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What is Quality of Life

"An individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns." (WHO, 1993)

Perception:
satisfaction <-> dissatisfaction



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Well-being

10 broad dimensions that matter most to people:

Natural environment

Personal well-being

Our relationships

Health

What we do

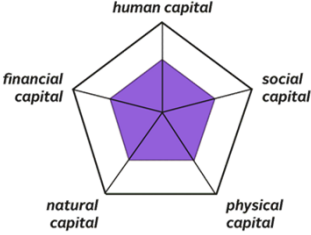
Where we live

Personal finance

The economy

Education and skills

Governance




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Ikigai

"a reason for being"



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1

What is Natural Capital?

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Natural Capital and Ecosystems Services

Natural Capital

Term 'capital' borrowed from financial sector to describe value of resources

Costanza et al., 1997 *Nature* 387, 253-360

- Natural Capital** global stock of natural assets including geology, soil, air, water and all living things (which are supported by these assets)
Value? 16-55 Trillion USD/annum (1997)
- Ecosystems play major role determining economic output and social well-being
 - providing resources and services, and absorbing emissions and waste.

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What knowledge is needed to determine important natural capital

Natural Capital Assets

- Species
- Communities
- Landscapes
- Ecosystems
- Soils
- Water

Ecosystem Services Provided

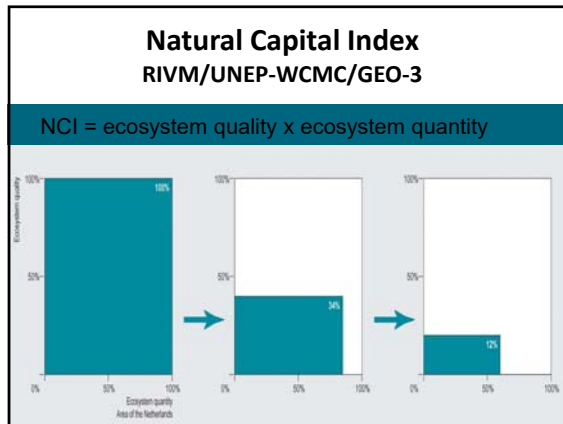
- Pollination
- Biomass
- CO2 draw down
- Soil erosion protection
- Water purification

Social benefits obtained

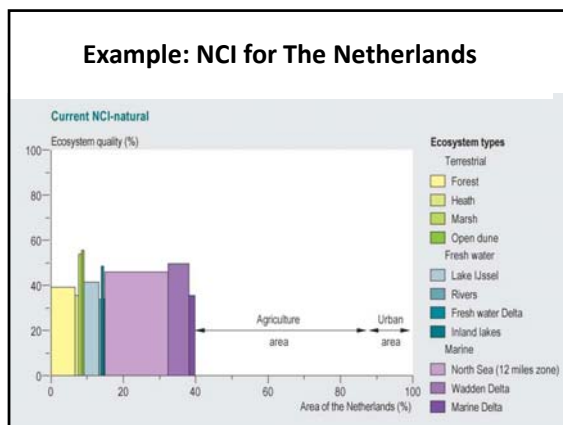
- Food & medicines
- Energy
- Clean water
- Recreation
- Hazard Protection
- Equitable climates

Global
Regional
Local

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Natural Capital Committee (NCC)

The Natural Capital Committee advises the government on natural capital, such as forests, rivers, minerals and oceans.

Contents

- [Role of the group](#)
- [Advice on government's 25 Year Environment Plan](#)
- [Membership](#)
- [Publications](#)
- [Minutes of meetings](#)

Role of the group

The Natural Capital Committee (NCC) is an independent advisory committee.

It provides advice to the government on the sustainable use of natural capital that is, our natural assets including forests, rivers, land, minerals and oceans.

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The UK Natural Capital Committee

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“being the first generation to leave the natural environment of England in a better state than that in which we found it”: better health; educational opportunities; recreation; tourism; sustainable supply chains; better carbon retention and sequestration; better catchment management and natural flood protection; better soils; enhanced, accessible landscapes; and more biodiversity.

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Current knowledge and data availability – UK Species

Species Group	Abundance	Distribution	Trend
Terrestrial & Freshwater	Microorganisms		
	Fungi		
	Algae		
	Lichens		
	Bryophytes		
	Higher plants		
	Invertebrates (freshwater)		
	Invertebrates (terrestrial) ²²		
	Fish (freshwater)		
	Amphibians		
	Reptiles		
	Birds		
	Mammals		
Marine	Plankton (phyto- and zoo-) ²³		
	Algae		
	Invertebrates		
	Fish ²⁴		
	Seabirds		
Mammals			

Key: Red – limited suitable data; Amber – data inconsistently collected across components, time or space; Green – good data at appropriate spatial or temporal scales

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Figure 3.2 Risk assessment results

Risk rating for 73 priority relationships between major land use categories (quantity, quality and spatial configuration) and goods

	Mountains, moors and heaths	Enclosed farmland	Semi-natural grassland	Woodlands	Freshwaters	Urban	Coastal margins	Marine				
	Qun	Qul	Sp	Qun	Qul	Sp	Qun	Qul	Sp	Qun	Qul	Sp
Food												
Fibre												
Energy												
Clean water												
Clean air												
Recreation												
Anaesthetics												
Hazard protection												
Wildlife												
Equitable climate												

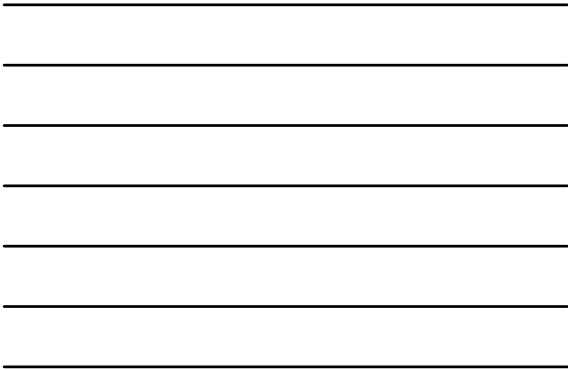
Key

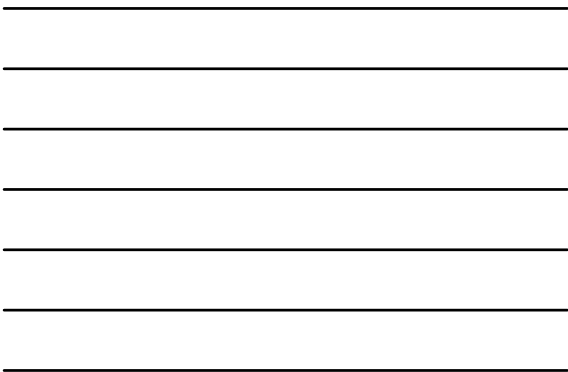
Qun = quantity; Qul = quality; Sp = spatial configuration

	High confidence	Low confidence
Low risk	A	A
High risk (or risk unknown)	B	B
Very high risk	C	C

This figure shows the results of the prioritisation and risk categorisation exercise. The 73 relationships (white cells) identified from the initial prioritisation exercise have been allocated to a risk category A-C based on current status and trend. Levels of confidence are indicated.

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Natural Capital and Ecosystems Services
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Why Ecosystems?

- Interest in ecosystems and their assessments has grown and they have become a **mainstream concept** (scientific and policy perspectives).
- Millennium Ecosystem Assessment (MA)*** clarified **benefits** that **humans** derive from ecosystems
- MA promoted term '**ecosystem services**' to describe benefits.
- MA documented that >60% of ecosystem services were deteriorating or already overused**

*Millennium Ecosystem Assessment (2005) Ecosystems and Human Well-being: Synthesis, World Resources Institute

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- The ecosystem approach aims at **integrated** management of land, water and living resources that promotes **conservation** and **sustainable** use, **equitably**.
- European Ecosystems**
 - Cropland and grassland
 - Rivers and lakes
 - Woodland and forest
 - Marine
 - Heath land and shrub
 - Islands
 - Urban
 - Wetlands
 - Mountains <http://biodiversity.europa.eu/topics/ecosystems-and-habitats>
- Aren't ecosystems just habitats?**

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What are habitats?

- Home** to a species or a variety of species
 - e.g., rock pool, tree canopy, leaf, mountain.
- Provides food, water and shelter.
- Habitats can provide for ecosystems e.g., under a rock?



The ecosystem concept describes the **interrelationships between **living organisms** and the **non-living environment****

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Mountains

- Mountains characterised by **wide natural and cultural variety**.
- Cover ~27 % of world's land surface and **provides freshwater for > half of humanity**.
- Mountains support ~25% of terrestrial biodiversity and ~50% of world's biodiversity 'hotspots'
- Of the 20 plant species that supply 80 % of the world's food, **six originated in mountains**.
- Only 3 % of Europe's total area** covered by mountain environments above tree line, yet hosts 20 % of native vascular plant species
- >2,500 species/subspecies found in alpine flora, confined to above tree-line.






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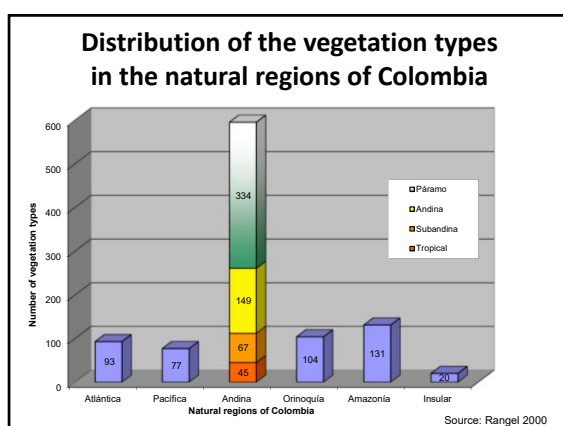
Endemism increases with altitude

- Isolation of populations and speciation over geological time scales.** e.g., Caucasus - highest endemism in temperate world, >6,500 plant species (25% unique).
- Mountain ecosystems fragile and vulnerable to change** - due to climatic and bio-geographic conditions. e.g. coffee and potato (e.g., CWRs)
- Main pressures** - land use change, infrastructure development, (unsustainable) tourism, (unsustainable) exploitation of natural resources, fragmentation of habitats, and climate change.
- Only 21% of conservation status assessments of mountain habitats are favourable and 60% are unfavourable**

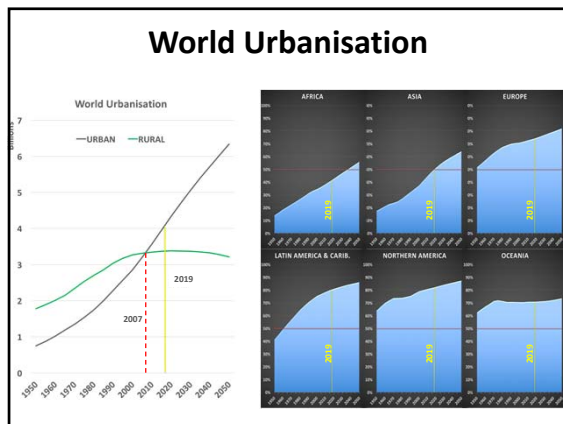



Capra ibex
Leontopodium alpinum

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What are Ecosystem Services:

- Activities/functions of ecosystems that provide benefits (or occasionally dis-benefits) to humans.
- Supporting services**
 - necessary for production of all other ecosystem services.
- Provisioning**
 - products obtained
- Regulating**
 - benefits obtained
- Cultural**
 - the non-material benefits and landscape values

A circular diagram illustrating the four categories of ecosystem services: Supporting, Provisioning, Regulating, and Cultural. Each category is represented by a colored segment of a circle, with various icons and text labels within each segment. The segments are arranged in a circle, with 'Supporting' at the top, 'Provisioning' on the right, 'Regulating' at the bottom, and 'Cultural' on the left.

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Provisioning Services:

Goods produced or provided by ecosystems

- ☐ Food
- ☐ Freshwater
- ☐ Raw materials
- ☐ Genetic resources
- ☐ Medicinal/other biochemical resources
- ☐ Ornamental resources
- ☐ Energy

A photograph showing a stack of large, cut logs of wood, illustrating raw materials as a provisioning service.

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Regulating Services:

Natural processes regulated by ecosystems

☐ Air purification

☐ Climate regulation

- Global (CO2 sequestration)
- Regional and local

☐ Moderation of extreme events

☐ Water purification and waste treatment

☐ Maintenance of soil fertility

☐ Erosion prevention

☐ Biological control

☐ Pollination

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Cultural Services:

Cultural and social benefits obtained from ecosystems

☐ Recreation

☐ Ecotourism

☐ Spiritual and religious experiences

☐ Inspiration for culture, art and design

☐ Information for cognitive development



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Supporting Services:

Functions that maintain all other services

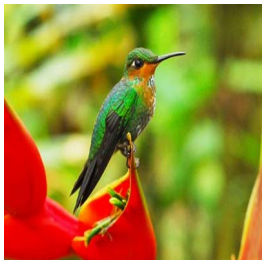
☐ Nutrient cycling

☐ Primary production

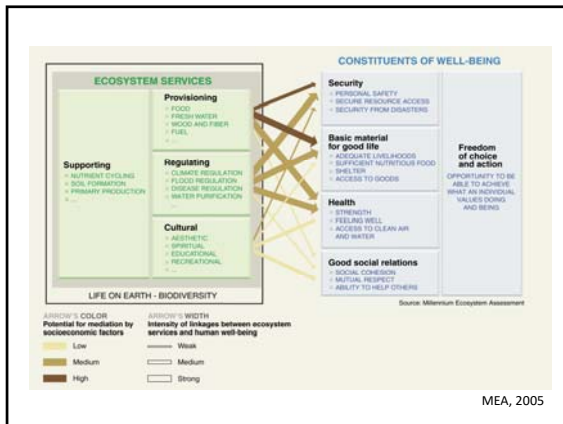
☐ Photosynthesis

☐ Water cycling

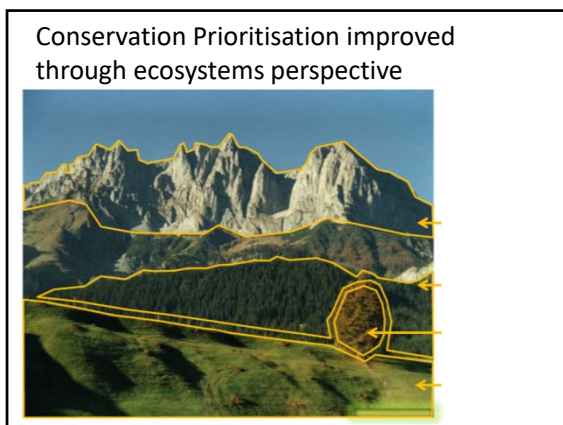
☐ Maintenance of biodiversity



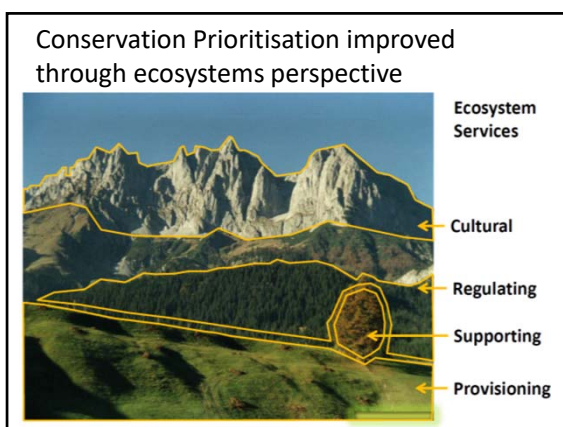
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Natural Capital and Ecosystems Services




Examples of key services 1

- **Climate regulation** - most important ecosystem service?
- Terrestrial ecosystems = carbon sinks
- **Peat soils** - largest single store of carbon and Europe has large areas in its boreal and cool temperate zones.
- Climate regulating function of peatlands depends on land use and intensification
 - (e.g., drainage and conversion to agriculture) – will have increasing impacts on capacity of soil to store carbon and on carbon emissions
- **Great quantities of carbon are being emitted from drained peatlands.**

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Natural Capital and Ecosystems Services




Examples of key services 2

- **Water purification** by ecosystems
- importance in **densely populated** regions owing to **heavy pressure on water**.
 - **Vegetation controls floods**, water flows and quality
 - Vegetation cover in upstream watersheds affect quantity, quality and variability of water supply **downstream**;
 - Soil micro-organisms **purify water**; soil invertebrates influence soil structure, decreasing surface runoff.
 - Forests, wetlands and protected areas provide clean water **at lower cost than water treatment plants**

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Natural Capital and Ecosystems Services



Examples of key services 3

- **Pests and diseases** are regulated *naturally* in ecosystems via actions of **predators and parasites**.
 - E.g., insectivorous birds and invertebrates
- **Soil biodiversity** major factor in soil formation
 - supports a range of **provisioning services** e.g., food, fibre and fuel provision
 - **fundamental to soil fertility**
 - diverse soil community **prevents loss of crops** resulting from soil-borne pest & diseases.

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Natural Capital and Ecosystems Services

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Examples of key services 4

- **Cultural services.**
 - Evidence in scale of membership of conservation organizations. E.g., **Royal Society for the Protection of Birds** has a **membership of over one million** and an **annual income of over £50 million**.
 - Mostly assoc. with **nature conservation and tourism**
 - Well managed **protected areas educate and inform**

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Natural Capital and Ecosystems Services

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[EU Biodiversity Strategy to 2020](#) calls Member States to assess state of ecosystems and their services to reduce losses

Mapping and Assessment of Ecosystems and their Services (MAES) – conference held in Brussels in December 2015
<http://biodiversity.europa.eu/maes>

Conceptual framework for EU wide ecosystem assessment
Links human societies and their well-being with the environment

The diagram illustrates the conceptual framework for EU-wide ecosystem assessment, showing the link between ecosystems and socio-economic systems.

ecosystems (green box):

- Functions** (top): ecosystem services, genetic resources, cultural services, recreational services, regulating services, provisioning services.
- state present and future** (bottom): biodiversity (central purple circle), genetic resources, ecosystem services, cultural services, recreational services, regulating services, provisioning services.

socio-economic systems (pink box):

- Human well-being** (top): economic, social and state; health, safety, security; environment.
- benefits** (middle): economic value, health value, shared social value, culture value.
- values** (bottom): economic value, health value, shared social value, culture value.
- response** (bottom): institutions, businesses, policies, legislation, targets, systems, instruments, ...; capabilities and assets.

Drivers of change (red arrow) point from the socio-economic systems to the ecosystems.

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[illegible]

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Intergovernmental Platform on Biodiversity & Ecosystem Services

Established in April 2012, as an **independent intergovernmental body** open to all member countries of the United Nations. A sister organisation to the IPCC

IPBES aims to become the leading intergovernmental body for **assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide to society.**

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INSIGHTS


Science
AAAS

Díaz et al. 2018
Science VOL 359
pp. 270-272

BIODIVERSITY AND ECOSYSTEMS
Assessing nature's contributions to people
Recognizing culture, and diverse sources of knowledge, can improve assessments.

By Sandra Díaz, Unai Pascual, Marie Stenseke, Berta Martín-López, Robert T. Watson, Zsolt Molnár, Rosemary Hill, Kai M. A. Chan, Ivar A. Baste, Kate A. Brauman, Stephen Polasky, Andrew Church, Mark Lonsdale, Anne Larigauderie, Paul W. Leadley, Alexander P. E. van Oudenhoven, Felice van der Plaats, Matthias Schröter, Sandra Lavorel, Yildiz Aumeeruddy-Thomas, Elena Bukvareva, Kirsten Davies, Sebsebe Demissew, Gunay Erpul, Pierre Failler, Carlos A. Guerra, Chad L. Hewitt, Hans Keune, Sarah Lindley, Yoshihisa Shirayama

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Natural Capital and Natures Contributions to People 

How is Nature's Contribution to People (NCP) different?

1. Recognizes the **central and pervasive role** that **culture** plays in defining all links between people and nature.
2. Use of NCP elevates, emphasizes, and operationalizes the role of **indigenous** and **local knowledge** in understanding nature's contribution to people.

Underpinned by perceptions of territory and ownership,

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Natural Capital and Natures Contributions to People
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NCP describes all contributions, (+ and –), of living nature (diversity of organisms, ecosystems, and their associated ecological and evolutionary processes) to people's quality of life (4).

Beneficial contributions:
food provision, water purification, and artistic inspiration,

Detrimental contributions:
disease transmission and predation that damage people or their assets.

Some **NCP** are benefits or detriments depending on the cultural or socioeconomic **context**

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Natural Capital and Natures Contributions to People
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Context-specific perspective
Generalizing perspective

Local indigenous knowledge systems - does not seek to explicitly validate itself beyond cultural contexts – universally applicable categories not meaningful

18 NCP are distinguished and organized in three broad groups – material, non-material and regulating– of general applicability (represented by the white-line figure overlapping the landscape at the bottom)

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Evolution of Natures Contribution to People.
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MA (2005)
IPBES (2013)
IPBES (2017)

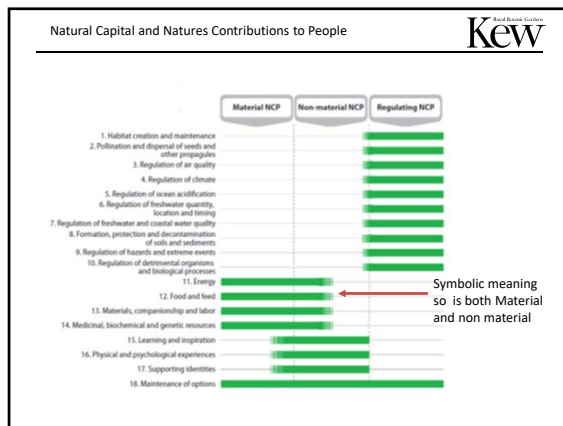
Arrows indicate before and after

No longer exist

Primary focus of Diaz et al., 2018

3 primary components of NCP

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Sustainable Development

Sustainable development, as defined by the World Commission on Environment and Development in 1987, is **development that meets the needs of the present without compromising the ability of future generations to meet theirs**. It embraces two notions:

The concept of **needs**, in particular those of the poor to which overriding priority should be given.

The idea of **limits to the environment's ability to meet present and future needs**.

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What is new and different about the 17 SDGs?

First, and most important, these Goals apply to every nation ... and every sector. Cities, businesses, schools, organizations, *all* are challenged to act.
This is called

Universality

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Second, it is recognized that the Goals are all **inter-connected**, in a system. We cannot aim to achieve just one Goal. We must achieve them all.
This is called

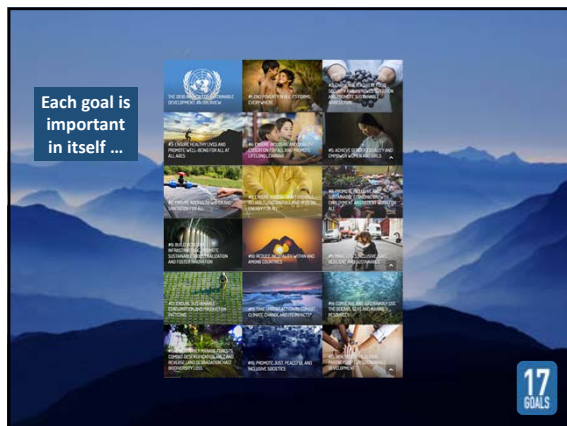
Integration

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And finally, it is widely recognized that achieving these Goals involves making very big, fundamental changes in how we live on Earth.
This is called

Transformation

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SDG are dependent or linked to biodiversity

- G01. End poverty
- G02. End hunger
- G03. Well-being
- G04. Quality education
- G05. Gender equality
- G06. Water & sanitation for all
- G07. Affordable & sustainable energy
- G08. Decent work for all
- G09. Technology to benefit all
- G10. Reduce inequality
- G11. Safe cities & communities
- G12. Responsible consumption by all
- G13. Stop climate change
- G14. Protect the ocean
- G15. Take care of the Earth
- G16. Live in peace
- G17. Partnerships to reach the goals

**Neglected Underutilised Species (NUSs)
and Ecosystems (NUEs)**

- Sustainable income sources from biodiversity
- Food security
 - Better nutrition
 - More sustainable agriculture
- Medicines
- Ecosystem services
- Climate change:
 - Plant resilience
 - Seed banking
 - Ecological Restoration
- IPA for conservation
- Energy from plant sources
- Plants with gender-specific uses
- More knowledge
- More education and professionals

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Suggested reading

Elmqvist et al., TEEB (2010). Ch2: Biodiversity, Ecosystems and Ecosystem Services [NB: the entire The Economics of Ecosystems and Biodiversity Foundation report can be downloaded from www.teebweb.org]

Luck, G.W. et al. (2009). [Quantifying the contribution of organisms to the provision of ecosystem services](#). Bioscience, 59(3): 223-235.

Mace, G.M., Norris, K. & Fitter, A.H. (2012). [Biodiversity and ecosystem services: a multi-layered relationship](#). Trends in Ecology and Evolution 27(1): 19-26.

Hooper et al., (2005) Ecological Monographs
<http://www.esajournals.org/doi/abs/10.1890/04-0922>

<http://www.openness-project.eu/library/reference-book/sp-link-between-biodiversity-and-ecosystem-services>

LINK BETWEEN BIODIVERSITY AND ECOSYSTEM SERVICES

FAO

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Relevant Links / Suggested reading

CBD "Biodiversity for Sustainable Development": <https://www.cbd.int/development/>

CBD "Biodiversity's role": <https://www.cbd.int/development/about/important.shtml>

CBD "Tool Box": <https://www.cbd.int/development/implementation/training.shtml>

TEEB "Ecosystem Services": <http://www.teebweb.org/resources/ecosystem-services/>

TEEB "Useful Links": <http://www.teebweb.org/resources/useful-links/>

OECD "Mainstreaming Biodiversity for Sustainable Development":
<http://www.oecd.org/environment/resources/Policy-Highlights-Mainstreaming-Biodiversity-for-Sustainable-Development.pdf>



Convention on Biological Diversity



The Economics of Ecosystems & Biodiversity



Mainstreaming Biodiversity for Sustainable Development

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