Group On Earth Observation Biodiversity Observation Network

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GEO BON

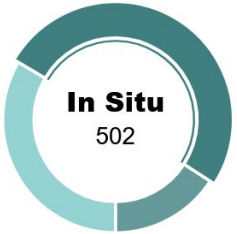
Improve the acquisition, coordination and delivery of biodiversity observations and related services to users including decision makers and the scientific community.

Biodiversity observations for a better future

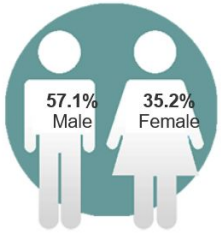
2148	129	1334
MEMBERS	COUNTRIES	INSTITUTIONS

Realm studied

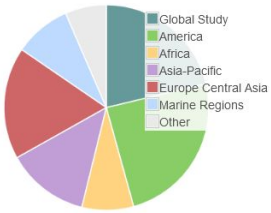
Earth Observation Approach



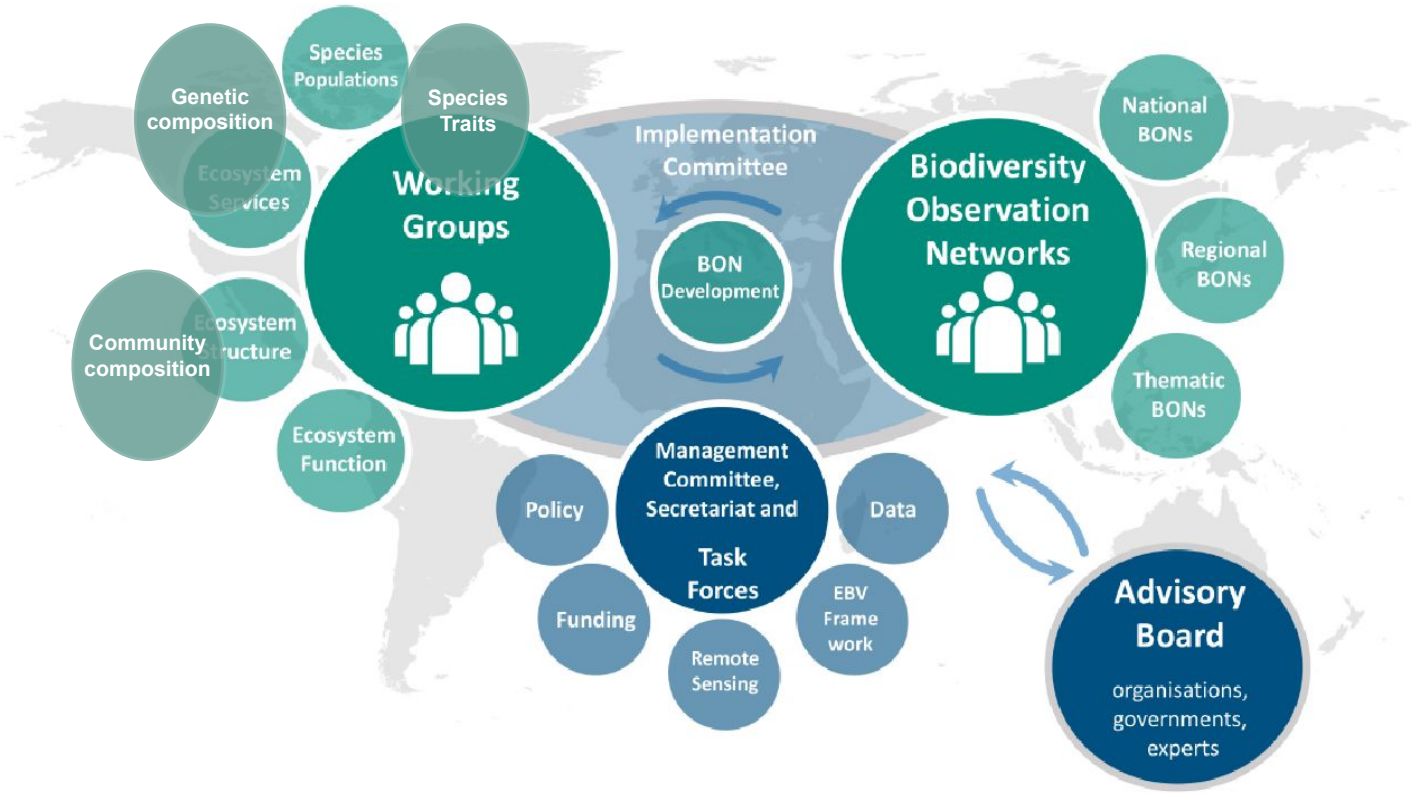
Gender Balance



Geographic zone studied



GEO BON


Genetic composition
Species Populations
Species Traits
Ecosystem Services
Working Groups
Community composition
Ecosystem Structure
Ecosystem Function
Implementation Committee
BON Development
Biodiversity Observation Networks
National BONs
Regional BONs
Thematic BONs
Management Committee, Secretariat and Task Forces
Policy
Funding
Remote Sensing
EBV Frame work
Data
Advisory Board
organisations, governments, experts

Ecosystem Services Working Group

1. To foster the **development of a scalable observation system of ecosystem services** that can operate from sub-national to global levels, that takes into account the socio-ecological systems in which ecosystem services are generated and appropriated
2. To identify the **essential ecosystem service variables** for effective observation of ecosystem services status and trends, including their supply, use, value and contributions to well-being
3. To conduct and facilitate **trend assessments and monitoring of ecosystem services at different spatial scales**, including the exploration trade-offs between ecosystem services and across temporal and spatial scales
4. To work closely with **national, regional and global decision makers** to identify priority exploration, synthesis, and outputs that the WG can deliver
5. To **inform on progress** towards Sustainable Development Targets, and other global and regional environmental policy targets taking into account essential ecosystem service variables
6. To **contribute to important policy-science** processes such as IPBES and to the appropriate conventions

Goals of the webinar

- Introduce the concept of essential ecosystem services variables
- Explore directions for implementation & improvement
- Generate new ideas and tasks for GEO BON working groups and the community

Speakers

Patty Balvanera
Universidad Nacional Autónoma de México

Tuyeni Mwampamba
Universidad Nacional Autónoma de México

Dany Karp
University of California

Anna Cord
Technische Universität Dresden

Valia Drakou
Harokopio University of Athens

Kate Brauman
University of Alabama

Ilse Geijzendorffer
Louis Bolk Instituut

Hosts

Maria Vallejos
University of Buenos Aires

Odirilwe Selomane
Stellenbosch University

Essential Ecosystem Service Variables

GEOBON Ecosystem Services Working Group

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

Current Opinion in Environmental Sustainability

Essential ecosystem service variables for monitoring progress towards sustainability

Patricia Balvanera[1,2], Kate A Brauman[10], Anna F Cord[3,4], Evangelia G Drakou[5], Ilse R Geijzendorffer[6,7], Daniel S Karp[8], Berta Martín-López[9], Tuyeni H Mwampamba[1] and Matthias Schröter[3,9]

CrossMark

Free access until April 2: https://authors.elsevier.com/a/1eZyZ6gsyPm0oj



Origin of GEO BON's Ecosystem Services Working Group

Daniel S. Karp
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http://karp.ucdavis.edu

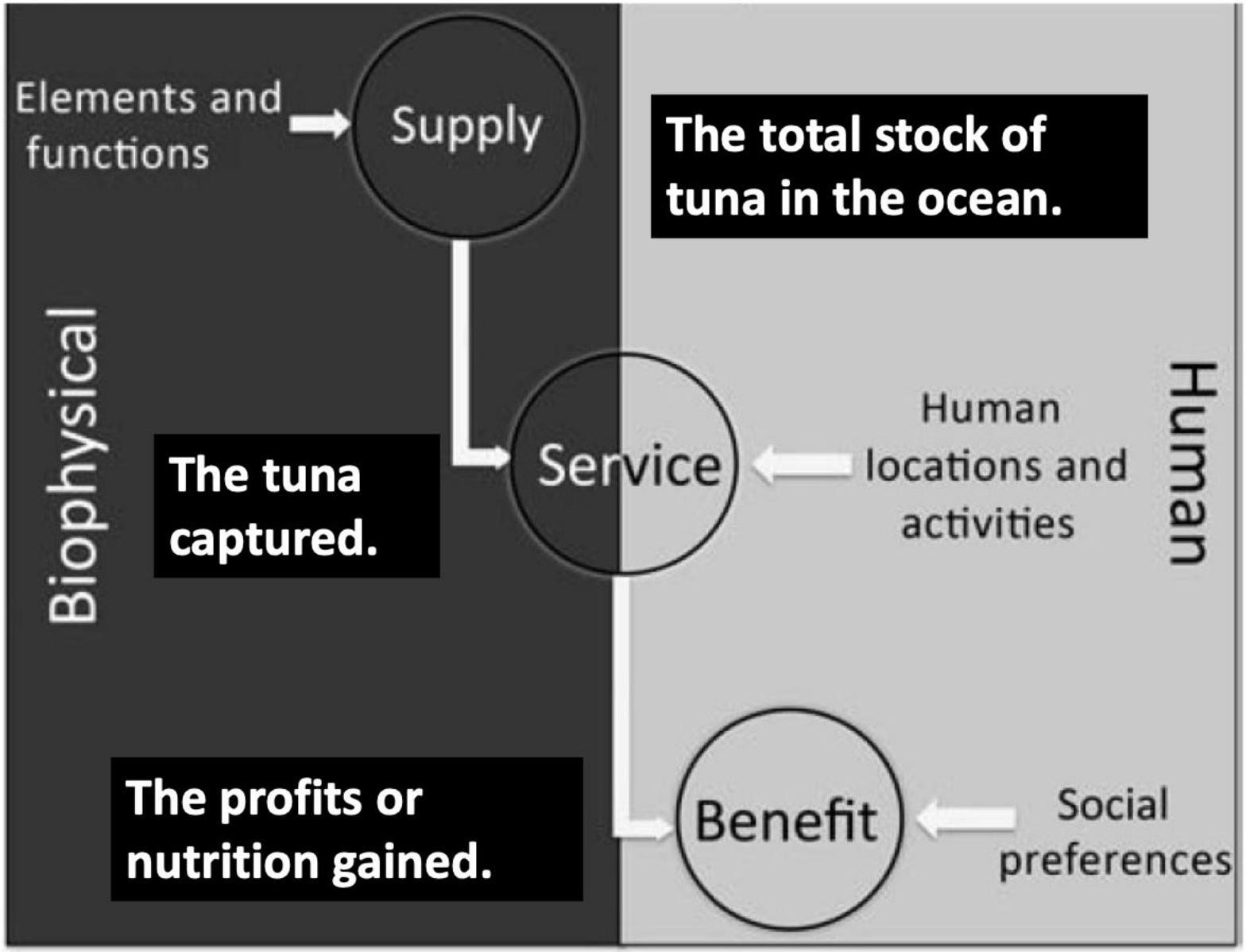

The Initial Vision

- Outlined in Tallis *et al.* (2012) *BioScience.*
- Core goal: Deliver information on the status and trends in ecosystem services, from local to global scales by…
  1. Identifying and compiling existing data sources
  2. Identifying data gaps
  3. Developing new protocols/standards for data collection

A Global System for Monitoring Ecosystem Service Change

HEATHER TALLIS, HAROLD MOONEY, SANDY ANDELMAN, PATRICIA BALVANERA, WOLFGANG CRAMER, DANIEL KARP, STEPHEN POLASKY, BELINDA REYERS, TAYLOR RICKETTS, STEVE RUNNING, KIRSTEN THONICKE, BRITTA TIETJEN, AND ARIANE WALZ

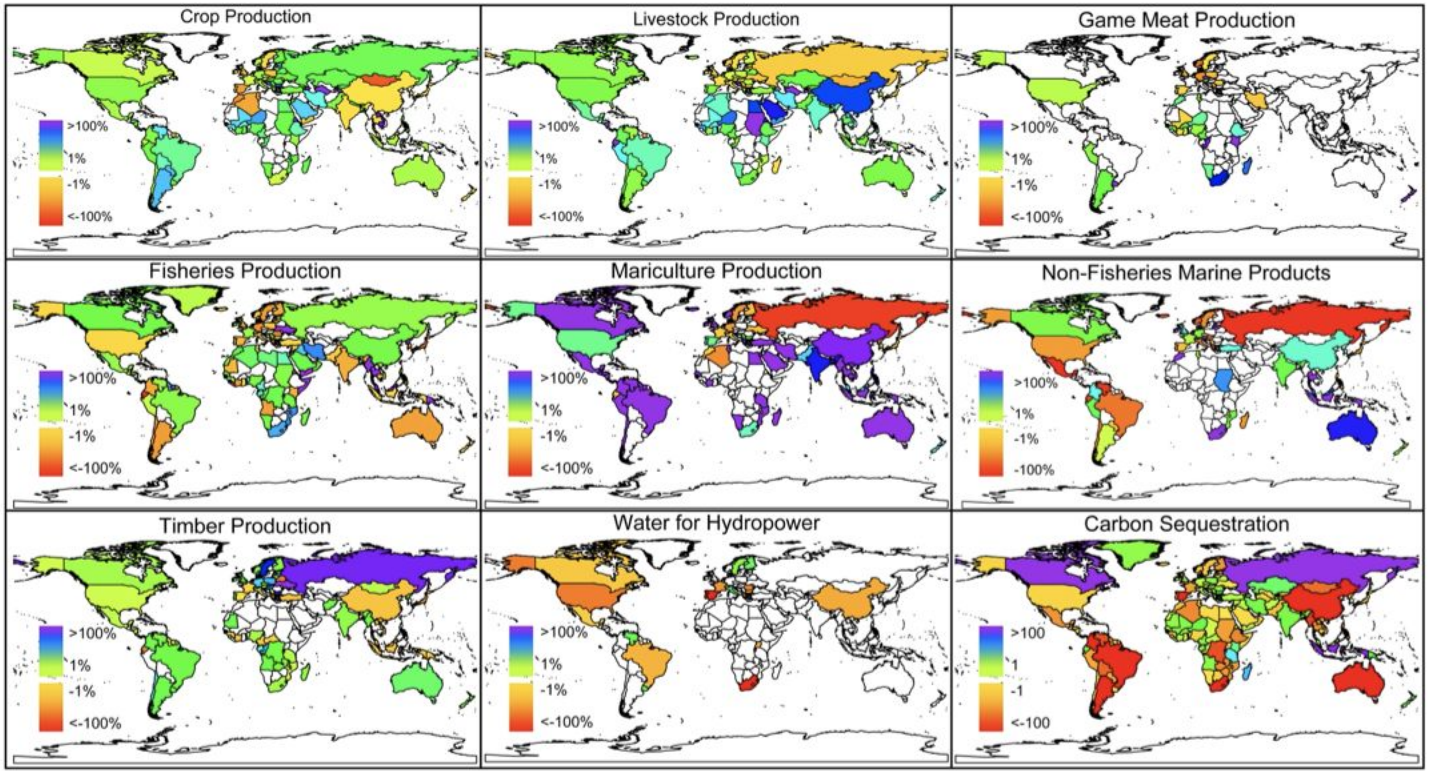
The Ecosystem Service Supply Chain



Tallis et al. (2012). *BioScience* **62**: 977-986.

Identifying Data Streams

	National statistics	Remote sensing		Field estimations		Models						
	FAOSTAT	High resolution	Low resolution	TESSA	Natura	InVEST	LPJmL	ARIES	ESTA	MIMES	Co$ting nature	WaterWorld
Ecosystem service component												
Supply		✓	✓			✓	✓	✓	✓	✓	✓	✓
Delivery	✓			✓	✓	✓		✓		✓	✓	✓
Contribution to well-being				✓	✓					✓	✓	
Value	✓			✓	✓	✓		✓	✓	✓		



Warmer colors represent service declines from 1996-2005, colder colors are increases

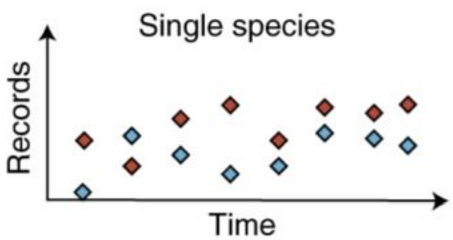
Karp et al. (2015) *Global Environmental Change*.

Balvanera et al. (2017) In: The GEO Handbook on Biodiversity Observation Networks

From Data to 'Essential Variables'

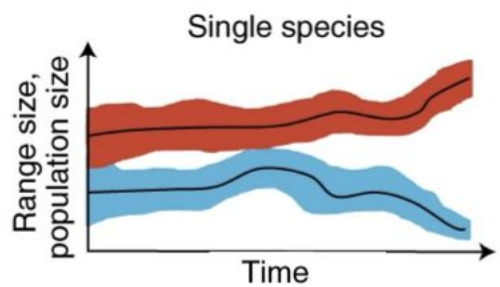
- **Definition:** the minimum data needed to detect *change* (over space or time) in a phenomenon
  - Should be able to operate across spatial/temporal scales
  - In between primary observations and indicators

Primary observations



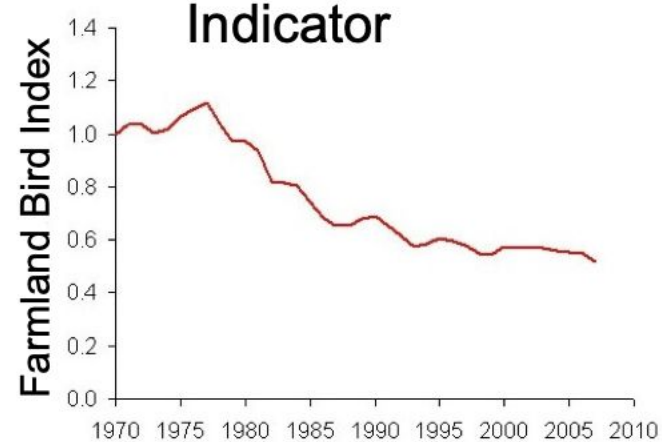
Example: bird occurrences

Essential variable



Example: bird population trends

Indicator

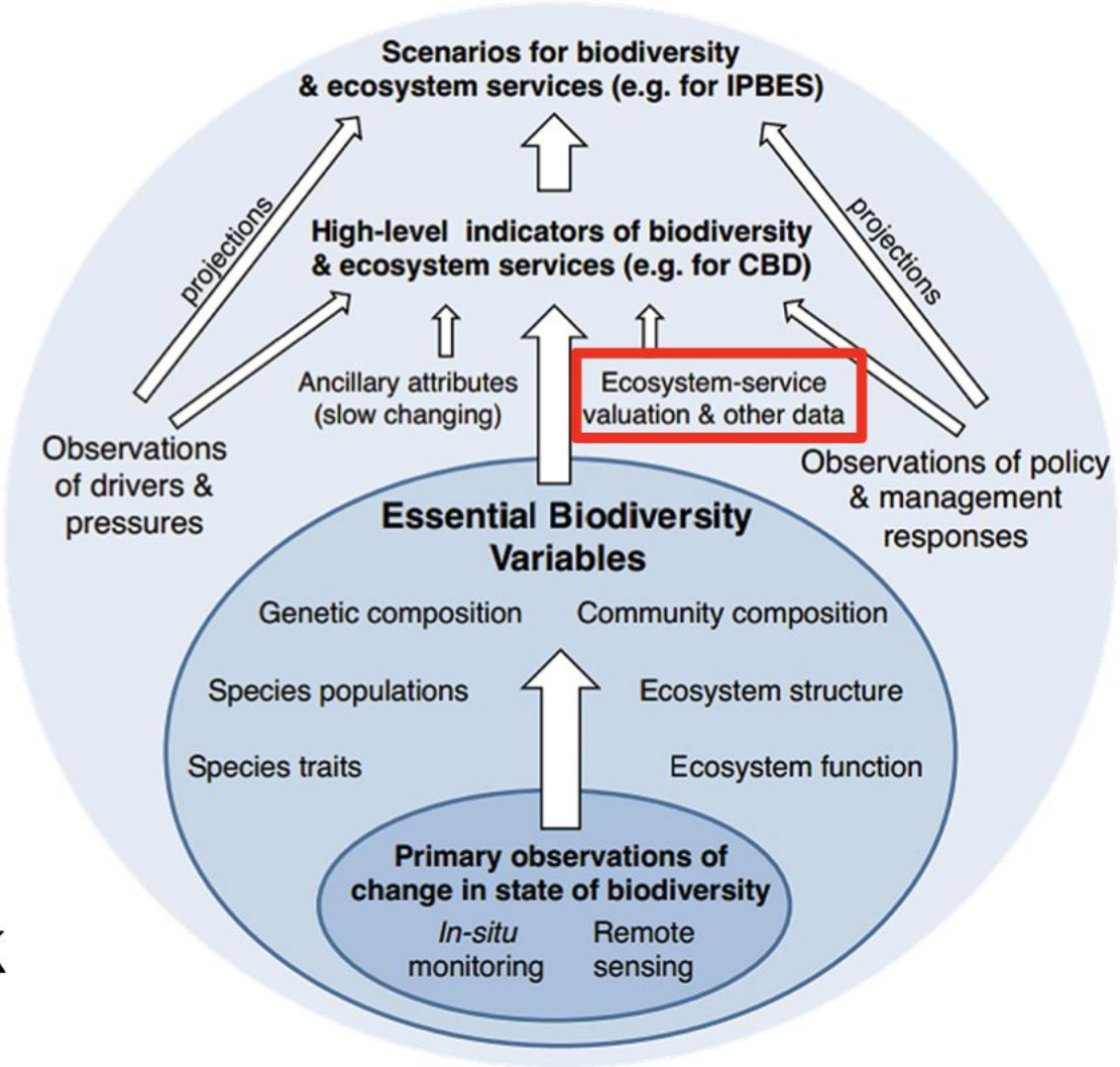


- **Essential biodiversity variables (EBVs)** developed in 2013 to provide a framework for tracking biodiversity change over space and time

Data from: RSPO
Jetz et al (2019) *Nature Ecol. Evol.*
Pereira et al (2013) *Science.*

Ecosystem Services and Essential Biodiversity Variables (EBVs)

- Initial effort to embed ecosystem services within EBVs
- Ultimately, too distinct with unique challenges
- Thus, ecosystem services outside the EBV framework



Pereira *et al.* (2013) *Science.*

Essential variables needed to address the links between people and nature

Ilse Geijzendorffer

EBVs in sustainability policies

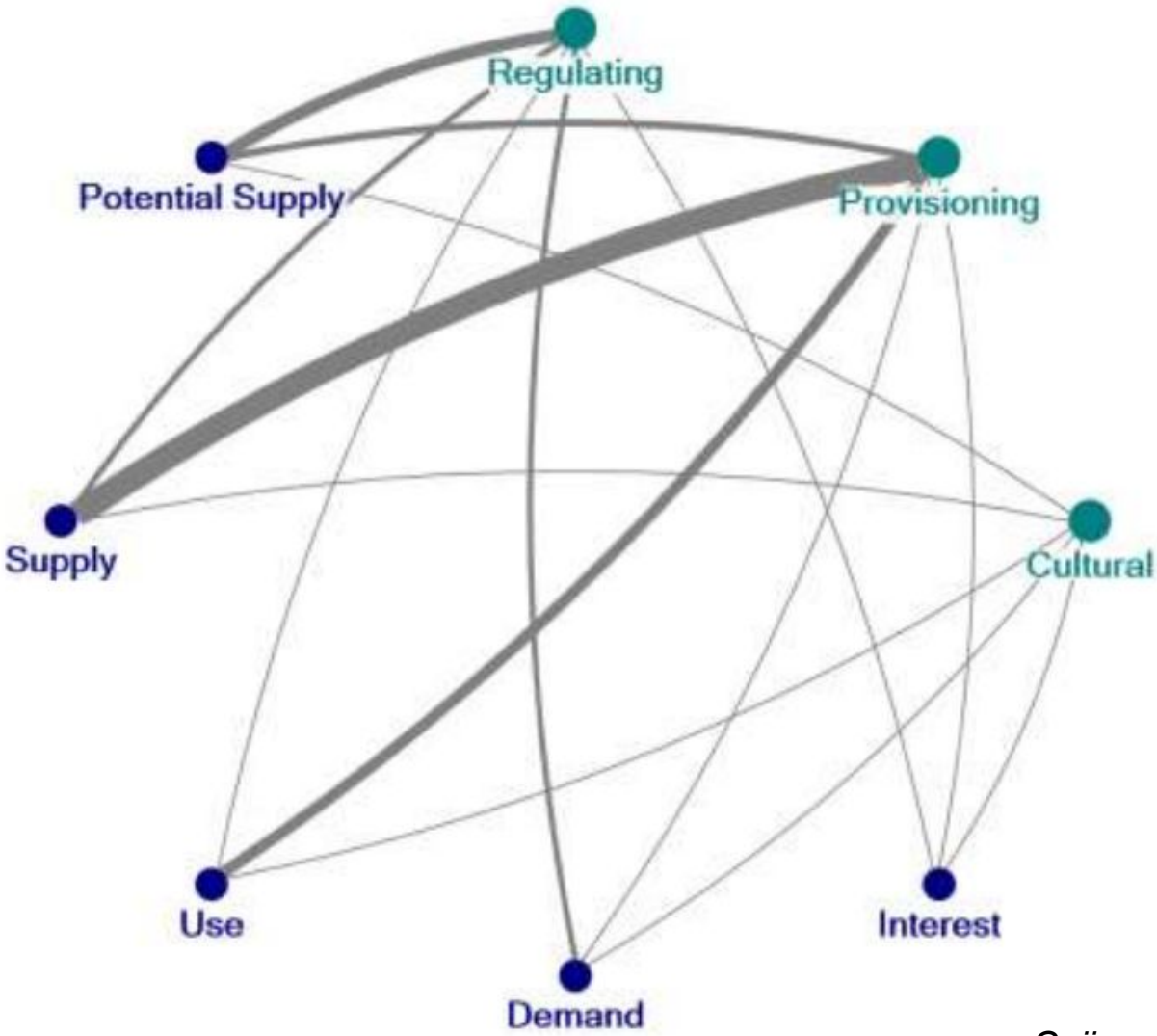
Table 1. Biodiversity information reporting requirements of selected biodiversity policy instruments, expressed as the percentage of EBVs required per EBV class. The EBV classes are: Genetic Composition (GC), Species Populations (SP), Species Traits (ST), Community Composition (CC), Ecosystem Function (EF) and Ecosystem Structure (ES)

Policy instruments*	Geographic scope	EBV classes					
		GC	SP	ST	CC	EF	ES
CBD (CBD 2010)	Global	100%	100%	100%	100%	100%	100%
Ramsar (Ramsar 2012)	Global	50%	100%	100%	100%	100%	100%
CMS (UNEP CMS 2014)	Global	75%	100%	67%	50%	100%	100%
Habitats Directive (EC 2011)	EU	0%	67%	0%	0%	25%	65%
Birds Directive (EEA 2011)	EU	0%	100%	50%	0%	25%	67%
MSFD (EC 2008; 2010)	EU	0%	100%	17%	100%	75%	100%
WFD (EC 2000)	EU	0%	100%	33%	100%	50%	67%

*Policy instrument abbreviations explained: CBD = Convention on Biological Diversity; Ramsar = Ramsar convention on Wetlands; CMS = Convention on the Conservation of Migratory Species of Wild Animals; MSFD = Marine Strategy Framework Directive and WFD = European Water Framework Directive.

Geijzendorffer et al 2015

Use of ES Variables in a selection of national and international reports for policymakers



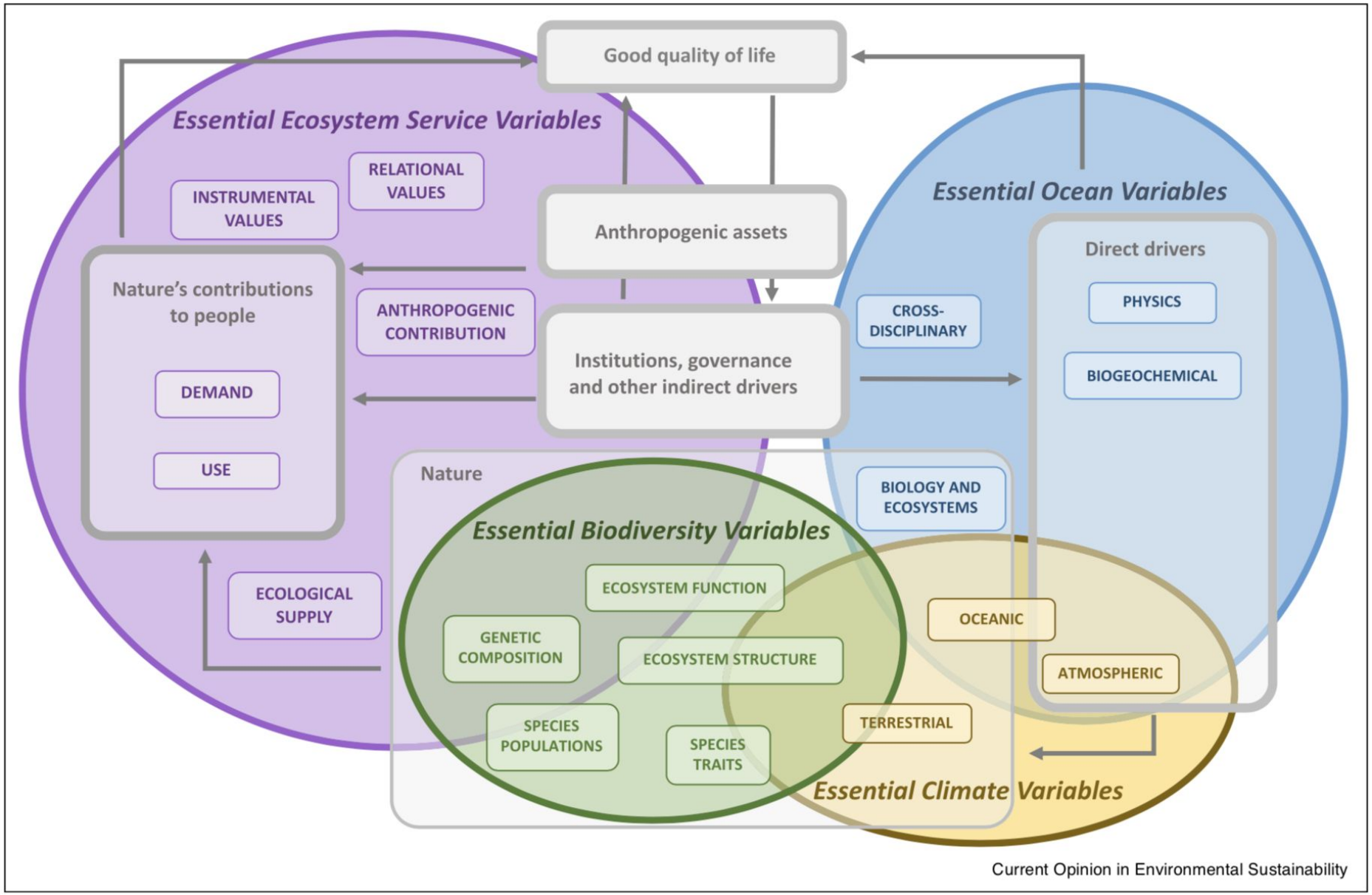
Geijzendorffer et al 2017

EVs for ES

- An EV approach for ES to facilitate progress on two fronts:
    - 1) identify on which aspects of ES data was actually needed for trend analysis at scales of relevance for management and policies,
    - 2) to guide progress on ES research and monitoring by identifying what was missing.

A conceptual frame independent of nomenclature, scale, data types
To be improved or complemented over time

EESV: a new framework based on proven principles



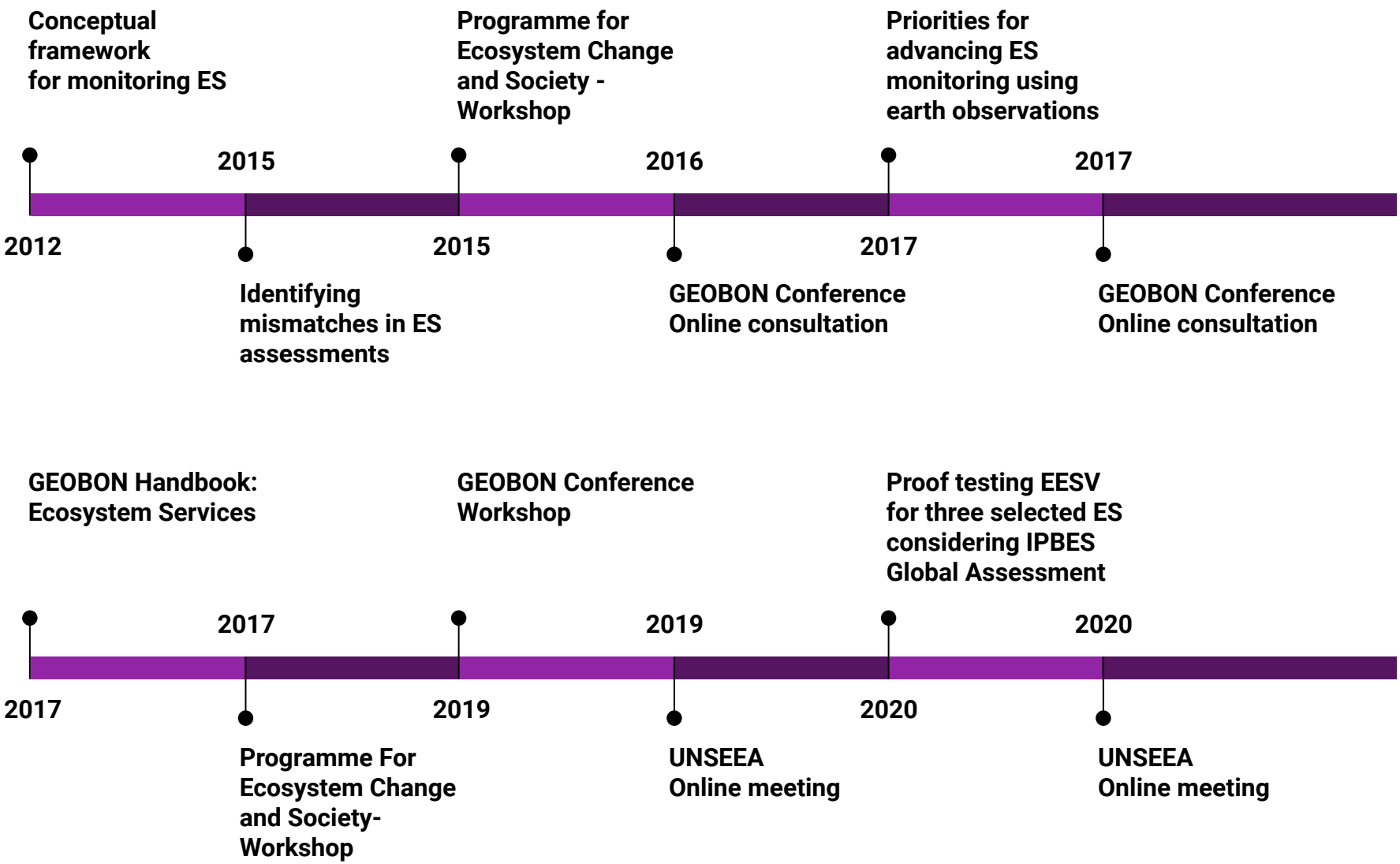
The Essential Ecosystem Service Variables

Patty Balvanera
Instituto de Investigaciones en Ecosistemas y Sustentabilidad
Universidad Nacional Autónoma de México


Cocina colaboratorio


Emilio Hernández

The process


Conceptual framework for monitoring ES
2012
Identifying mismatches in ES assessments
2015
Programme for Ecosystem Change and Society - Workshop
2015
GEOBON Conference Online consultation
2016
Priorities for advancing ES monitoring using earth observations
2017
GEOBON Conference Online consultation
2017
GEOBON Handbook: Ecosystem Services
2017
Programme For Ecosystem Change and Society- Workshop
2019
GEOBON Conference Workshop
2019
UNSEEA Online meeting
2019
Proof testing EESV for three selected ES considering IPBES Global Assessment
2020
UNSEEA Online meeting
2020

What are they?

The minimum set of core **variables** needed to identify key changes in the interactions between nature and society that contribute to human well-being through ecosystem services/nature's contributions to people.

EESV **classes** represent shared and grouped key attributes for all ecosystem services/nature's contributions to people to be monitored across space and time.

Ecological supply

The ecosystem structure and functions that underlie the potential capacity of ecosystems to provide ecosystem services/nature's contributions to people.

Anthropogenic contribution

Efforts that humans invest to enhance ecological supply and to make use of ecosystem services/nature's contributions to people

Demand

Explicitly or implicitly expressed human desire or need for an ecosystem service/nature's contribution to people, in terms of its quantity or quality, irrespective of whether awareness exists about such need.

Use

Active or passive appropriation of an ecosystem service/nature's contribution by people.

Instrumental value

Importance of an ecosystem service/nature's contributions to people to societies or individuals as a means to achieve a specific end (e.g. some dimension of human well-being)

Relational values

Importance ascribed to how ecosystems contribute to desirable and meaningful interactions between humans and nature and between humans in relation to nature.

The EESV classes are strongly interrelated

- Supply must exceed demand if the flow of services is to be sustainable;
- Instrumental value underpins demand;
- Use sits at the intersections between supply, anthropogenic contribution and demand;
- Instrumental and relational values arise from the human-nature interactions that lead to anthropogenic contribution and use.

EESV classes are a first step

They apply to all ecosystem services/nature's contributions, irrespective of their type (e.g. provisioning/material, regulating, cultural/non-material) and the conceptualization issued (e.g. CICES, IPBES)

Operationalizing the EESV for three examplary Ecosystem Services /Nature's Contributions to People & next steps

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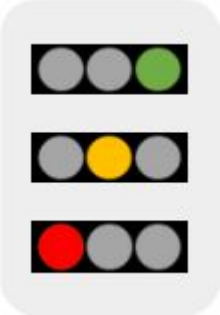
HAROKOPIO UNIVERSITY
GEOGRAPHY DEPARTMENT

EESVs in practice

- Three narratives across varying social-ecological global contexts

- The EESV effort builds on *existing knowledge and indicators* that are tested and available at varying scales & resolutions
- Feasibility assessment based on
  - Available data
  - Matching between data sources and EESVs
  - Spatial-temporal resolution



	Wild food from fisheries	Crop pollination by wild insects	Physical and psychological experiences from wildlife viewing
EESV Class	***Ecological Supply***		
Proposed EESV	Biomass of marine species consumed by humans	Abundance and diversity of wild pollinators	Availability of megafauna-based recreational opportunities
Data Sources	Biomass measurements at national level, per species group (e.g. tuna), per fishery type (e.g. bottom trawl fishery) — From fisheries data (www.seaaroundus.org)	Modeled bee abundances — From land use/land cover maps that reflect spatial variation in nesting and floral resources; proxies available based on habitat suitability and distance to pollination-dependent crops	Distribution and abundance of large mammals — From species range maps (www.iucnredlist.org/resources/spatial-data-download)
Feasibility			
IPBES Indicator	Proportion of fish stocks within biologically sustainable levels (GA)	Suitable habitat for pollinators (GA)	Richness of species used for recreational activities (ECA)

EESV Class	***Anthropogenic contribution***		
Proposed EESV	Extent of physical infrastructure for fishing	Landscape interventions around agricultural fields to promote wild pollinators	Infrastructure to support wildlife viewing
Feasibility			
IPBES Indicator	Estimated fishing effort (GA)	Not yet assessed by IPBES	Not yet assessed by IPBES

	Wild food from fisheries	Crop pollination by wild insects	Physical & psychological experiences from wildlife viewing
EESV Class	*Demand*		
Proposed EESV	Demand for food from fisheries	Extent of pollinator-dependent crop production	Demand for wildlife viewing tourism
Feasibility			
IPBES Indicator	Not yet assessed by IPBES	Types and production volume of food crops reliant on animal pollination (POL)	Not yet assessed by IPBES
EESV Class	*Use*		
Proposed EESV	Fish catches used as a source of food	Crop production attributed to wild pollinators	Wildlife watching experiences
Feasibility			
IPBES Indicator	Total catch globally (GA)	Global deficits in wild pollination (GA)	Visitation rates to natural terrestrial, coastal, and marine areas (GA)
EESV Class	*Instrumental value*		
Proposed EESV	Economic value of food from fisheries	Nutrition contribution from pollinator- dependent crops	Revenues of the wildlife-based tourism sector
Feasibility			
IPBES Indicator	Not yet assessed by IPBES	Nutrition contribution from pollinator-dependent crops (GA)	Economic importance of wildlife-based tourism (AF)
EESV Class	*Relational value*		
Proposed EESV	Practices that reflect responsibility ties to wild food from the Ocean	Cultural and spiritual practices that reflect responsibility ties to wild pollinators	Importance of stewardship, care and responsibility linked to wildlife viewing experiences
Feasibility			
IPBES Indicator	Number of good food safeguarding practices (ECA)	Spiritual and cultural values and practices underpinned by indigenous peoples and local communities (POL)	Level of contribution of recreational experiences (ECA)

Next steps

- **<u>Core challenge</u>**: processes operating at each EESVs class occur at different SCALES and each ES requires different disciplinary expertise.

- THREE PROPOSED ACTION POINTS:
  1. **Interdisciplinary Expert Panels** formed to develop, test & operationalize EESVs
  2. **Collaboration** across ES experts can help reduce number of EESVs to be monitored
  3. Operationalization of a **Global Ecosystem Services Monitoring System** through GEOBON

Monitoring EESV and delivering data products

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Chair of Computational Landscape Ecology
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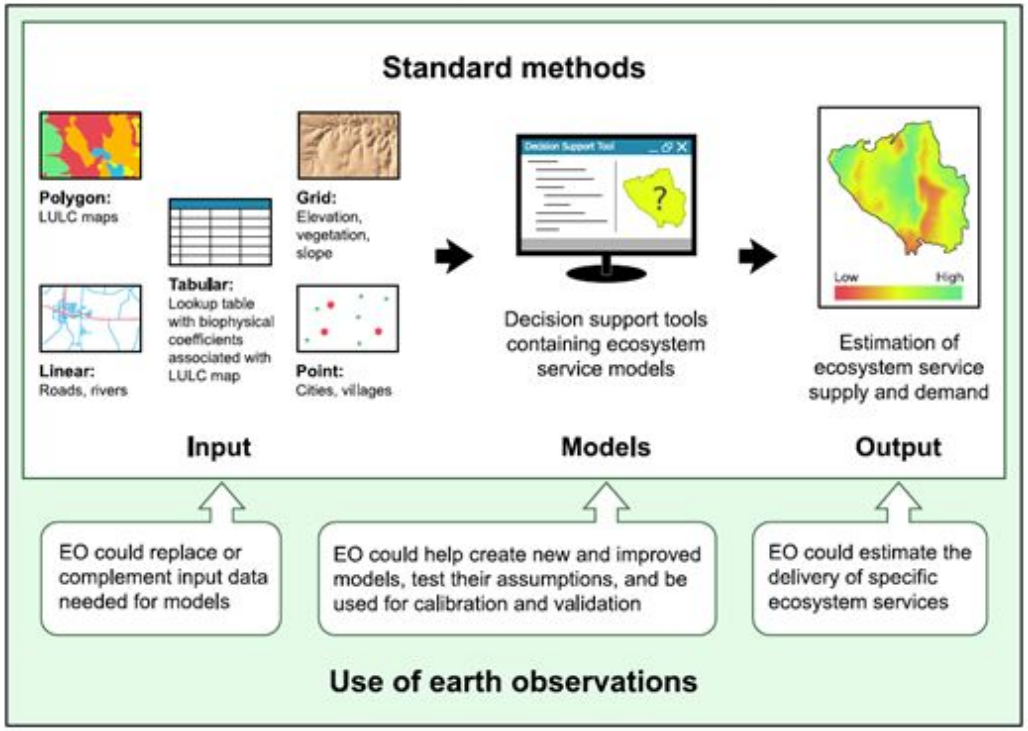
Monitoring EESVs is a major <u>challenge</u> & <u>adventure</u>!

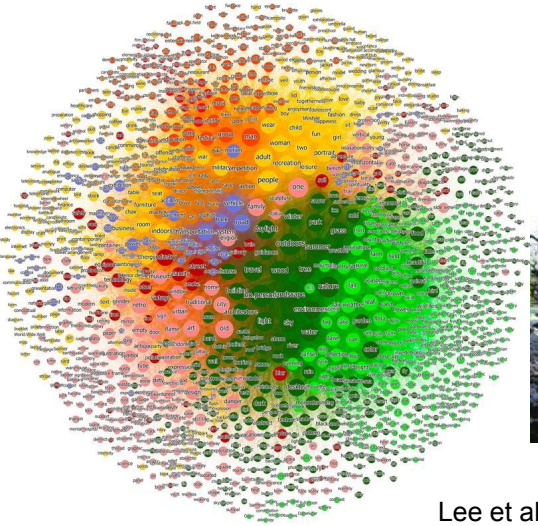
- EESV classes are strongly interrelated → **Full monitoring** of ecosystem service trends requires monitoring (changes in) **<u>all</u> EESVs**
- **"Big data":** Data on trends of nature, society and their interactions generated daily at multiple spatio-temporal resolutions, but (often) not interoperable & not comparable across scales, contexts and types of ecosystem services etc.



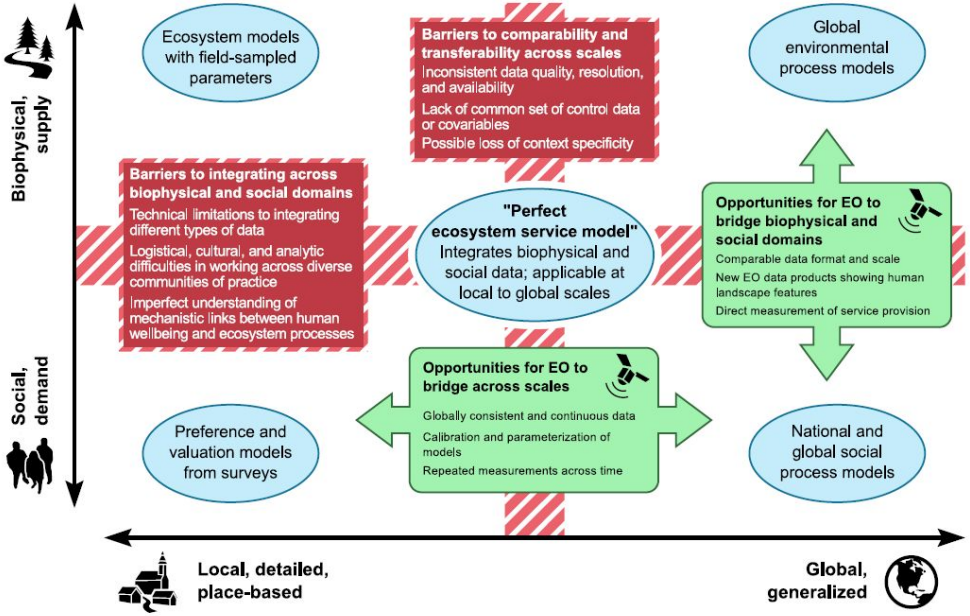
Ramirez-Reyes et al. (2019), *Science of the Total Environment*

Next steps and opportunities

- Systematizing & further developing existing ES monitoring efforts
- Understanding pros/cons & trade-offs of different approaches
- Building on remote sensing-based efforts developed for monitoring EBVs and latest developments in ES research
- Inter- and transdisciplinary approaches & working groups
- Collaboration between data producers and data users, between science and policy



Lee et al. (2019), *Ecological Indicators*

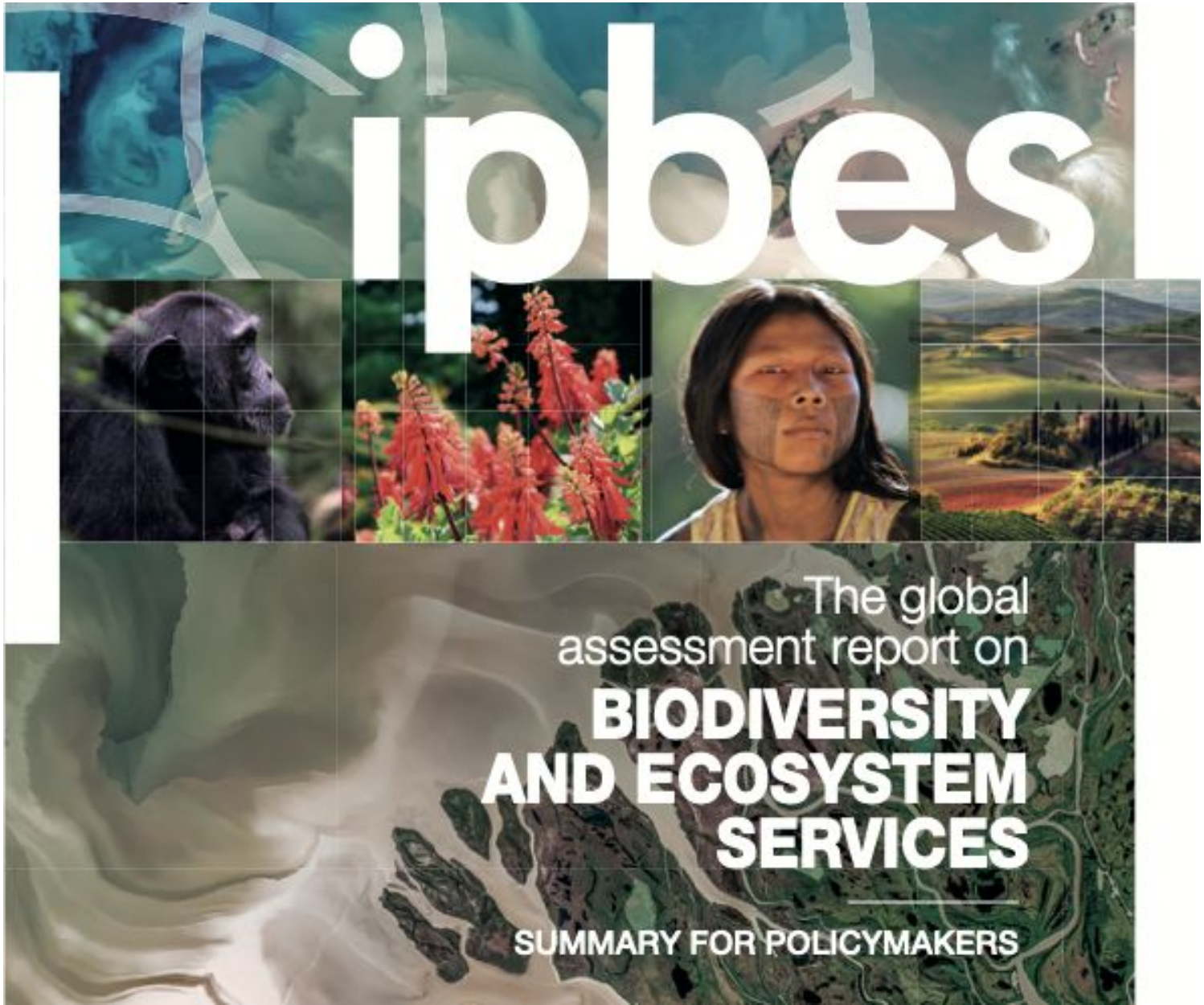


Ramirez-Reyes et al. (2019), *Science of the Total Environment*

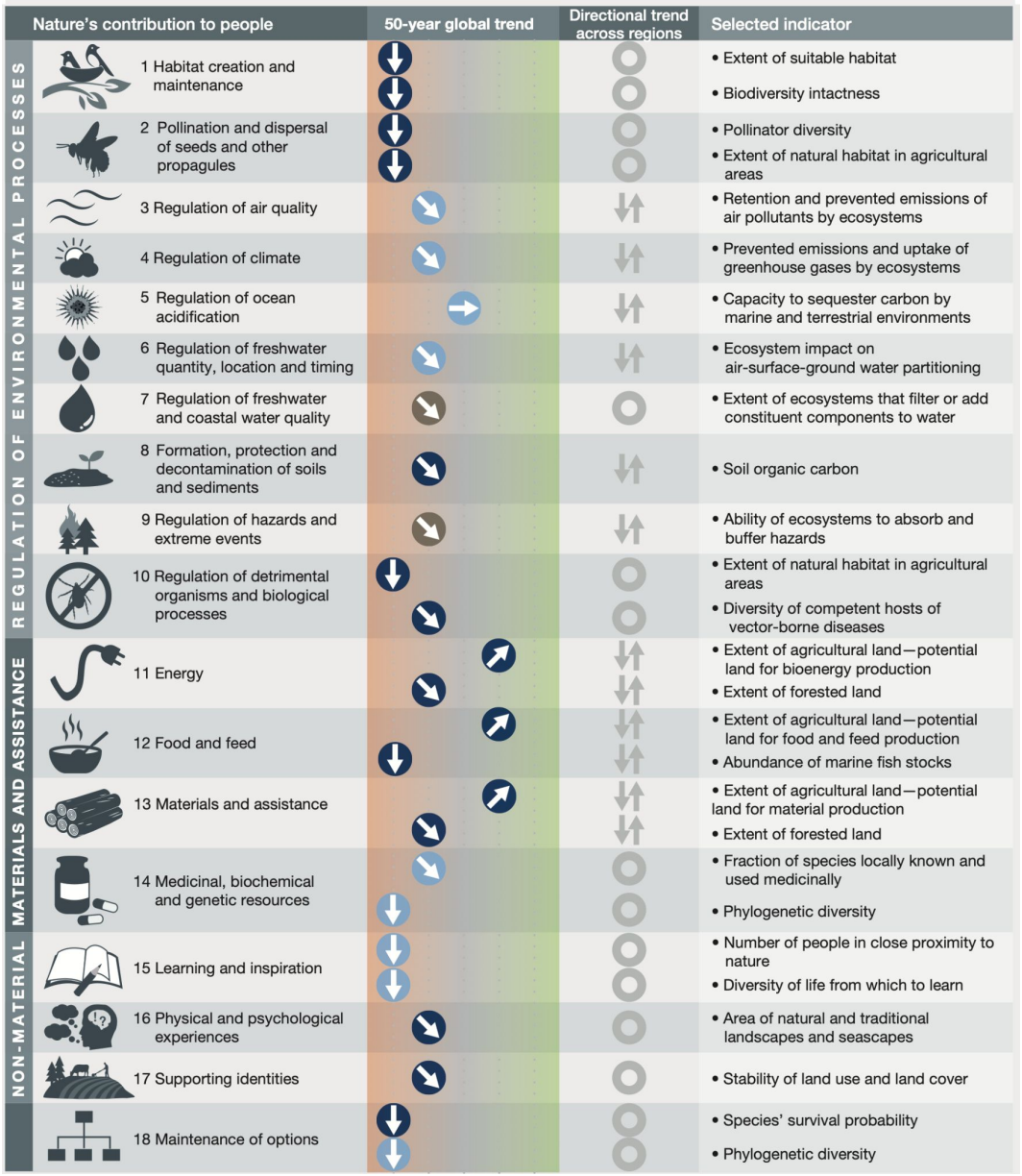
The importance of EESV to support IPBES assessments and the pathways towards achieving the post 2020 CBD vision and the SDGs

Kate Brauman

Monitoring status and trends requires data



ES monitoring has emphasized biophysical supply



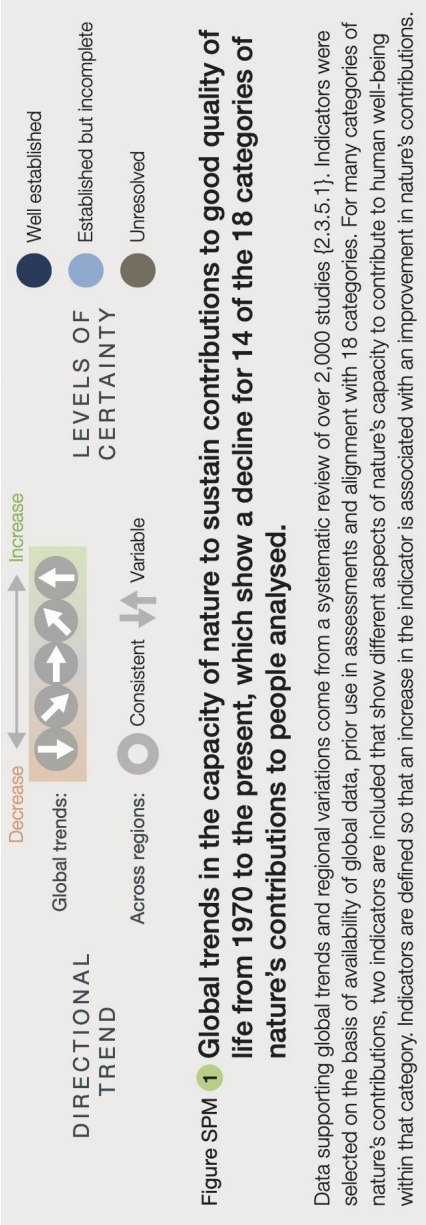


Figure SPM 1 **Global trends in the capacity of nature to sustain contributions to good quality of life from 1970 to the present, which show a decline for 14 of the 18 categories of nature's contributions to people analysed.**

Data supporting global trends and regional variations come from a systematic review of over 2,000 studies {2.3.5.1}. Indicators were selected on the basis of availability of global data, prior use in assessments and alignment with 18 categories. For many categories of nature's contributions, two indicators are included that show different aspects of nature's capacity to contribute to human well-being within that category. Indicators are defined so that an increase in the indicator is associated with an improvement in nature's contributions.

Much less data has been available for integrated assessment

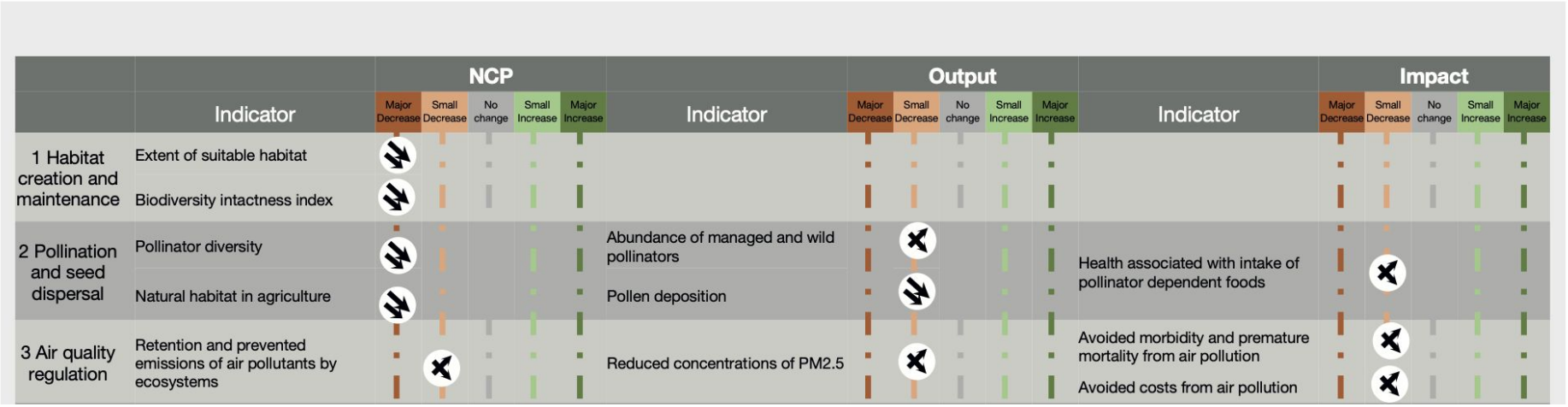


Figure 2 3 3 **Global trends in potential NCP, output, and impact on good quality of life by 18 NCP.**

For each NCP, the overall global trend over the past 50 years (1968-2018) for potential NCP (left panel), output (center panel), and impact on good quality of life (right panel) is indicated by a symbol and its location in columns indicating either major decrease, small decrease, no change, small increase, or major increase. When comprehensive data do not go back 50 years, trends are for a shorter period of time that match the length of data. Indicators are defined so that an increase in the indicator is associated with an improvement in NCP, output, or impact. Indicators related to harm or damage are thus defined as a reductio in harm or damage. Double arrows pointing either up or down indicate increasing or decreasing trends, respectively, across regions that are similar in direction but differ in magnitude. Crossed arrows indicate that trends in different regions show significant differences (e.g., declines in forests in most tropical regions and increases in forests in many temperate region Habitat creation and maintenance (NCP 1) and Maintenance of options (NCP 18) are both defined in terms of contributing to potential NCP and do not relate directly to output or impact on good quality of life.

more details: Brauman et al, PNAS 2020

Progress toward the ES-relevant Aichi Biodiversity Targets has been largely assessed via literature

Goal	Target	Target element (abbreviated)	Progress towards the Aichi Targets		
			Poor	Moderate	Good
D. Enhance benefits to all	14	14.1 Ecosystems providing services restored and safeguarded			
		14.2 Taking account of women, IPLCs, and other groups	Unknown		
	15	15.1 Ecosystem resilience enhanced	Unknown		
		15.2 15 per cent of degraded ecosystems restored	Unknown		
	16	16.1 Nagoya Protocol in force			
		16.2 Nagoya Protocol operational			

Figure SPM 6 **Summary of progress towards the Aichi Targets.**

Scores are based on a quantitative analysis of indicators, a systematic review of the literature, the fifth National Reports to the Convention on Biological Diversity and the information available on countries' stated intentions to implement additional actions by 2020. Progress towards target elements is scored as "Good" (substantial positive trends at a global scale relating to most aspects of the element); "Moderate" (the overall global trend is positive, but insubstantial or insufficient, or there may be substantial positive trends for some aspects of the element, but little or no progress for others; or the trends are positive in some geographic regions, but not in others); "Poor" (little or no progress towards the element or movement away from it; or, despite local, national or case-specific successes and positive trends for some aspects, the overall global trend shows little or negative progress); or "Unknown" (insufficient information to score progress).

ES role in SDGs was assessed via literature as poor/declining, partial, or unknown relationship

Selected Sustainable Development Goals	Selected targets (abbreviated)	Recent status and trends in aspects of nature and nature's contributions to people that support progress towards target *		Uncertain relationship
		Poor/Declining support	Partial support	
1 No poverty	1.1 Eradicate extreme poverty			U
	1.2 Halve the proportion of people in poverty			U
	1.4 Ensure that all have equal rights to economic resources			
	1.5 Build the resilience of the poor			
2 Zero hunger	2.1 End hunger and ensure access to food all year round			
	2.3 Double productivity and incomes of small-scale food producers			
	2.4 Ensure sustainable food production systems			
	2.5 Maintain genetic diversity of cultivated plants and farmed animals			
3 Good health and well-being	3.2 End preventable deaths of newborns and children			U
	3.3 End AIDS, tuberculosis, malaria and neglected tropical diseases			U
	3.4 Reduce premature mortality from non-communicable diseases	Unknown		
	3.9 Reduce deaths and illnesses from pollution	Unknown		
6 Clean water and sanitation	6.3 Improve water quality			
	6.4 Increase water use and ensure sustainable withdrawals			
	6.5 Implement integrated water resource management			
	6.6 Protect and restore water-related ecosystems			
11 Sustainable cities and communities	11.3 Enhance inclusive and sustainable urbanization			
	11.4 Protect and safeguard cultural and natural heritage			
	11.5 Reduce deaths and the number of people affected by disasters			
	11.6 Reduce the adverse environmental impact of cities			
	11.7 Provide universal access to green and public spaces			
13 Climate action	13.1 Strengthen resilience to climate-related hazards			
	13.2 Integrate climate change into policies, strategies and planning			
	13.3 Improve education and capacity on mitigation and adaptation	Unknown		
	13a Mobilize US$100 billion/year for mitigation by developing countries	Unknown		
	13b Raise capacity for climate change planning and management	Unknown		
14 Life below water	14.1 Prevent and reduce marine pollution			
	14.2 Sustainably manage and protect marine and coastal ecosystems			
	14.3 Minimize and address ocean acidification			
	14.4 Regulate harvesting and end overfishing			
	14.5 Conserve at least 10 per cent of coastal and marine areas			
	14.6 Prohibit subsidies contributing to overfishing			
	14.7 Increase economic benefits from sustainable use of marine resources			
15 Life on land	15.1 Ensure conservation of terrestrial and freshwater ecosystems			
	15.2 Sustainably manage and restore degraded forests and halt deforestation			
	15.3 Combat desertification and restore degraded land			
	15.4 Conserve mountain ecosystems			
	15.5 Reduce degradation of natural habitats and prevent extinctions			
	15.6 Promote fair sharing of benefits from use of genetic resources			
	15.7 End poaching and trafficking			
	15.8 Prevent introduction and reduce impact of invasive alien species			
	15.9 Integrate biodiversity values into planning and poverty reduction			
	15a Increase financial resources to conserve and sustainably use biodiversity			
	15b Mobilize resources for sustainable forest management			

Figure SPM 7 **Summary of recent status and trends in aspects of nature and nature's contributions to people that support progress towards achieving selected targets of the Sustainable Development Goals.**

The targets selected are those where the current evidence and wording of the target make it possible to assess the consequences of the trends in nature and nature's contribution to people as they relate to the achievement of the target. Chapter 3, Section 3.3 provides

Consistent ES monitoring will improve understanding of processes and outcomes

Convention on Biological Diversity

PRESS RELEASE

Part one of UN Biodiversity Conference closes, sets stage for adoption of post-2020 global biodiversity framework at resumption in 2022

Your thoughts and questions:

- How do you want to implement this?
- How do you want to extent this?
- What needs to be done?

You are welcome to join the Ecosystem Servies Working Group.

Write us!

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