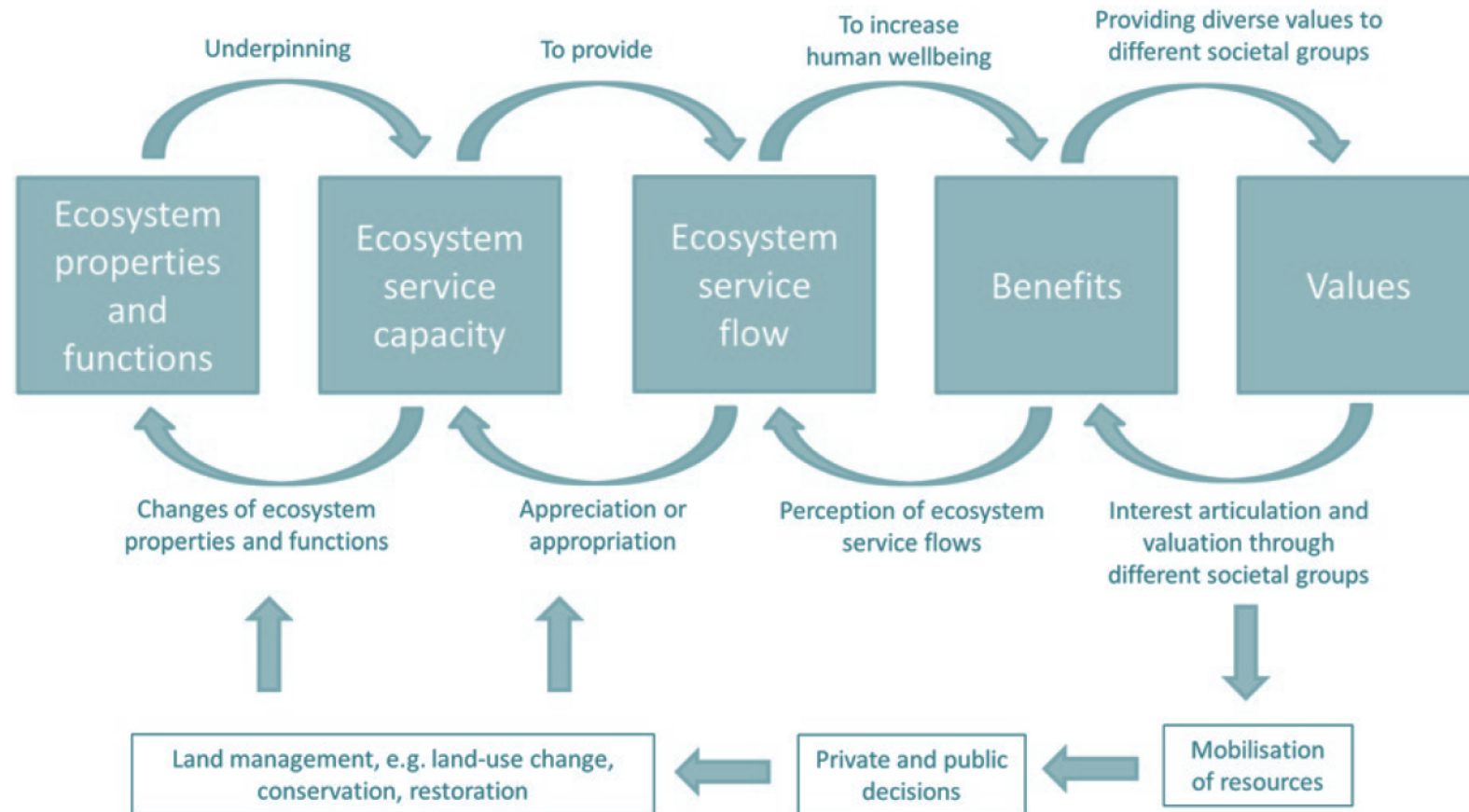
Mecanismos de mudança



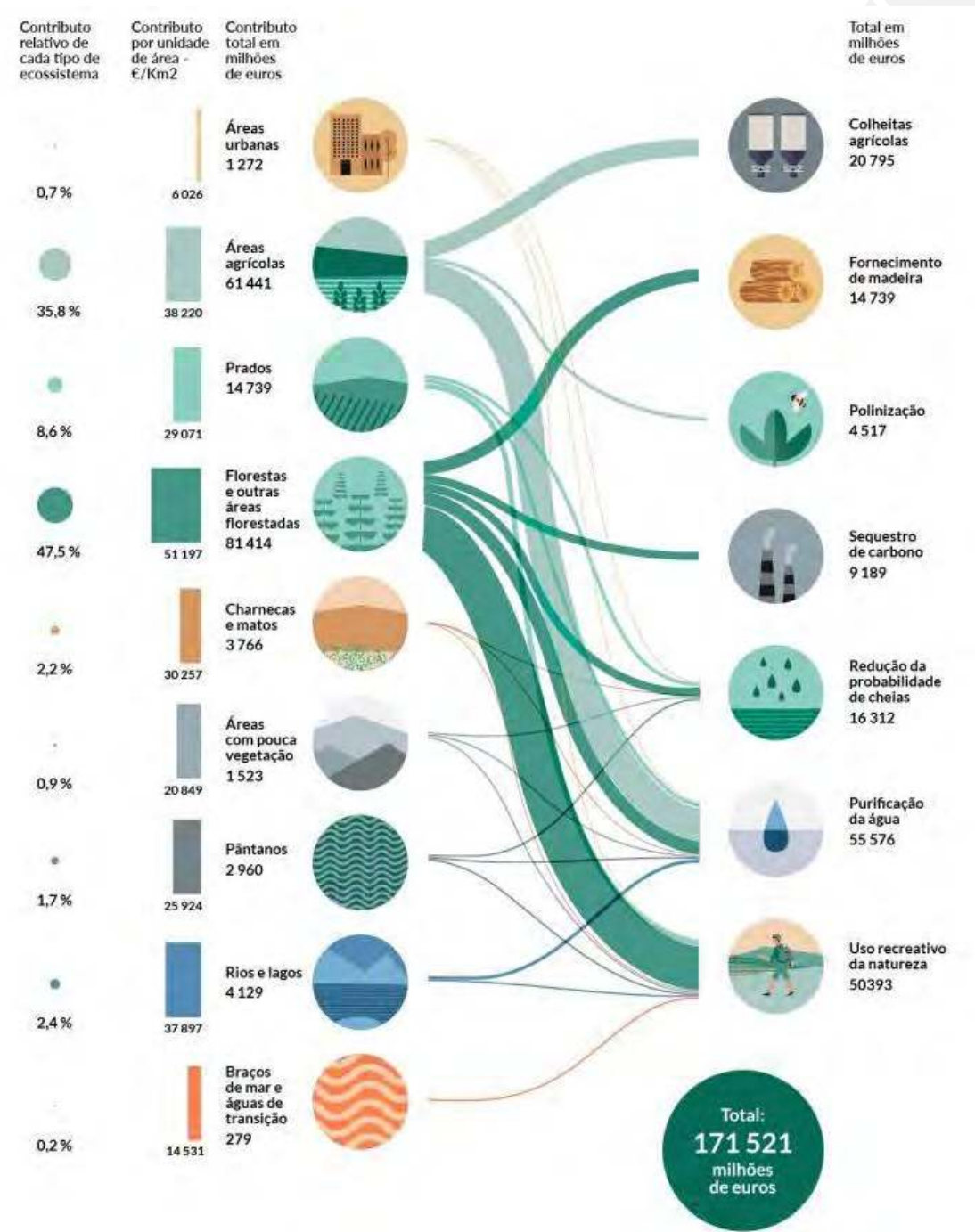
Que soluções procurar?



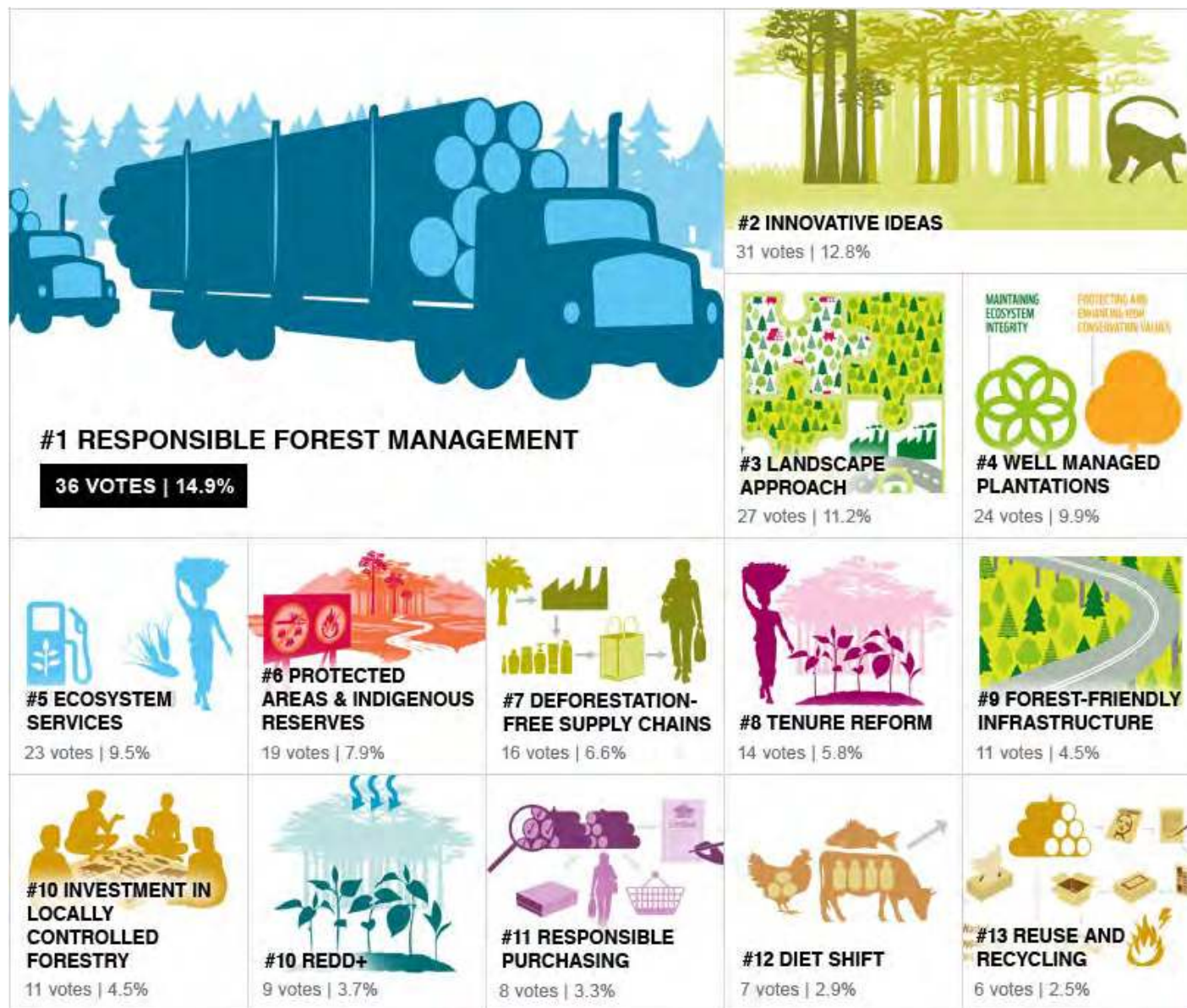
Valorização dos serviços dos ecossistemas



Valoração dos SE



Que soluções podem promover os SE?



Que medidas e/ou estratégias considera necessárias implementar para promover/valorizar os serviços dos ecossistemas?

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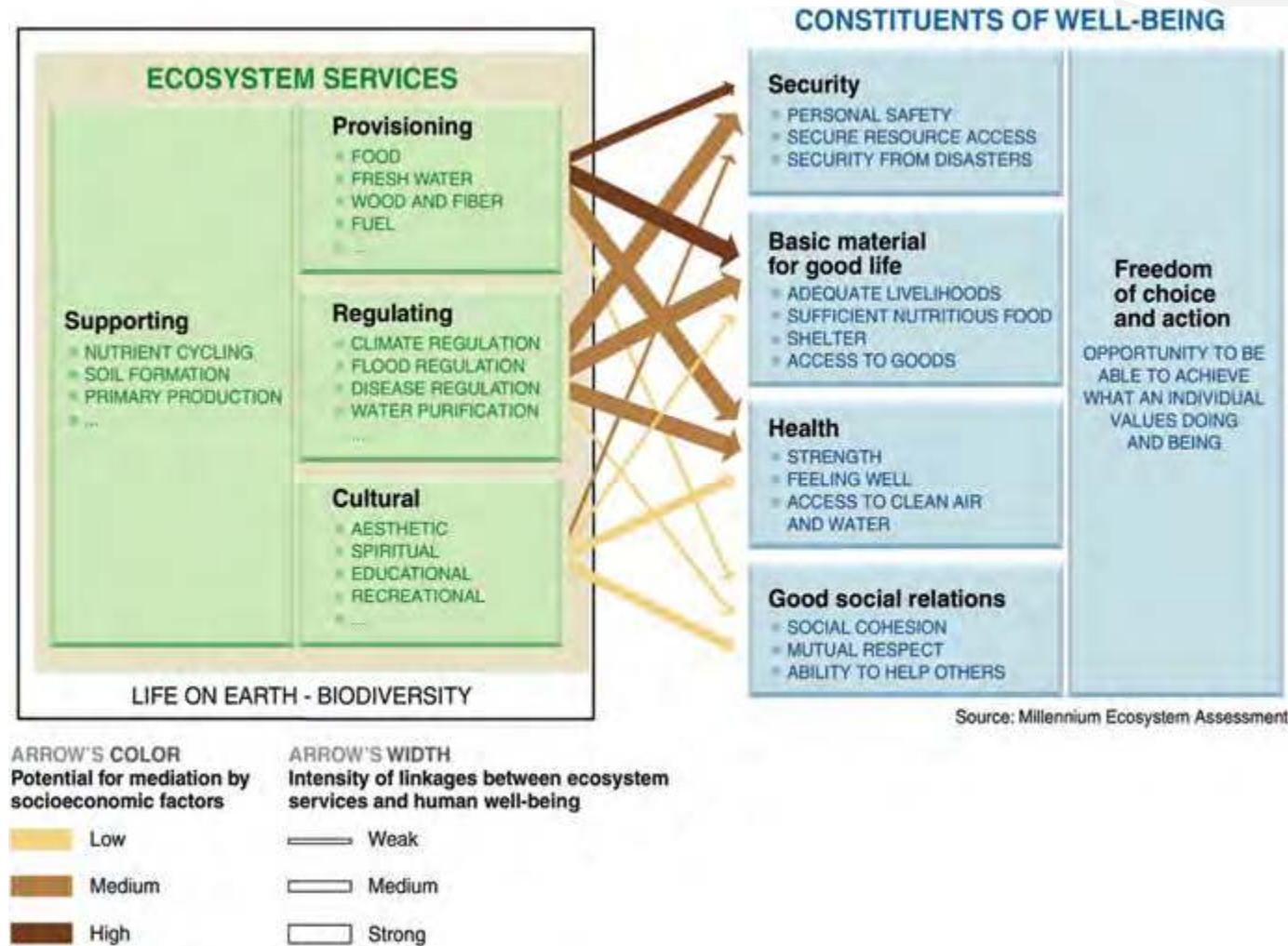
Mentimeter

Serviços dos ecossistemas: diferentes abordagens

Programs/Institutions	Description	Website
Millennium Ecosystem Assessment (MEA)	The MEA was a 4-year, 1300 scientist study commissioned by the United Nations in 2005. The report analysed the state of the world's ecosystems and provided recommendations for policymakers (MEA, 2005). It determined that human actions have depleted the world's natural capital to the point that the ability of a majority of the globe's ecosystems to sustain future generations can no longer be taken for granted	www.millenniumassessment.org
The Economics of Ecosystems and Biodiversity (TEEB)	In 2008, the first report of a second international study was published on The Economics of Ecosystems and Biodiversity (TEEB, 2008), hosted by United Nations Environment Programme (UNEP). The TEEB's primary purpose was to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics, and policy to enable practical actions moving forward. The TEEB report was picked up extensively by the mass media, bringing ecosystem services to a broad audience.	teebweb.org
Ecosystem Services Partnership	The Ecosystem Services Partnership was created in 2008, inspired by the MEA and TEEB projects and has since grown to become the biggest international member-based network focused on facilitating ecosystem services research and practical applications. The network connects over 3000 ecosystem services professionals from science, policy and practice worldwide (including over 50 member-organizations) who are working together in 37 working groups, 10 regional chapters and 40+ national networks on all continents	www.es-partnership.org
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services is an intergovernmental body which provides information on the state of biodiversity and ecosystem services for decision making purposes. It was established in 2012 and current membership includes 126 countries. It is placed under the auspices of four United Nations entities: UNEP, UNESCO, FAO and UNDP	www.ipbes.net
EU Biodiversity Strategy to 2020	The European Union Strategy to 2020 includes the concept of "ecosystem services", with strategic targets and actions. It includes the proposal to map and assess the state of the ecosystems, their services and economic values with the goal of incorporating these values into and accounting and reporting systems at EU and national level by 2010	ec.europa.eu/environment/nature/biodiversity/strategy/
WAVES	The Wealth Accounting and Valuation of Ecosystem Services is a World Bank-led global partnership that aims to promote sustainable development by promoting planning and national environmental and wealth accounting	www.wavespartnership.org
Natural Capital Project (NatCap)	The Natural Capital Project is a partnership between the Stanford University, University of Minnesota, The Nature Conservancy, and the World Wildlife Fund with the goal of integrating the value of ecosystem services into decision making. The NatCap has developed open-sources tools, such as the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) which models the ecosystem services values and uses	www.naturalcapitalproject.org/
Natural Capital Coalition (NCC)	The NCC was created in 2014 and it is a global multi stakeholder organization with the goal of supporting the business community to incorporate ecosystem services and their values into their operations. The recently published the Natural Capital Protocol, a framework designed to support businesses managers decision related to their impact on the environment	naturalcapitalcoalition.org/

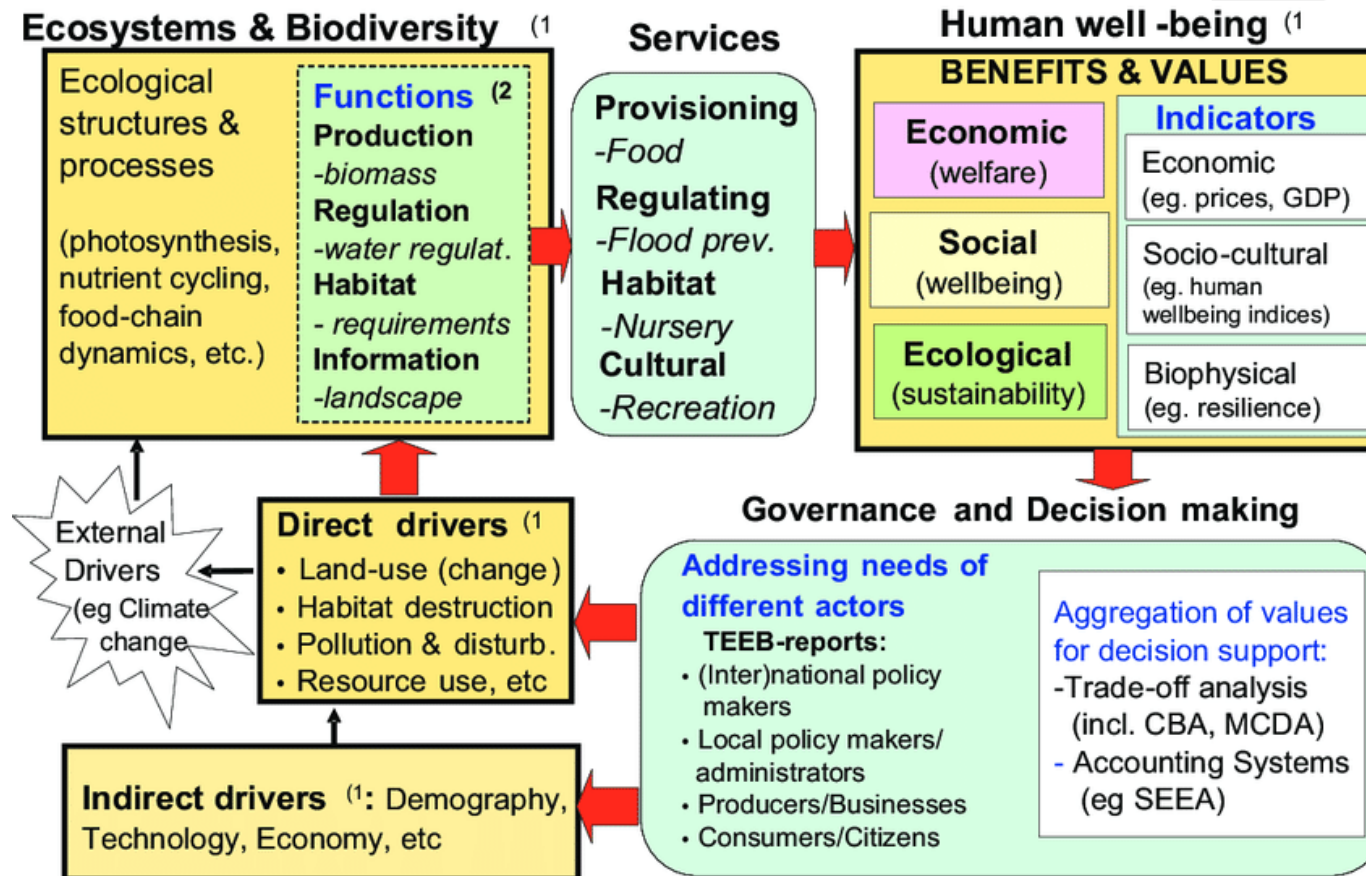
Categorização e ferramentas

Millennium ecosystem Assessment – Ecological approach



Categorização e ferramentas

TEEB: The economics of ecosystems and biodiversity – Economic approach

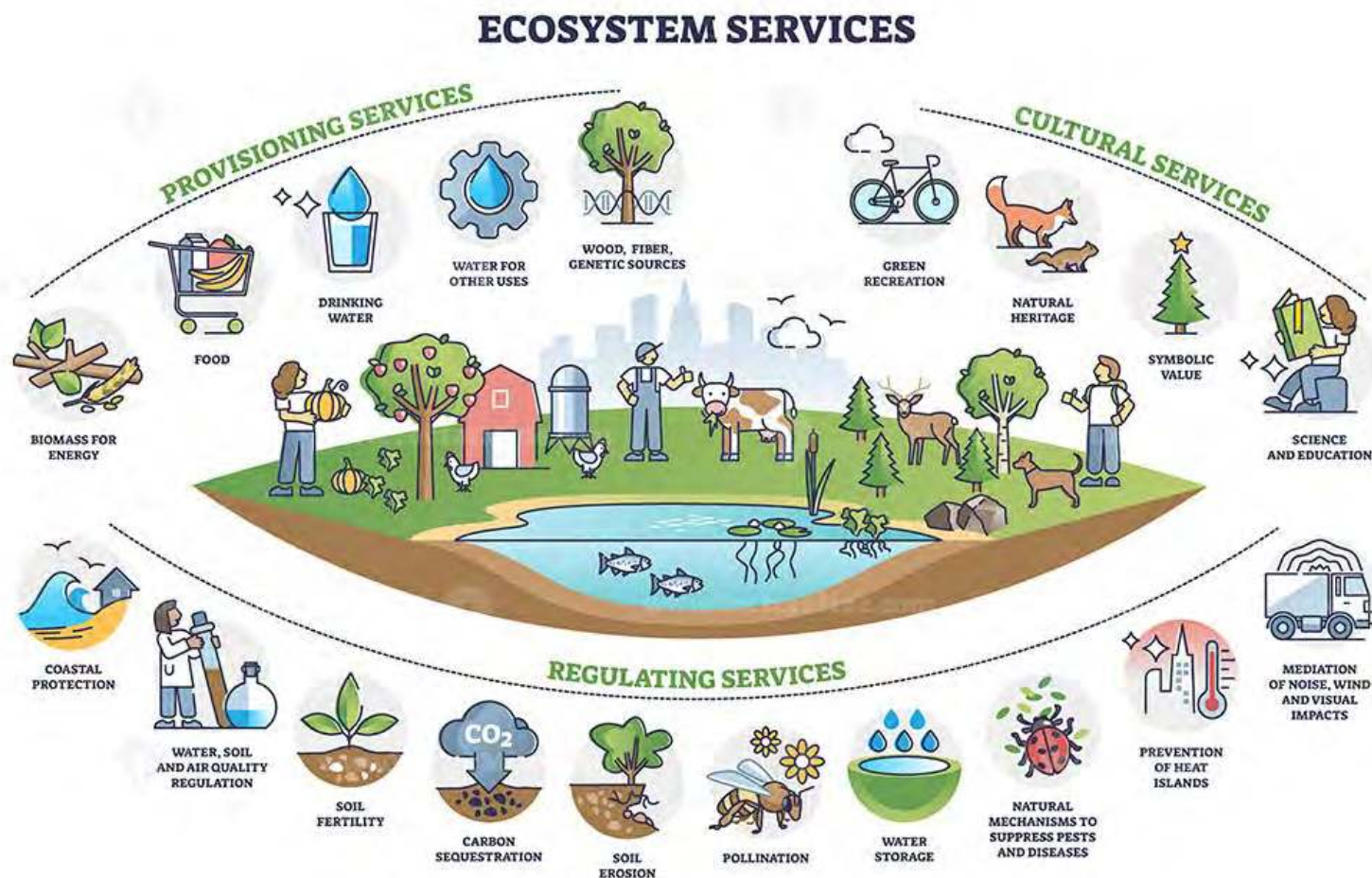


¹⁾ The four bold-lined boxes coincide with the overall MA- Framework

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

Categorização e ferramentas

CICES: Common international classification of ecosystem services – scientific-based approach



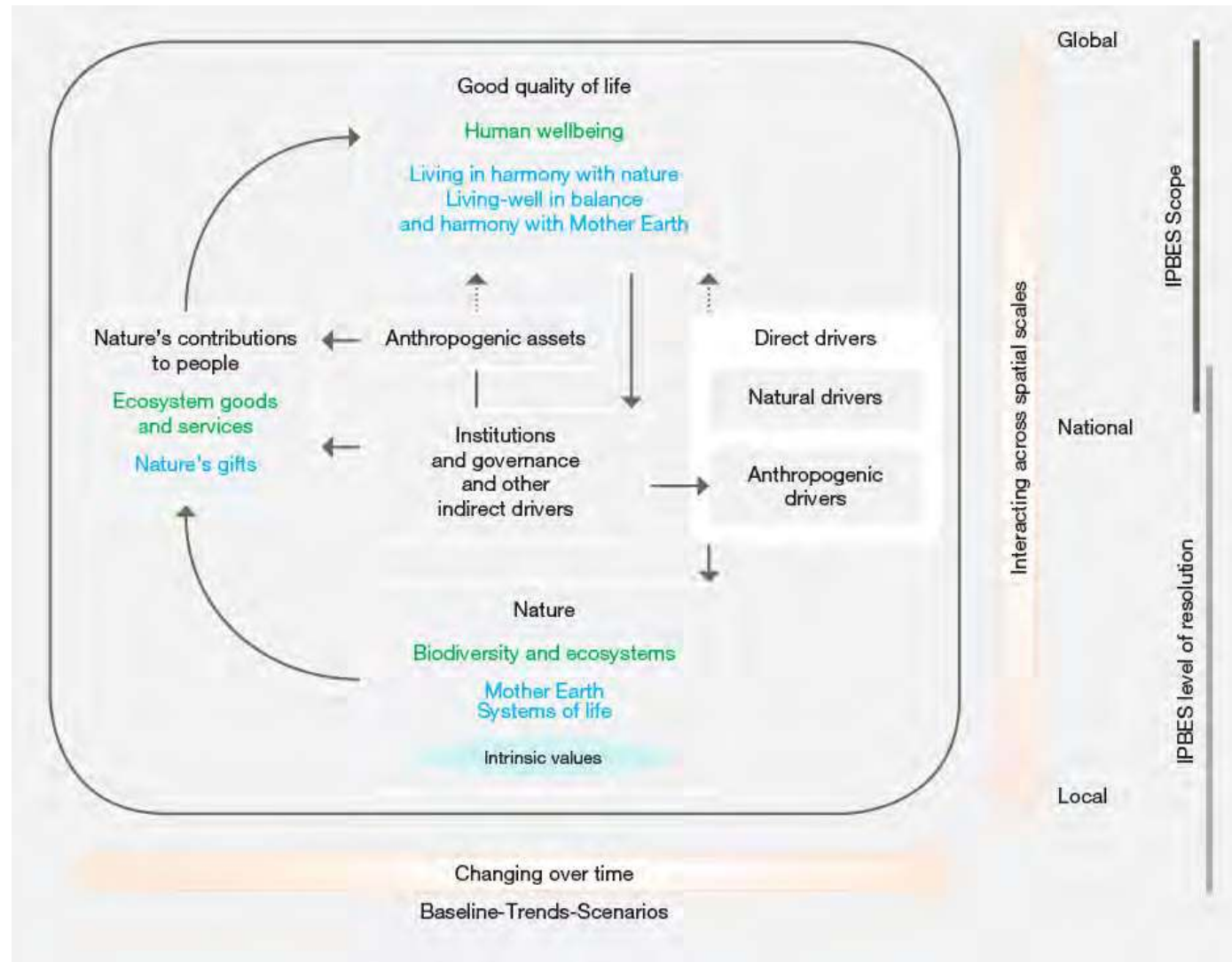
Categorização e ferramentas

CICES: Common international classification of ecosystem services – scientific-based approach

CICES V5.1		01/01/2018																			
Filter	Section	Division	Group	Class	Code	Class type	V4.3 Equivalent	Code(4.3)	Simple descriptor	Ecological clause	Use clause	Example Service	Example Goods and Benefits	Literature examples for individual services	Literature examples for multiple ecosystem services	Marine CICES (Relevance)	IPBES Code	IPBES Name	MA	TEEB	
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
CICES	Provisioning (Biotic)	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	1111	Crops by amount, type (e.g. cereals, root crops, soft fruit, etc.)	Cultivated crops	1111	Any crops and fruits grown by humans for food/food crops...	The ecological contribution to the growth of cultivated, land-based crops...	...that can be harvested and used as raw material for the production of food	Standing wheat crop before harvest (Procy for: ecosystem contribution to growth of harvestable wheat)	Harvested crop; Grain in farmer's store; flour, bread	Maes et al., 2016, Mapping and Assessment of Ecosystems and their Services: This report assesses a variety of ecosystem services across the different sections, such as crop production, water provision, air quality regulation and recreation.	Forest provisioning services: Kalaba et al., 2013, Contribution of forest provisioning ecosystem services to rural livelihoods in the Mimbo woodlands of Zambia. http://link.springer.com/article/10.1007/s11111-013-089-5	0	12	Food and feed	Food	Food	
CICES	Provisioning (Biotic)	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	1112	Material by amount, type, use, media (land, soil, freshwater, marine)	Fibres and other materials from plants, algae and animals for direct use	1211	Material from plants, fungi, algae or bacterial that we can use	The ecological contribution to the production of plants, fungi, algae or bacterial...	...that can be harvested and used as raw material for non-nutritional purposes	Harvestable surplus of: annual tree growth	Processed timber (Volume of harvested wood)			0	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Cultivated plants (including fungi, algae) grown as a source of energy	1113	By amount, type, source	Plant-based resources	1311	Plant materials used as a source of energy	The ecological contribution to the growth of cultivated crops....	...that can be harvested and used as a source of biomass-based energy	Standing crop of Miscanthus at time of harvest	Energy production			0	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Plants cultivated by in-situ aquaculture grown for nutritional purposes	1121	Plants, algae by amount, type	Plants and algae from in-situ aquaculture	1115	Plants that are cultivated in fresh or salt water that we eat	The ecological contribution to the growth of plants and algae under	...that can be harvested and used as raw material for the production of food	Harvestable surplus of seaweed biomass in situ	Vitamin supplement			1	12	Food and feed	Food	Food	
CICES	Provisioning (Biotic)	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Fibres and other materials from in-situ aquaculture for direct use or processing (excluding genetic materials)	1122	Plants, algae by amount, type	Plants and algae from in-situ aquaculture	1115	Plants that are cultivated in fresh or salt water that we can use as a material	The ecological contribution to the growth of plants and algae under	...that can be harvested and used as raw material for non-nutritional	Harvestable surplus of seaweed biomass in situ	Seaweed as an insulating material			1	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Cultivated aquatic plants for nutrition, materials or energy	Plants cultivated by in-situ aquaculture grown as an energy source	1123	Plants, algae by amount, type	Plants and algae from in-situ aquaculture	1115	Plants that are cultivated in fresh or salt water that we can use as an energy	The ecological contribution to the growth of plants and algae under	...that can be harvested and used as a source of energy	Harvestable surplus of seaweed biomass in situ	Seaweed as a source of energy			1	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Reared animals for nutrition, materials or energy	Animals reared for nutritional purposes	1131	Animals, products by amount, type (e.g. beef, dairy)	Reared animals and their outputs	1112	Livestock raised in housing and/or grazed outdoors	The ecological contribution to the rearing of domesticated land-based animals and their outputs...	...that can be used as raw material for the production of food	Increase in weight or numbers of cattle herd per year [previously the grass feeding these animals was considered the final service.]	Meat produced at abattoir, eggs, milk sold on farm or in shops			0	12	Food and feed	Food	Food	
CICES	Provisioning (Biotic)	Biomass	Reared animals for nutrition, materials or energy	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	1132	Material by amount, type, use, media (land, soil, freshwater, marine)	Materials from plants, algae and animals for agricultural use	1212	Material from animals that we can use	The ecological contribution to the production of animal matter...	...that can be harvested and used as raw material for non-nutritional purposes	Harvestable number and quality of animal skins in herd	Hide products			0	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Reared animals for nutrition, materials or energy	Animals reared to provide energy (including mechanical)	1133	By amount, type, source	Animal-based resources & Animal-based mechanical energy	1312, 6, 1321	Animal materials used as a source of energy or for traction	The ecological contribution to domesticated or wild animal species whose	...that can provide a source of energy	Volume of dung or number of animals used for traction	Cooking fuel or Haulage	Energy from manure: Ytode et al., 2009, Nonmarket co-benefits and economic feasibility of on-farm biogas energy production. Energy policy, 37(3), pp.1070-1075.	Energy from manure: Ytode et al., 2009, Nonmarket co-benefits and economic feasibility of on-farm biogas energy production	0	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Reared aquatic animals for nutrition, materials or energy	Animals reared by in-situ aquaculture for nutritional purposes	1141	Animals by amount, type	Animals from in-situ aquaculture	1116	Animals that are cultivated in fresh or salt water that we eat	The ecological contribution to the growth of cultivated aquatic	...that can be used as raw material for the production of food	Harvestable stock of bivalves	Seafood (e.g. mussels)			1	12	Food and feed	Food	Food	
CICES	Provisioning (Biotic)	Biomass	Reared aquatic animals for nutrition, materials or energy	Fibres and other materials from animals grown by in-situ aquaculture for direct use or processing (excluding genetic materials)	1142	Animals by amount, type	Animals from in-situ aquaculture	1116	Animals that are cultivated in fresh or salt water that we can use as	The ecological contribution to the growth of cultivated aquatic	...that can be harvested and used as raw material for non-nutritional	Harvestable pearls produced by oyster beds	Pearls used for adornment			1	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Reared aquatic animals for nutrition, materials or energy	Animals reared by in-situ aquaculture as an energy source	1143	Animals by amount, type	Animals from in-situ aquaculture	1116	Animals that are cultivated in fresh or salt water that we can use as a source of energy	The ecological contribution to the growth of cultivated aquatic animals...	...that can provide a source of energy	Biogas from aquaculture waste	Energy production			1	11	Energy	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	
CICES	Provisioning (Biotic)	Biomass	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	1151	Plants, algae by amount, type	Wild plants, algae and their outputs	1113	Food from wild plants	Parts of the standing biomass of a non-cultivated plant species...	...that can be harvested and used for the production of food	Harvestable volume of wild berries or wild mushrooms, Or: Benthic macroalgae (e.g. Ulva, Laminaria (Kelp)) and macrophytes (e.g. Salicornia and other saltmarsh plants) harvested in the shallow subtidal and/or littoral zone	Berries as food or for the production of jam	Wild food in Europe as an ecosystem service, both food from wild plants and animals. Schulp et al., 2014, Wild food in Europe: A synthesis of knowledge and data of terrestrial wild food as an ecosystem service. http://www.sciencedirect.com/science/article/pii/S0921800914001900		1	12	Food and feed	Food	Food	
CICES	Provisioning (Biotic)	Biomass	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Fibres and other materials from wild plants for direct use or processing (excluding genetic materials)	1152	Plants, algae by amount, type	Wild plants, algae and their outputs	1113	Materials from wild plants	Parts of the standing biomass of a non-cultivated plant species...	...that can be harvested and used as raw material for non-nutritional purposes	Harvestable volume of reeds Or: Macroalgae used for thickening agents, agar and superconductor electrodes	Rooting material			1	13, 14	Materials and assistance, Medicinal, biochemical and genetic resources	Fibre, Timber, Ornamental, Biochemical	Raw materials, medicinal resources	

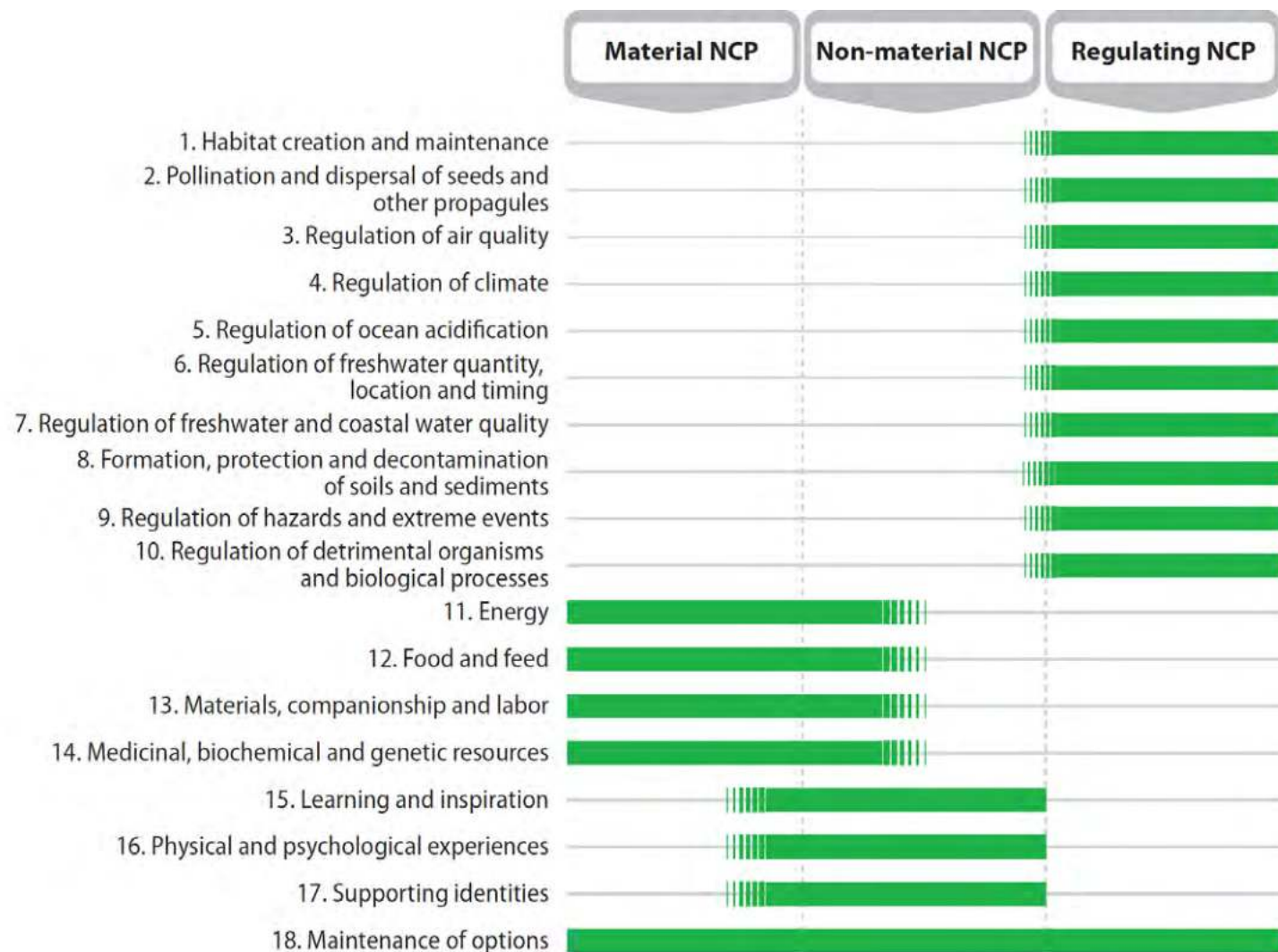
Categorização e ferramentas

- IPBES - Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services



Categorização e ferramentas

- IPBES – Nature contributions to people (NCP)



Categorização e ferramentas

- IPBES – Nature contributions to people (NCP)

- | | |
|--|-----------------------------------|
| 1 Habitat & Biodiversity Conservation | 9 Regulation of extreme events |
| 2 Pollination and Seed Dispersal | 10 Pest and Disease Control |
| 3 Air Quality Regulation | 11 Energy |
| 4 Climate Regulation | 12 Food and Nutrition |
| 5 Regulation of the Chemical Composition of the Oceans | 13 Materials and Fibers |
| 6 Regulation of Water Quantity and Flow | 14 Medicine |
| 7 Regulation of Water Quality | 15 Learning and Inspiration |
| 8 Soil Formation and Protection | 16 Nature Experiences |
| | 17 Identity, Heritage, and Legacy |



Categorização e ferramentas

- IPBES – Nature contributions to people (NCP)

Maps are useful for analyzing, interpreting and communicating ecosystem service data. They can show diverse aspects (where are services supplied/used) and show connections with land use, or exposure to threats.

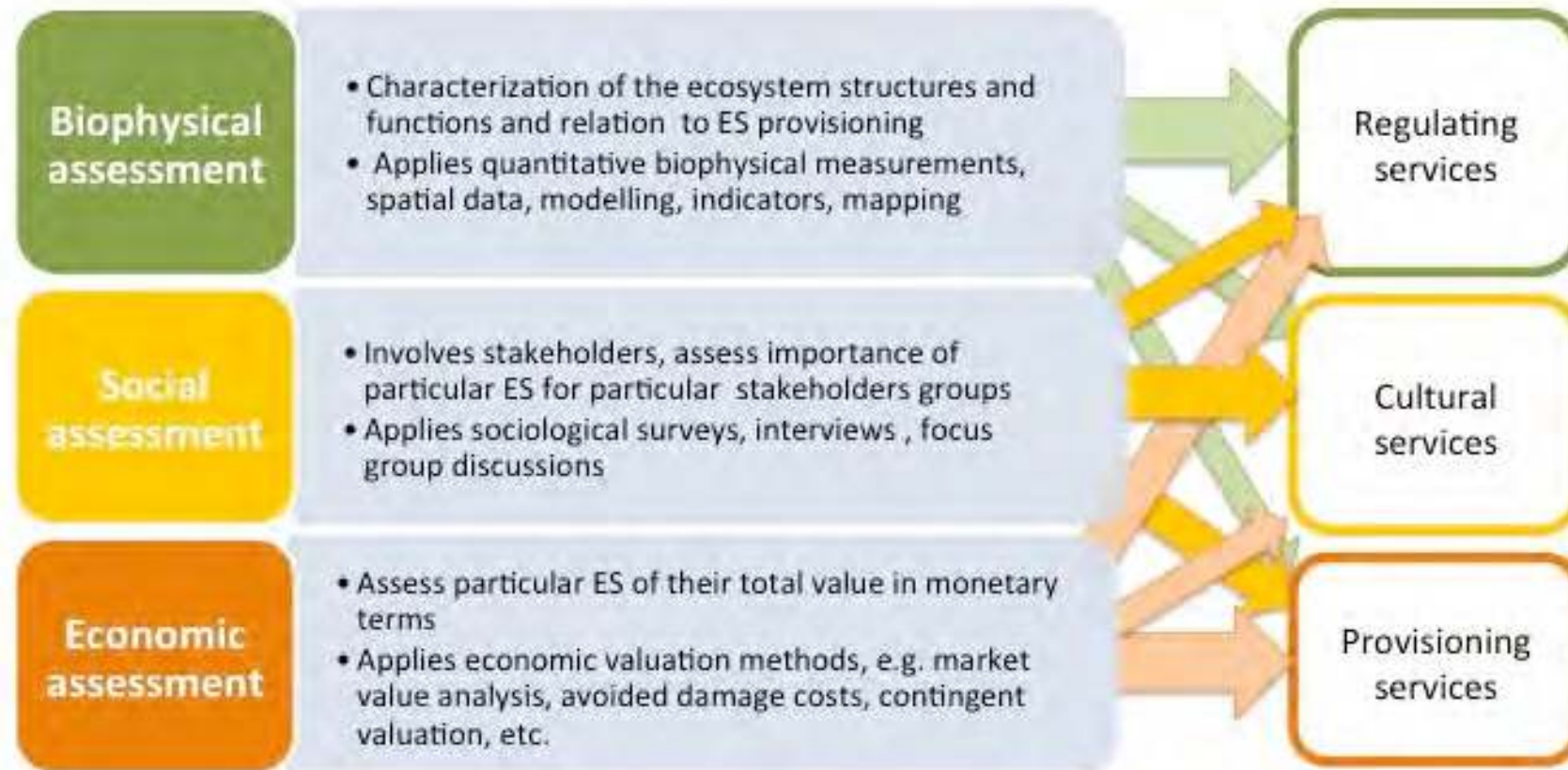


	Nature's contribution to people	50-year global trend	Directional trend across regions	Selected indicator
REGULATION OF ENVIRONMENTAL PROCESSES	1 Habitat creation and maintenance	↓	↓	- Extent of suitable habitat - Biodiversity intactness
	2 Pollination and dispersal of seeds and other propagules	↓	↓	- Pollinator diversity - Extent of natural habitat in agricultural areas
	3 Regulation of air quality	↓	↕	Retention and prevented emissions of air pollutants by ecosystems
	4 Regulation of climate	↓	↕	Prevented emissions and uptake of greenhouse gases by ecosystems
	5 Regulation of ocean acidification	→	↕	Capacity to sequester carbon by marine and terrestrial environments
	6 Regulation of freshwater quantity, location and timing	↓	↕	Ecosystem impact on air-surface-ground water partitioning
	7 Regulation of freshwater and coastal water quality	↓	○	Extent of ecosystems that filter or add constituent components to water
	8 Formation, protection and decontamination of soils and sediments	↓	↕	Soil organic carbon
	9 Regulation of hazards and extreme events	↓	↕	Ability of ecosystems to absorb and buffer hazards
	10 Regulation of detrimental organisms and biological processes	↓	○	- Extent of natural habitat in agricultural areas - Diversity of competent hosts of vector-borne diseases
MATERIALS AND ASSISTANCE	11 Energy	↓	↗	- Extent of agricultural land—potential land for bioenergy production - Extent of forested land
	12 Food and feed	↓	↗	- Extent of agricultural land—potential land for food and feed production - Abundance of marine fish stocks
	13 Materials and assistance	↓	↗	- Extent of agricultural land—potential land for material production - Extent of forested land
	14 Medicinal, biochemical and genetic resources	↓	○	- Fraction of species locally known and used medicinally - Phylogenetic diversity
NON-MATERIAL	15 Learning and inspiration	↓	○	- Number of people in close proximity to nature - Diversity of life from which to learn
	16 Physical and psychological experiences	↓	○	Area of natural and traditional landscapes and seascapes
	17 Supporting identities	↓	○	Stability of land use and land cover
	18 Maintenance of options	↓	○	- Species' survival probability - Phylogenetic diversity

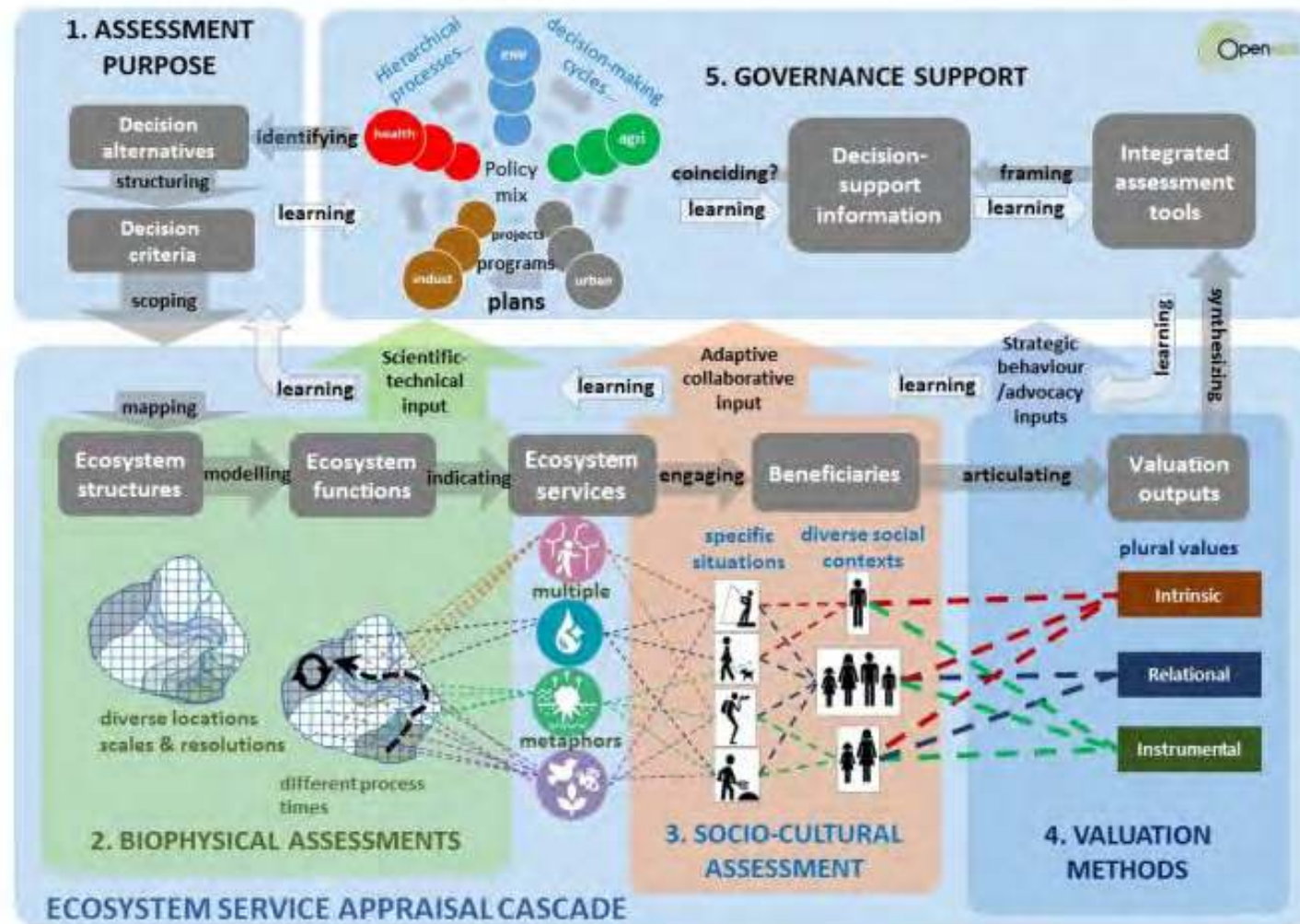


Avaliação dos serviços dos ecossistemas

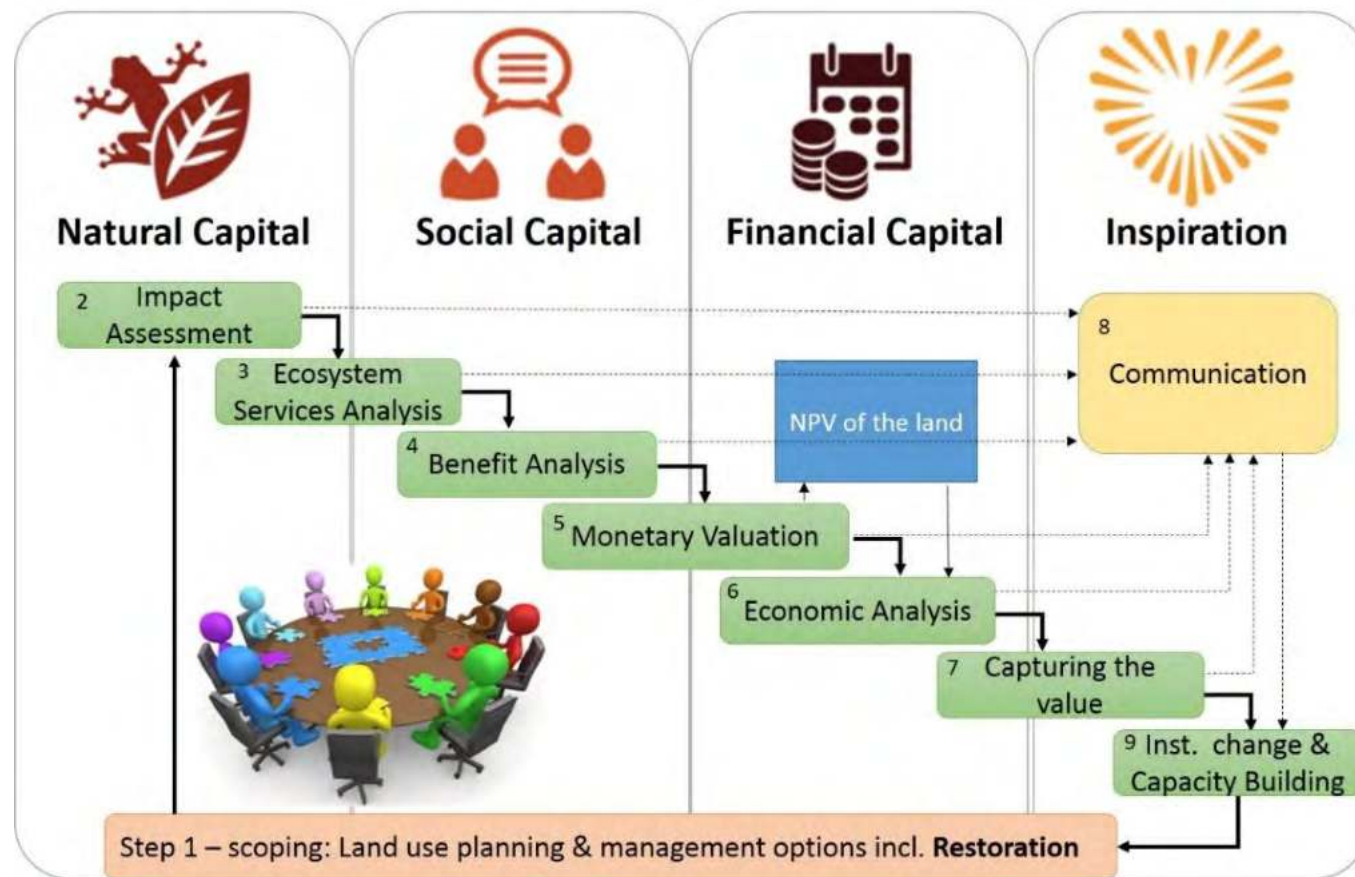
ES assessment methods



Avaliação dos serviços dos ecossistemas



Avaliação dos serviços dos ecossistemas



Avaliação dos SE

Ferramentas

Tool name and website	Acronym	Tool description	Citation
Written step-by-step tools			
Ecosystem Services Toolkit publications.gc.ca/site/eng/9.829253/publication.html	EST	The EST is a guidance document consisting of steps with practical worksheets for conducting qualitative and/or quantitative ES assessment, indicators, advice on relevant issues, and a compendium of tools, methods, and models that might be applied. It is a freely available dynamic PDF. The EST itself does not require computer modelling but guides a practitioner to select appropriate measurement, modelling or other assessment methods.	(Value of Nature to Canadians Study Taskforce, 2017)
Protected Areas Benefits Assessment Tool www.panda.org/our_work/biodiversity/protected_areas/arguments_for_protection/	PA-BAT	The PA-BAT is a rapid, workshop-driven and standardised assessment of different stakeholders' perceptions about ES benefits from protected and other areas. It is freely available in PDF format, does not require modelling or other computer skills, and can be adapted. It requires stakeholder engagement such as a workshop.	(Dudley & Stolton 2008; Ivanic et al. in press)
Toolkit for Ecosystem Service Site-based Assessment v.2.0 tessa.tools/	TESSA	TESSA is a PDF manual that provides accessible guidance and low-cost methods to evaluate the benefits people receive from nature at particular sites. TESSA generates information that can be used to influence decision making. It does not require computer modelling but it does require stakeholder participation and encourages primary data collection using the methods provided.	(Peh et al., 2017)

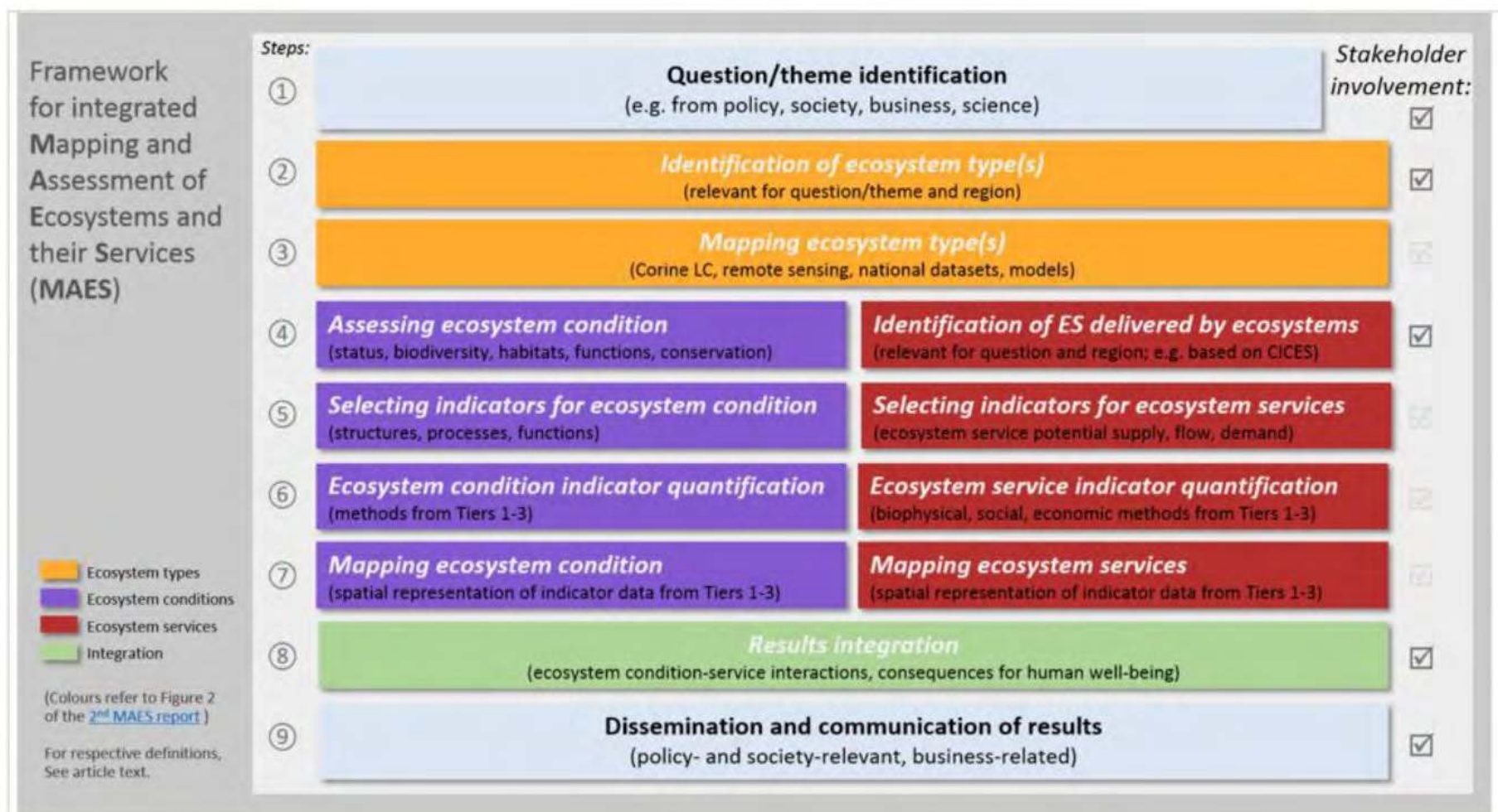
Computer-based modelling tools

Artificial Intelligence for Ecosystem Services aries.integratedmodelling.org	ARIES	ARIES is an ecosystem services modelling platform. ARIES' underlying software, k.LAB, is designed for integrated socioeconomic-environmental modelling, which includes ES. ARIES can accommodate a range of different users and user needs, including scenarios, spatial assessment and economic valuation of ES, optimisation of payments for ecosystem services programs, and spatial policy planning. Using ARIES currently requires modelling skills and GIS.	(Villa et al., 2014)
Co\$ting Nature v.3 www.policysupport.org/costringnature	CSN	CSN is web-based tool for spatially analysing ES and assessing the impacts of human interventions such as land use change scenarios. It provides a globally or locally relative index of service provision that can be used for ES assessment, conservation prioritisation, analysis of co-benefits, pressures and threats. Version 3 includes economic/monetary valuation. Using CSN does not require modelling skills or GIS.	(Mulligan, 2015)
Integrated Valuation of Ecosystem Services and Tradeoffs 3.4.2 www.naturalcapitalproject.org/invest/	InVEST	InVEST is a suite of software models for mapping and quantifying ES in biophysical or economic terms under different scenarios (e.g., policy or management options). InVEST models are based on simple, generalised production functions and require commonly available input data. Using InVEST requires GIS but not modelling skills.	(Sharp et al., 2018)

Tool name and website	Acronym	Tool description	Citation
Multiscale Integrated Models of Ecosystem Services www.afordablefutures.com	MIMES	MIMES is an analytical framework designed to integrate different ecological and economic models to understand and visualise ES values. MIMES relies on SIMILE software and each MIMES application is customised to a specific socio-ecological system. Using MIMES requires modelling skills and GIS.	(Boumans et al., 2015)
Social Values for Ecosystem Services solve.cr.usgs.gov	SoVES	SoVES is an ArcGIS-dependent application that allows the user to identify, assess and map the perceived social values that people attribute to cultural ES, such as aesthetic or recreational values. Combining spatial and points-allocation responses from surveys (which can be undertaken in person, online or through mailing), it produces points-based social-values metric and raster maps of social value intensities. Using SoVES requires GIS.	(Sherrouse et al., 2011)
WaterWorld v.2 www.policysupport.org/waterworld	WW	WW is a web-based tool for modelling hydrological services associated with specific activities under current conditions and under scenarios for land use, land management and climate change. It provides quantitative biophysical results or relative indices that can be used to understand hydrological ecosystem services, water resources and water risk factors. Using WW does not require GIS or modelling skills.	(Mulligan, 2013)

Avaliação dos SE

Modelo conceptual MAES



Avaliação dos SE

Indicadores de provisão

Division	Group	Class	Indicators
Nutrition	Biomass	Cultivated crops	
		Reared animals and their outputs	- Meat production (Iberian pig species) - Meat consumption (Iberian pig species) - Number of individuals (Iberian pig) - Meat production (reindeer) - Meat consumption (reindeer) - Number of individuals (reindeer)
		Wild plants, algae and their outputs	- Distribution of heathlands and other habitats for bees - Distribution of plants important for honey production - Distribution of wild berries, fruits, mushrooms (NFI plot data) - Distribution of wild berries (modelling) - Honey production - Honey consumption - Wild berries, fruits and mushroom harvest
		Wild animals and their outputs	- Amount of meat (hunting) - Value of game - Hunting records (killed animals)
		Plants and algae from in-situ aquaculture	
		Animals from in-situ aquaculture	
	Water	Surface water for drinking	- Total supply of water per forest area (modelling) - Area of forest dedicated to preserve water resources - Surface water supply per forest area (at river basin level) - River discharge - Reservoir water (proxy) - Population and per capita water consumption
		Ground water for drinking	None
	Materials	Fibres and other materials from plants, algae and animals for direct use or processing	- Forest biomass stock - Forest biomass increment - Forest for timber, pulp wood, etc. production - Commercial forest tree volume & harvesting rates - Trees (presence): cork oak for cork & pines for resins - Tree species (timber tress) - Wood consumption (industrial roundwood, fuelwood) - Consumption of cork and resins
		Materials from plants, algae and animals for agricultural use	- Distribution of foraging areas in forest; estimate of grassland/shrubland (NPP) - Marketed forage
		Genetic materials from all biota	- Distribution of plants species with biochemical /pharmaceutical uses - Raw materials for medicines
	Water	Surface water for non-drinking purposes	Same as for drinking purposes
		Ground water for non-drinking purposes	
Energy	Biomass-based energy sources	Plant-based resources	- Wood fuel stock (fraction of forest biomass stock) - Wood fuel production (fraction of forest biomass increment) - Distribution of tress for wood production - Fuel wood consumption
		Animal-based resources	
	Mechanical energy	Animal-based energy	

Avaliação dos SE

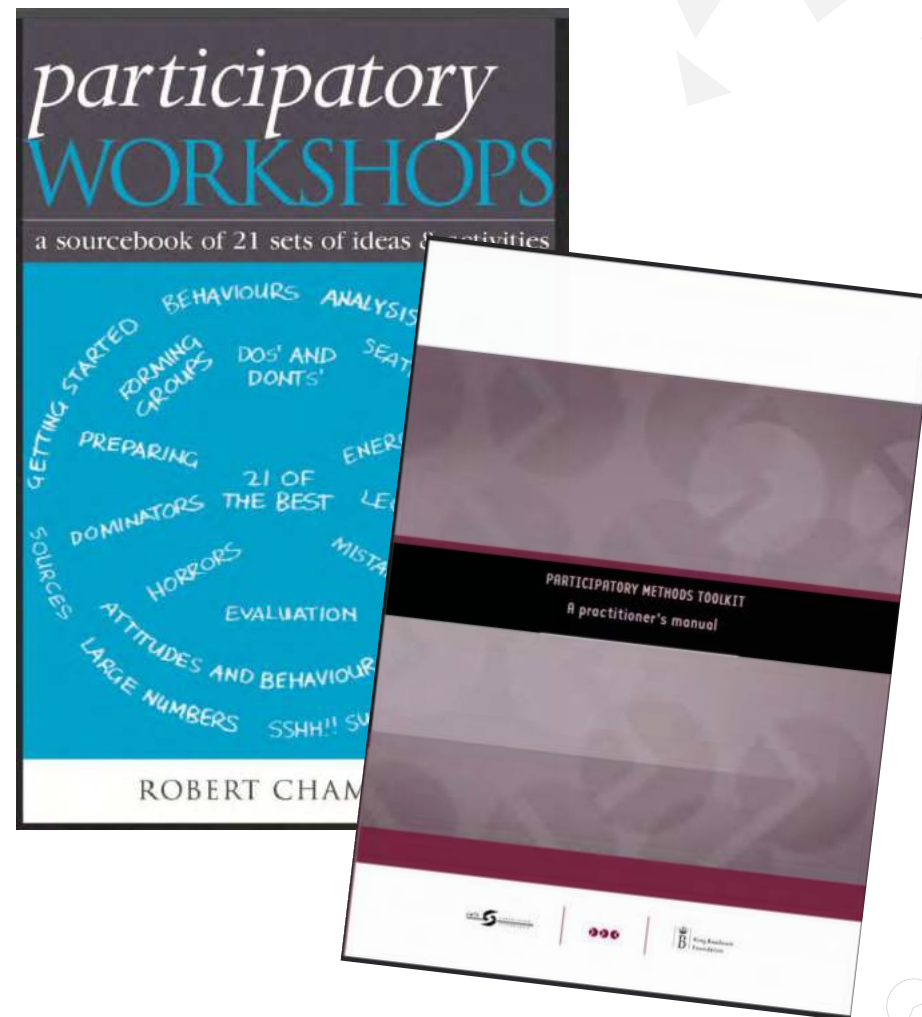
Indicadores de condição

Pressures	
Habitat conversion and degradation (land conversion)	Fragmentation by roads and other linear features (index)
	Fragmentation by forest cover loss (index)
	Forest cover change and deforestation (ha/year)
	Landslides (number/year, area/year) Soil sealing (ha/year)
Climate change	Forest damage by storms and/or other extreme weather events (damage: ha/year or timber m ³ /year)
	Change in climate parameters (including drought): long term changes (>=30-year) (e.g.: °C, mm, indexes)
	Number of fires (number/year)
	Burnt area (ha/year)
	Change in soil moisture (water stress) (index) Drought and heat induced tree mortality, drought stress (area/time unit)
Pollution and nutrient enrichment	Formation of tropospheric ozone (ground level ozone) (ppb/year)
	Deposition of nitrogen, sulphate, sulphur, calcium and magnesium (kg/ha/year)
	Excessive nutrient loading: Nitrogen in soil (kg/ha/year), C/N ratio in soil (ratio)
	Acidification (kg S/ha/year) Industrial (point) and diffuse soil pollution (heavy metals concentration) (mg/kg/year)
Over-exploitation	See note 1
Over-harvesting	Long term ratio of annual fellings (m³/ha/year) to net annual increment (m³/ha/year) (SEBI 017) see note 2
Introduction of invasive alien species	Number of annual introductions of invasive alien species* (number/year)
Other	Insect outbreaks, pest damage and parasites (damage: ha/year or timber m ³ /year)
	Damage by wildlife and herbivores (damage: ha/year or timber m ³ /year) Soil erosion (kg/ha/year)
Ecosystem condition	
Environmental quality	Percentage of forest designated as 'protective forests' (soil, water, other functions and infrastructure and managed resources) (%)
	Percentage of forest under management plan or equivalent instruments (%)
	Tropospheric ozone (ground level ozone) concentration (ppb)
	Concentration of nitrogen, sulphate, sulphur, calcium and magnesium (kg/ha)
Ecosystem attributes	
Structural ecosystem attributes (general)	Deadwood (m³/ha) (SEBI 018)
	Plant functional types (typology)
	Forest types (typology)
	Forest age structure (% of forest in age categories)
	Seral diversity (typology)
	Defoliation (% of trees)
	Discolouration (% of trees)
	Tree height (m)
	Tree cover density (%)
	Tree crown size (diameter, m)
	Forest fragmentation and connectivity (index) (SEBI 013) (CI)
	Biomass volume (growing stock) (m³/ha) (SEBI 017)
	Carbon stock (tonne/ha)
	Forest area (km²)
	Forest structural heterogeneity (index from remote sensing)
	Forest structural homogeneity (index from remote sensing)
	Canopy volume (from remote sensing) (m ³)
	Naturalness (index or typology)

Importância das metodologias participativas

Estratégias participativas

- processo de decisão mais democrático, promovendo o acesso de mais atores relevantes
- melhorar a qualidade das decisões e soluções para problemas de natureza complexa e incerta
- aumentam o nível de confiança entre o público e as instituições, legitimando as estruturas de governança
- capacitação do público - educação e redes de atores relevantes - processo bidirecional
- fortalecimento da coesão social através da procura de consensos e resolução de conflitos



Importância das metodologias participativas

- permitir uma governação democrática e de alta qualidade
- reforçar a capacidade de intervenção civil
- desenvolver programas e iniciativas de forma eficaz e eficiente, com maior apoio
- aumentar a confiança da sociedade nas decisões
- aumentar a compreensão das questões, preocupações, prioridades e soluções públicas
- fomentar a aprendizagem mútua através da partilha de informação e experiências
- assegurar que as decisões e políticas incorporam preocupações, conhecimentos e valores públicos que de outra forma poderiam ser ignorados
- identificar aspetos controversos de uma questão, reunindo diferentes pontos de vista para alcançar consensos de forma colaborativa.

(adaptado de Slocum, 2003)



Casos de estudo

Reservas da Biosfera Portuguesas

Iceland 
Liechtenstein
Norway grants

Reservas da Biosfera Territórios sustentáveis, comunidades resilientes.



REPÚBLICA
PORTUGUESA

AMBIENTE E AÇÃO CLIMÁTICA

Equipa CFE - UC

Modelo conceptual para avaliação dos Serviços dos Ecossistemas



Serviços dos Ecossistemas

Fundamentais para a mitigação dos efeitos das alterações globais, e para a promoção do desenvolvimento sustentável.

Desenvolvimento sustentável

Acrescentar valor às RBs portuguesas, aumentando a sua resiliência e sustentabilidade, e promovendo os seus territórios e património únicos.



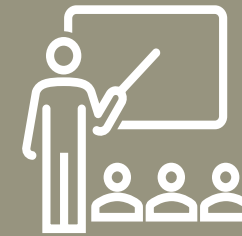
Mapeamento

Informação geográfica e biológica;
Deteção remota;
Mapeamento de SE (atuais e potenciais).



Metodologia participativa

Seleção de SE chave para promover o desenvolvimento sustentável e os recursos endógenos.



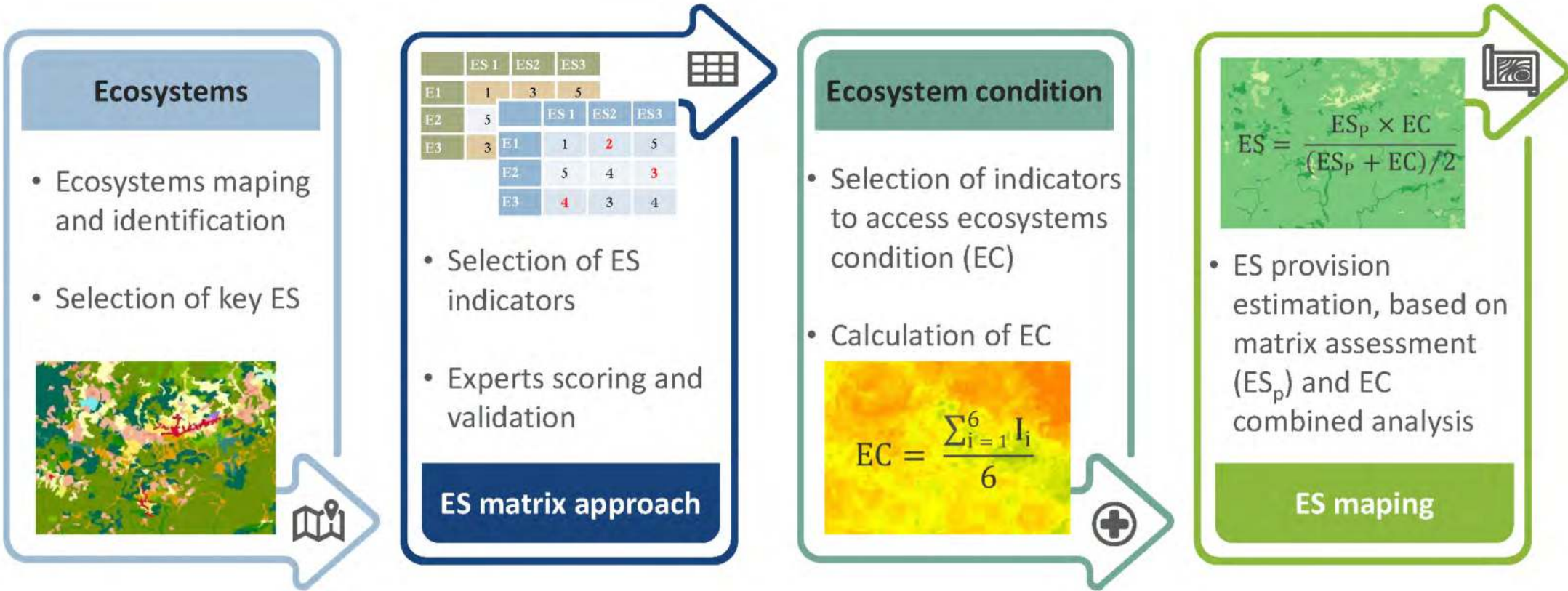
Capacitação

Formação dos atores locais na valorização e promoção dos SE, assegurando a sua produção e consumo sustentáveis.

Reservas da Biosfera Portuguesas



Methodological approach



Metodologias Participativas



SE chave

Considerando os aspectos identitários, objetivos e prioridades de cada uma das reservas da biosfera, irá proceder-se à seleção de quais os SE chave, com vista ao desenvolvimento sustentável dos recursos naturais endógenos existentes nas RB.

Soluções de base natural

Seleção de SE chave recorrendo a uma metodologia participativa e colaborativa multi-actor, visando o seu papel na mitigação e adaptação às alterações climáticas.



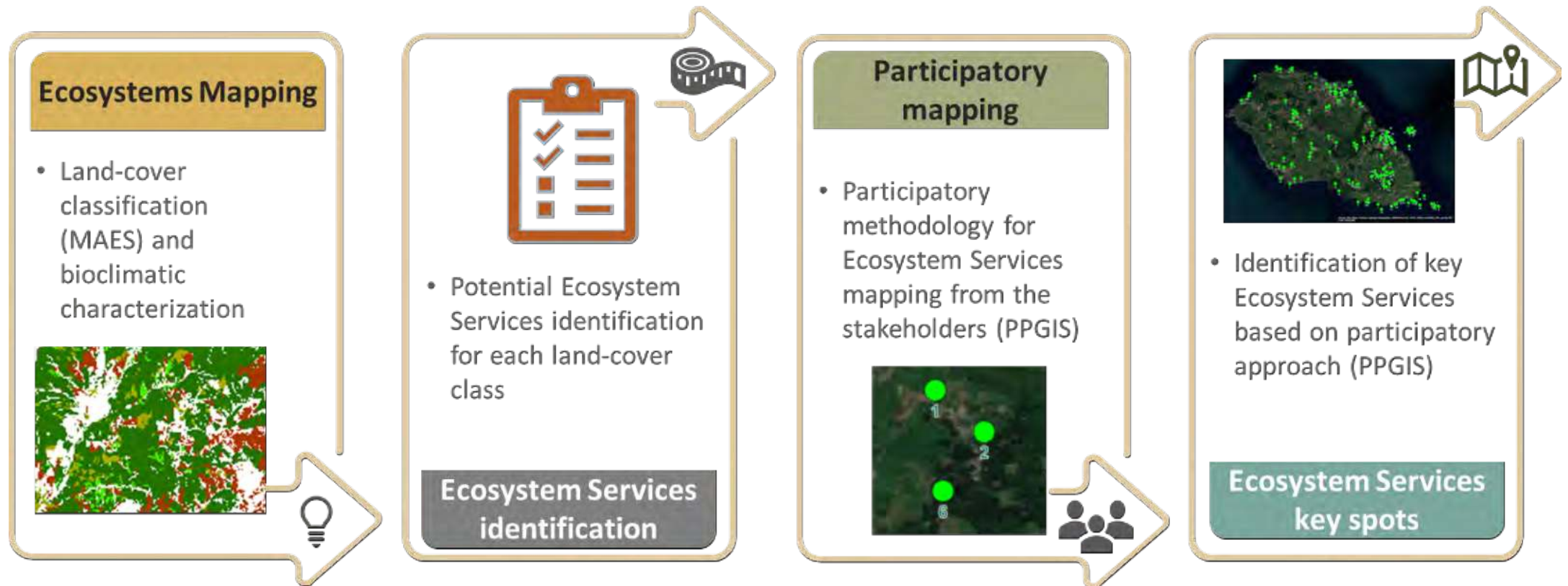
Valorização

Levantamento dos bens e serviços que atualmente trazem benefícios à comunidade e quais os que podem ser valorizados em termos ecológicos, socioculturais e económicos.

Valoração

Um grupo selecionado intervenientes (cientistas, entidades gestoras das RB e atores locais) realizará uma avaliação holística dos SE, com base no seu valor ecológico, económico e social.

Methodological approach



Participatory approach: participatory mapping

In this survey we will ask some questions about specific biosphere reserves. Please choose the biosphere reserve that your answers will relate to.

Which Biosphere Reserve are you answering the survey about?

- ☐ Paul do Boquilhoa
- ☐ Convo Island
- ☐ Graciosa Island
- ☐ Flores Island
- ☒ Gerês-Xurés Transboundary Reserve
- ☐ Berlengas
- ☐ Sertão - Madeira
- ☐ Meseta Ibérica Transboundary Reserve
- ☐ Fajã de São Jorge
- ☐ Tejo-Tago Transboundary Reserve
- ☐ Castro Verde
- ☐ Porto Santo

How familiar are you with this area?

- ☐ I am not at all familiar this area
- ☐ I am slightly familiar this area
- ☐ I am moderately familiar this area
- ☐ I am very familiar this area
- ☐ I am extremely familiar this area

What is your main relationship with the biosphere reserve?

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Where does nature contribute to your well-being?

Click on the blue ecosystem service buttons below. Then move the point to a place on the map where you consider the service to be important. You can place as many points as you like, although the bottom of the page is guided to help you identify what the service is.

1. Habitats and biodiversity conservation
2. Pollination and seed dispersal
3. Regulation of air quality
4. Regulation of climate
5. Regulation of the chemical composition of the atmosphere
6. Regulation of water quantity and flow
7. Water quality regulation
8. Soil formation and protection
9. Extreme event regulation
10. Regulation of pests and diseases
11. Energy
12. Food and feed
13. Materials and fibre
14. Medicinal and genetic resources
15. Learning and inspiration

5 / 6

Ecosystems Mapping

- Land cover classification and mapping
- Ecosystem services mapping

Participatory methodology

- Selection of key ecosystem services for mapping
- Development of participatory mapping methodology

Ecosystem services mapping

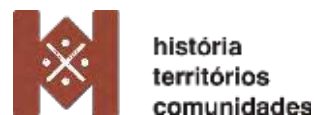
- Mapping of ecosystem services
- Comparison of spatial ecosystem services

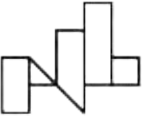
Ecosystem services mapping

- Mapping of ecosystem services
- Comparison of spatial ecosystem services



PARCERIA E EQUIPA



Iceland 
Liechtenstein
Norway grants

Working together for a green Europe.

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promotor



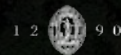
operador do programa



Obrigada!

Joana Alves* & Helena Freitas

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