

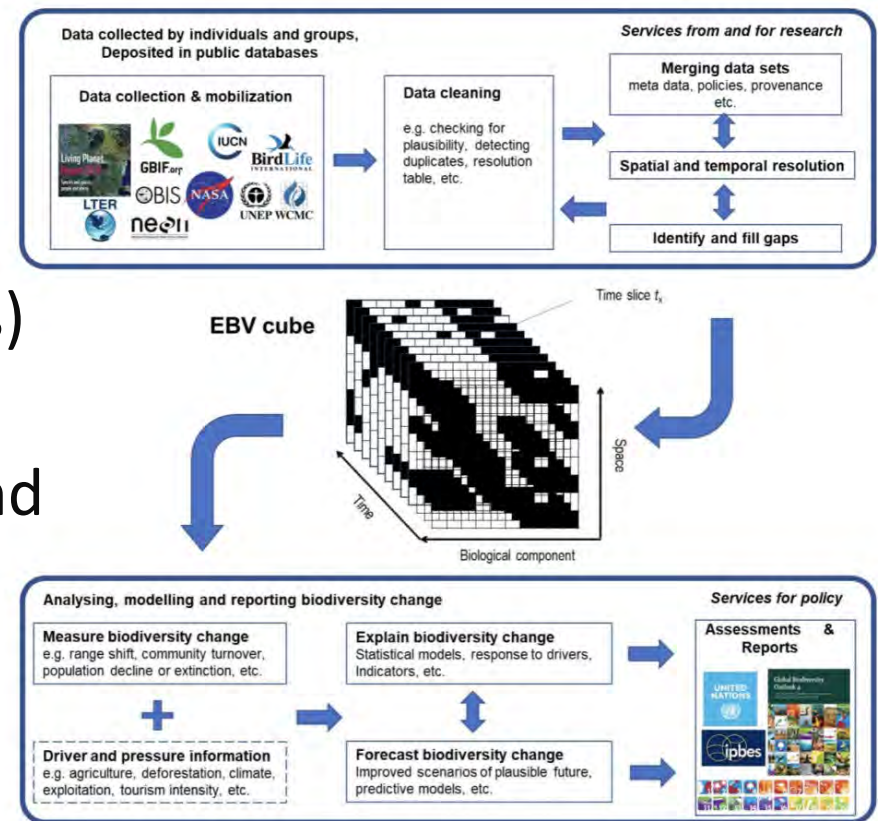
[Session 5] Brainstorming session:

Asia-Pacific perspectives on EBV and indicators

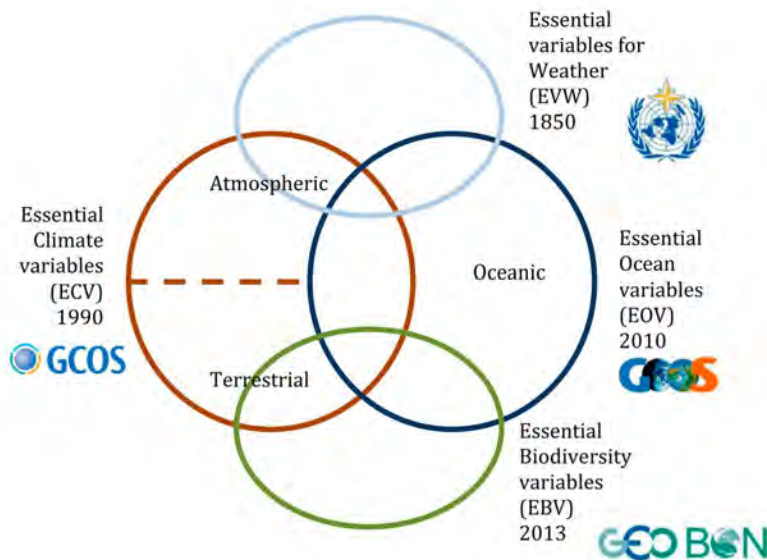
Yayoi Takeuchi & Lea Vegh (National Institute for Environmental Studies)

Goal of the Session

- Explore the utilization and feasibility of Essential Biodiversity Variables (EBVs) and existing indicators.
- Explore how to link EBVs and indicators to biodiversity policy and agendas in the Asia-Pacific (AP) region.

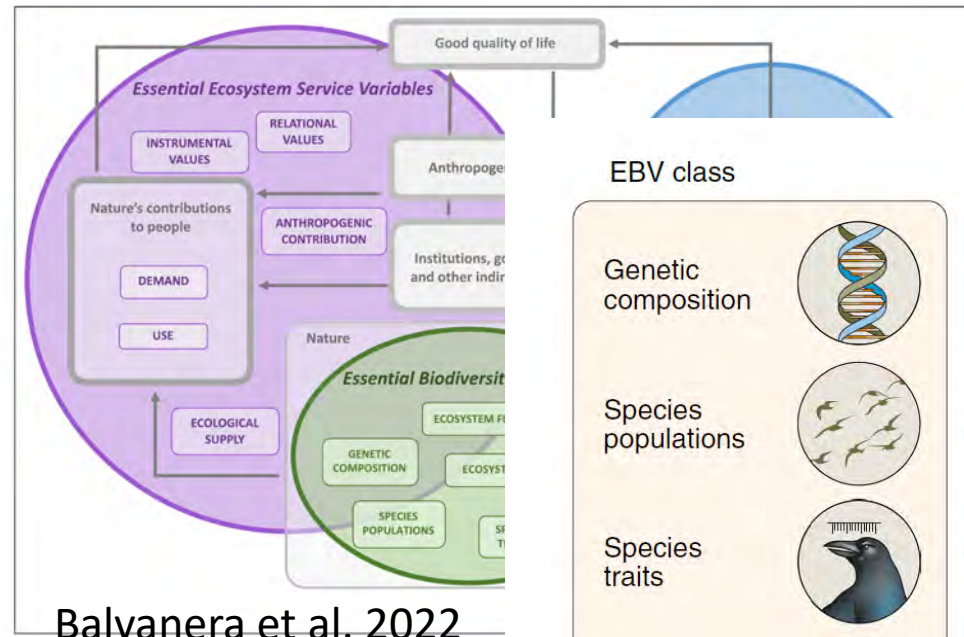


Essential Biodiversity Variables

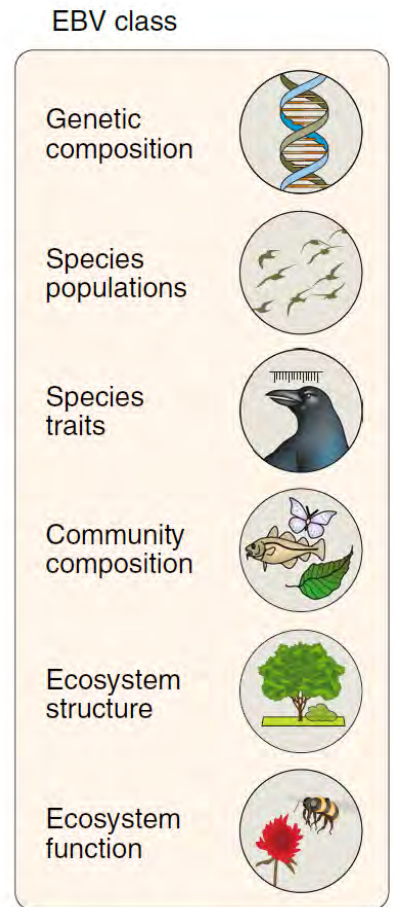


Masō et al. 2020

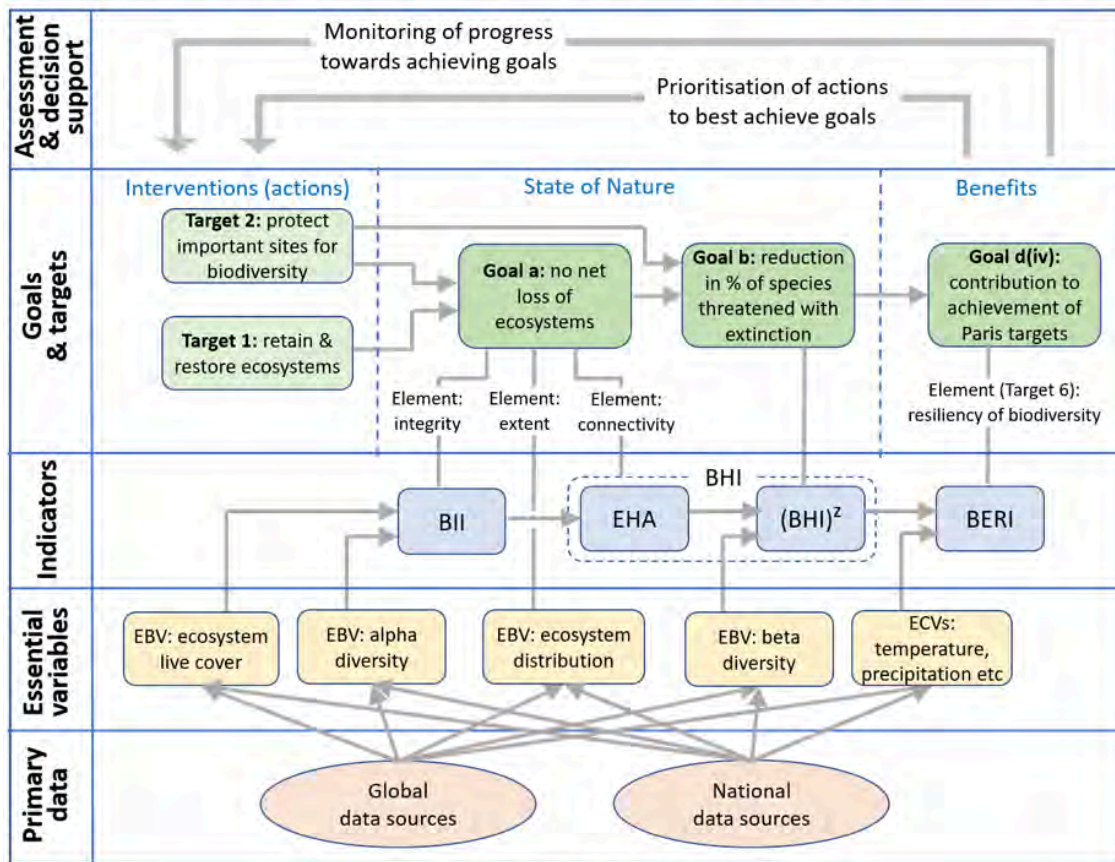
- Essential Climate Variables
- **Essential Ocean Variables** (IOC, 2011)
- **Essential Biodiversity Variables** (Pereira et al. 2013; Navarro et al. 2017)
- **Essential Ecosystem Service Variables** (EESVs): defined as a type of EBV to support the monitoring of ecosystem services (Balvanera et al. 2022).



Balvanera et al. 2022



GEO BON's EBV-based indicators enable:



*Example based on CSIRO & PREDICTS
Global Biodiversity Change Indicators*

***Indicators:** BII – Biodiversity Intactness Index, EHA – Effective Habitat Area
BHI - Biodiversity Habitat Index, BERI – Bioclimatic Ecosystem Resilience Index

- EBVs, Indicators to contribute to the Global biodiversity framework and NBSAP

Are EBVs and indicators sufficient for evaluating our biodiversity issues especially in AP region?

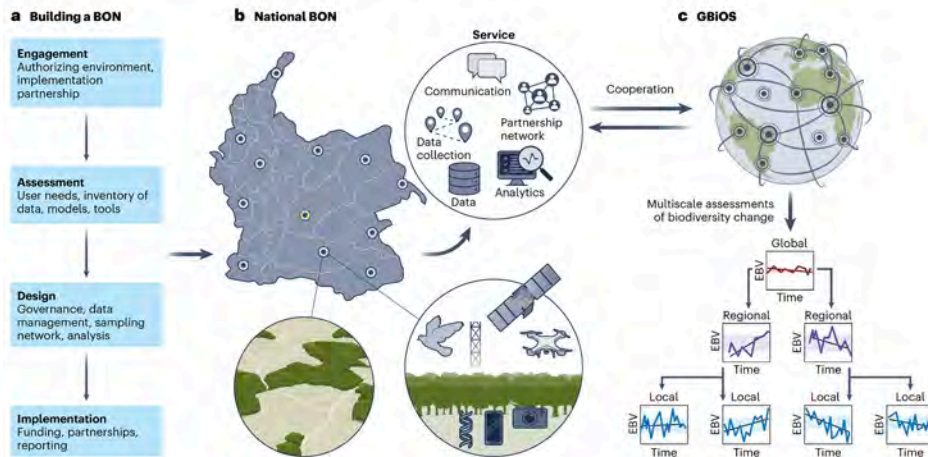
EBVs on a National Scale

GBIOS, Gonzalez et al. 2023

Comment

A global biodiversity observing system to unite monitoring and guide action

Andrew Gonzalez, Petteri Vihervaara, Patricia Balvanera, Amanda E. Bates, Elisa Bayraktarov, Peter J. Bellingham, Andreas Bruder, Jillian Campbell, Michael D. Catchen, Jeannine Cavender-Bares, Jonathan Chase, Nicholas Coops, Mark J. Costello, Maria Dornelas, Grégoire Dubois, Emmett J. Duffy, Hilde Eggemont, Nestor Fernandez, Simon Ferrier, Gary N. Geller, Michael Gill, Dominique Gravel, Carlos A. Guerra, Robert Guralnick, Michael Harfoot, Tim Hirsch, Sean Hoban,



Lack of case studies in the AP region



Original research article

How Essential Biodiversity Variables and remote sensing can help national biodiversity monitoring

Petteri Vihervaara*, Ari-Pekka Auvinen, Laura Mononen, Markus Törmä, Petri Ahlroth, Saku Anttila, Kristin Böttcher, Martin Forsius, Jani Heino, Janne Heliölä, Meri Koskelainen, Mikko Kuussaari, Kristian Meissner, Olli Ojala, Seppo Tuominen, Markku Viitasalo, Raimo Virkkala

Finnish Environment Institute, Meilahdenkatu 34a, P.O.Box 140, FI-00251 Helsinki, Finland

Table 1


Links between Finnish Biodiversity Indicators and Essential Biodiversity Variables. Abbreviations: Reptiles (RT), Mammals (MM), Birds (BS), Inland waters (IW), Freshwaters (FW), Alpine habitats (AL), Urban habitats (UH), Shores (SH), Rocky and other habitats (RH), and Climate change (CC). Indicators with names in blue on the left column are under preparation. EBV sub-classes marked in red are additions suggested by the authors. An asterisk (*) refers to a monitoring scheme at risk of being discontinued. Question mark (?) refers to some uncertainty in the correspondence of the biodiversity indicator and EBV.

		Essential Biodiversity Variables											
		Genetic composition	Species populations	Species traits	Community composition	Ecosystem structure	Ecosystem function	Ecological processes	Ecological interactions	Ecological services	Ecological resilience	Ecological integrity	Ecological sustainability
Primary purpose													
Secondary purpose or proxy													
Could be used as a proxy (higher uncertainty)													
Finland Biodiversity Indicators													
FD: Bird-wild													
FD: Forest													
FD: Forest age													
FD: Forest structure													
FD: Tree species composition													
FD: Forest birds													
FD: Forest insects													
FD: Forest vegetation													
FD: Forest water													
FD: Forest-wild on													

UK, Boyd et al. 2023

BIOLOGICAL
REVIEWS

Cambridge
Philosophical Society

Original Article  Open Access  

An operational workflow for producing periodic estimates of species occupancy at national scales

Robin J. Boyd , Thomas A. August, Robert Cooke, Mark Logie, Francesca Mancini, Gary D. Powney, David B. Roy, Katharine Turvey, Nick J. B. Isaac

First published: 16 April 2023 | <https://doi.org/10.1111/brv.12961>

SECTIONS

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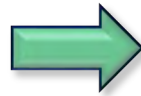
ABSTRACT

Policy makers require high-level summaries of biodiversity change. However, deriving

Relationship between existing indicators and EBVs [Lea]

EBVs and indicators

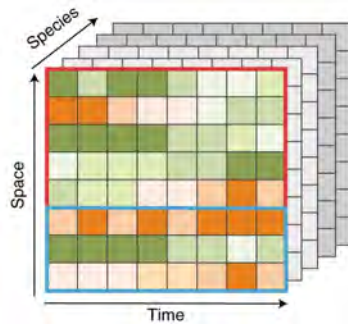
Essential Biodiversity Variables



Biodiversity Indicators

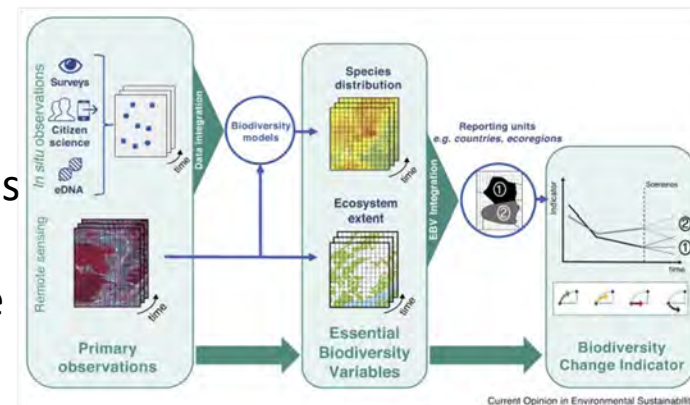


Track progress to meet KM-GBF Goals and targets



Jetz et al. 2019

- Scientifically solid
- Responsive to changes
- Easily understandable



Navarro et al. 2017

What indicators to use?

Biodiversity Indicator Partnership

<https://www.bipindicators.net/>

The Biodiversity Indicators Partnership

The Biodiversity Indicators Partnership (BIP) is a global initiative to promote the development, delivery, and use of biodiversity indicators.

Its primary role is to delivering indicators to monitor progress toward global and national goals and targets, such as those established under the Convention on Biological Diversity, and the Convention on Migratory Species and Ramsar, among others. The BIP also supports indicators used in IPBES Assessment reports and for reporting progress towards Sustainable Development Goals. Indicators supported by the BIP are also used by national and regional government.

Join our BIP Partners meeting scheduled for 6-8 March 2024 in Cambridge, UK and online.

Area of forest under sustainable management: total FSC and PEFC forest management certification

The "forest certification" indicator measures the area certified as responsibly managed forests, including natural or semi-natural forests that are used to produce timber and non-timber forest products, and forest plantations. An increase in the area of PEFC and FSC certified forest represents an increase in the area for which evidence of sustainable forest management is available in terms of forest managed responsibly with respect to biodiversity conservation, including the protection of critical ecosystems, in addition to promoting the social, economic, cultural and ethical dimensions of sustainable forest management.

[View Full Indicator](#) →

Bioclimatic Ecosystem Resilience Index (BERI)

The Bioclimatic Ecosystem Resilience Index (BERI) addresses just one of many possible dimensions of ecosystem resilience, by focusing on the capacity of ecosystems to retain biological diversity in the face of ongoing, and uncertain, climate change. It therefore contributes to assessing an important element of Target 15 - i.e. to enhance "ecosystem resilience ... through conservation and restoration". The approach uses existing global modelling of spatial turnover in species composition within three broad biological groups (plants, invertebrates and vertebrates) to scale projected changes in composition under a plausible range of climate scenarios. These projections serve as filters through which to analyse the configuration of habitat observed for a particular year (past to present) - represented as a grid in which cells have been scored in terms of habitat condition. The BERI is then calculated, for each cell in this grid, as a function of the connectedness of that cell to areas of natural habitat in the surrounding landscape which are projected to support a similar composition of species under climate change to that currently associated with the focal cell. Results can then be aggregated to report on status and trends for any desired set of reporting units - e.g. ecoregions, countries, or ecosystem types.

[View Full Indicator](#) →

Biodiversity Barometer

The Union for Ethical BioTrade (UEBT) published its first Biodiversity Barometer in 2009, as a tool to gauge global consumer awareness and understanding of biodiversity. The biodiversity barometer is recognized by businesses as a valuable source of information. It is also used to track global biodiversity awareness targets that the CBD has set for 2020.

The Biodiversity Barometer indicator measures the level of public awareness of biodiversity in 14 case countries, and relates to Aichi Target 1.

GEO BON

<https://geobon.org/ebvs/indicators/>

GEO BON

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Global Biodiversity Change Indicators

Model-based integration of remote sensing data that enables dynamic updates

Towards a new generation of biodiversity indicators

BHI	Biodiversity Habitat Index
GDI	Genetic Diversity Indicator - Proportion of populations with Ne > 500
GERI	Global Ecosystem Restoration Index
LBII	Local Biodiversity Intactness Index
PARC	Protected Area Representatives & Connectedness Indices
RIASI	Rate of Invasive Alien Species Spread Indicator
SHI	Species Habitat Index
SPI	Species Protection Index
SSII	Species Status Information Index

What indicators to use?

UN-WCMC

([World Conservation Monitoring Centre](https://www.post-2020indicators.org/))

<https://www.post-2020indicators.org/>

UN WCMC
environment
programme

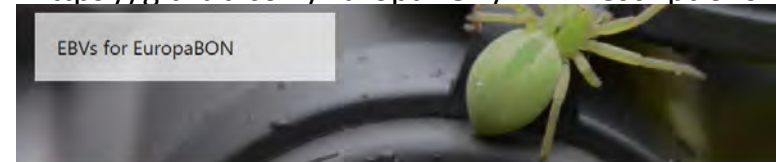
Indicators for the Kunming – Montreal Global Biodiversity Framework

Parties to the Convention on Biological Diversity adopted the Kunming-Montreal biodiversity package of decisions at the UN Biodiversity Conference (December 2022). These included the Kunming-Montreal Global Biodiversity Framework which aims to catalyse, enable and galvanize urgent and transformative action to halt and reverse biodiversity loss, to achieve

Goal/target	Indicator name	Availability	Time series	Update frequency	Other MEAs/Processes	Metadata Factsheet
Goal A	A.1 Red List of Ecosystems*	Available	2014 - 2025	5 years		See metadata
Goal A	A.2 Extent of natural ecosystems*	In development	1992 - Present	In development		See metadata
Goal A	A.3 Red List Index	Available	1980 - 2023	Yearly	IPBES, CMS, SDG, UNCCD, SPMS, AEW, ACAP, Raptors MOU, CITES	See metadata
Goal A	A.4 The proportion of populations within species with an effective population size > 500*	Available	1990-2010	Every 4 years	N	See metadata
Goal B	B.1 Services provided by ecosystems*	In development	Data pending	In development	Data pending	See metadata

EuropaBON

<https://github.com/EuropaBON/EBV-Descriptions>



We thank you for your

We are pleased to inform you of our successful navigation through the comprehensive public review process initiated earlier this year for the [EuropaBON EBV list](#). In light of the meticulous scrutiny the list underwent, encompassing more than **170 comments**, we extend our sincere appreciation to members for their dedicated efforts and constructive contributions.

This process culminated in a refined EuropaBON EBV list, now available on [GitHub](#). The collaborative spirit exhibited by the EuropaBON community has not only facilitated the thorough addressing of all comments, but has also underscored the significance of collective

Product Solutions Open Source Pricing

EuropaBON / EBV-Descriptions Public

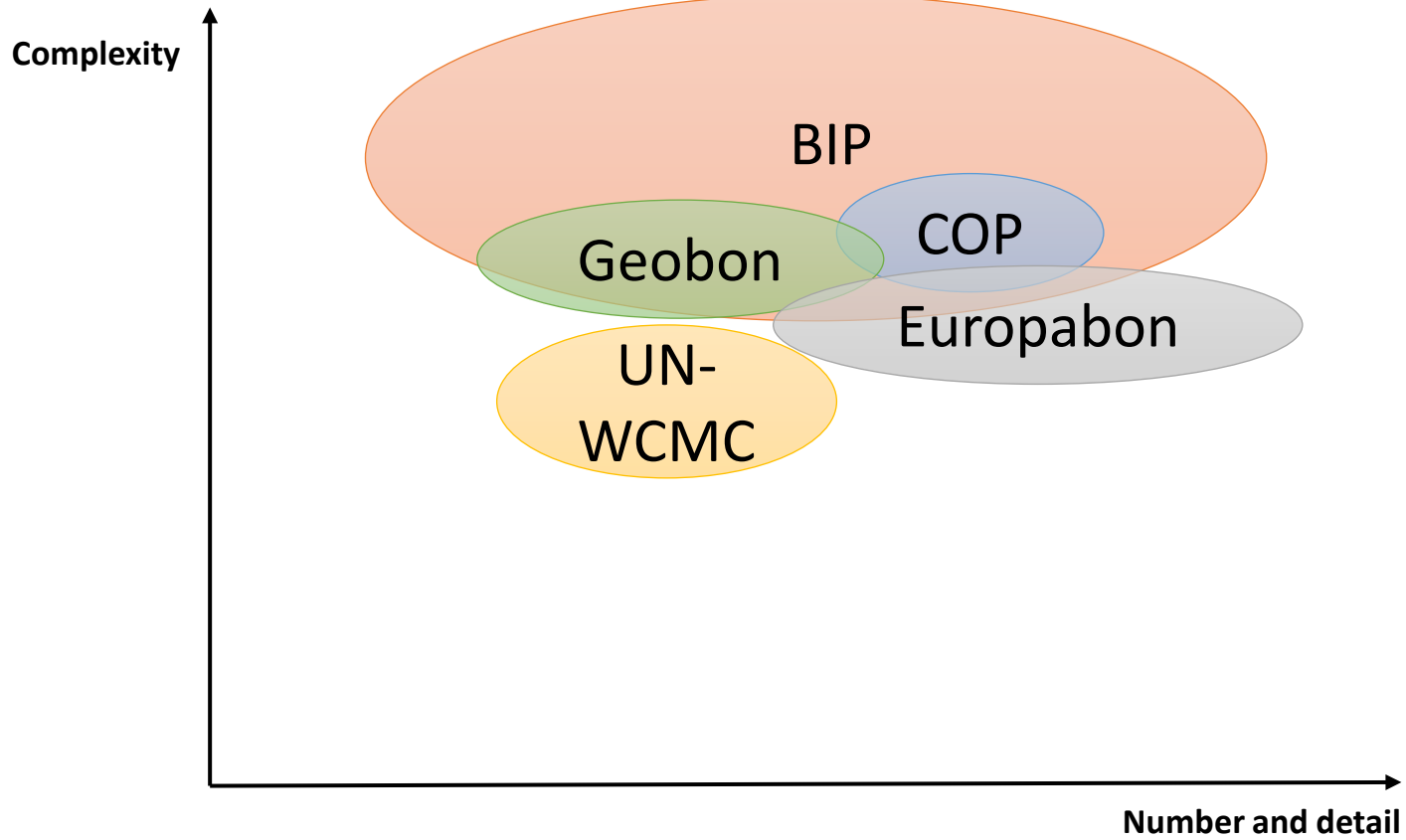
Code Issues Pull requests Actions Projects Wiki Security Insights

Terrestrial Species abundances of selected terrestrial bird species

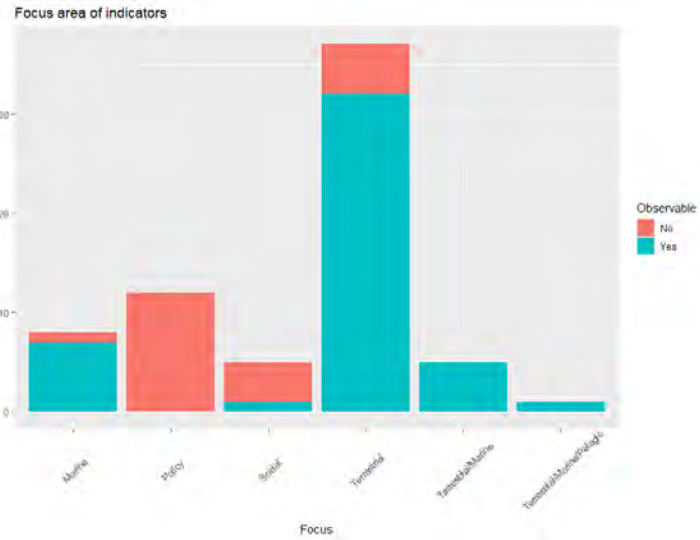
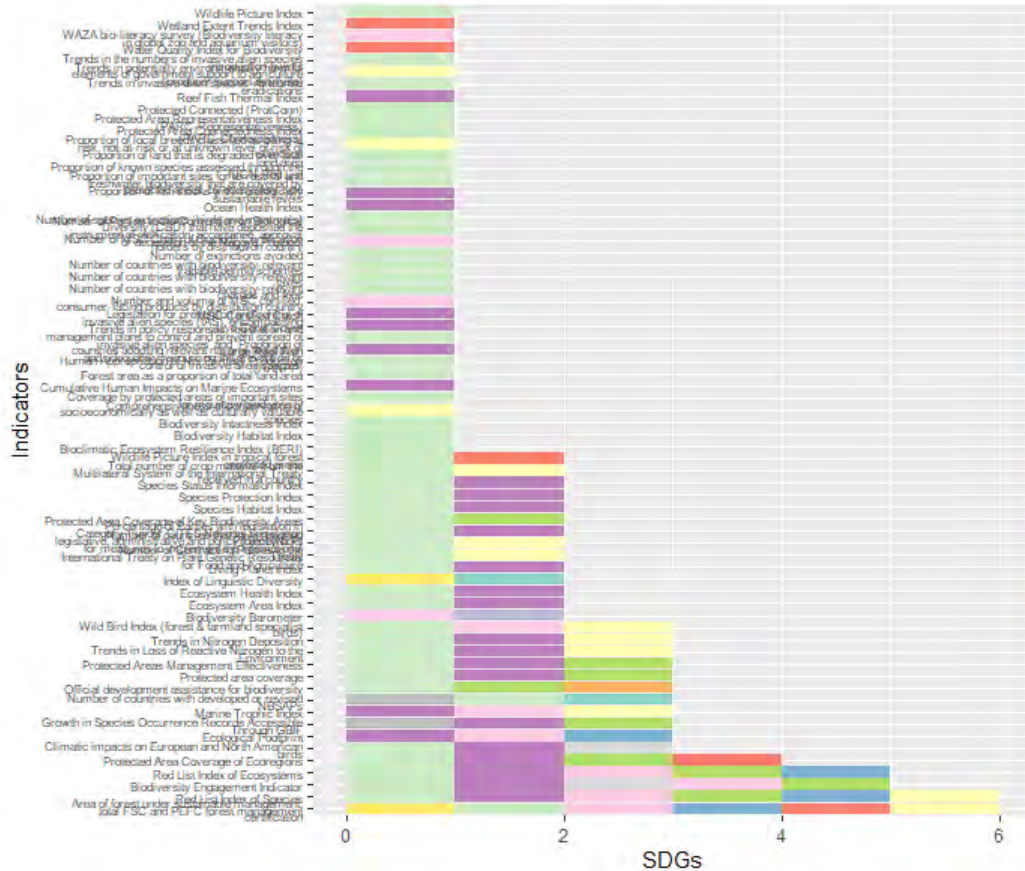
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Species abundances of selected terrestrial bird species

Key	Value
ID	Spp_SP_abn_bird_TER
Realm	Terrestrial
EBV class	Species populations
EBV name	Species abundances of selected terrestrial bird species
Step in identification process	Expert workshop
Definition	The (relative) abundance of European rare, priority, and common bird species within contiguous spatial units (grid cells) across the EU over time.
Metric	<ul style="list-style-type: none">Estimated count of breeding wintering and passage individualsModeled relative abundance of breeding wintering and passage individuals



Biodiversity Indicator Partnership - BIP



Biodiversity Habitat Index

Indicator description

The Biodiversity Habitat Index (BHI) has been developed by CSIRO (Australia's national science agency), working in partnership with GEO BON, GBIF, Map of Life and the PREDICTS project. This indicator is intended to add value to existing assessments of the "rate of loss (and degradation and fragmentation) of all natural habitats, including forests", under Aichi Target 5, by translating the observed spatial distribution of habitat loss and degradation into expected impacts on retention of terrestrial biodiversity.

Data and methodology

Coverage: Global/Sub-global/Regional/National.

The indicator is derived from data and models covering the entire terrestrial surface of the planet at 30-arcsecond (approximately 1km) grid resolution.

Scale: Global data. As above - the indicator covers the entire global extent of forest biomes at 1km grid resolution.

Time series available: 2005, 2010, 2015

Next planned update: 2020.

Possible disaggregations: The indicator can potentially be reported at any desired level of spatial disaggregation including individual 1km grid-cells, countries, any defined regional classification (e.g. IPBES regions), or the entire planet.

It can also be reported separately for each of three biological groups - plants, invertebrates, vertebrates - or as a combined average across these groups.

Metadata used: The models of ecological similarity used to derive this indicator were fitted using the following input data (see Hoskins et al 2019 for details):

- Global 30-arcsecond (approximately 1km) gridded environmental surfaces for: Min Monthly Min Temperature, Max Monthly Max Temperature, Max Diurnal Temperature Range, Annual Precipitation, Actual Evaporation, Potential Evaporation, Min Monthly Water Deficit, Max Monthly Water Deficit, Soil pH, Soil Clay Proportion, Soil Silt Proportion, Soil Bulk Density, Soil Depth, Ruggedness Index, Topographic Wetness Index (Sources: <http://www.worldclim.org>/<https://www.soilerids.org/> <http://www.earthenv.org/> <http://www.worldgrids.org/>).
- Global occurrence records for all terrestrial species within the following taxa: vascular plants, amphibians, reptiles, birds, mammals, ants, bees, beetles, bugs, butterflies, centipedes, dragonflies, flies, grasshoppers, millipedes, snails, moths, spiders, termites, wasps. The records for amphibians, birds and mammals were extracted from data accessible through the Map of Life (<https://mol.org/>) while records for all other taxa were extracted from data accessible through the Global Biodiversity Information Facility (GBIF <http://www.gbif.org/>).

Change in condition was estimated through an extension of CSIRO's statistical downscaling of coarse-resolution land-use data using 1km-resolution environmental and remotely-sensed land-cover covariates (Hoskins et al 2016). This recent work has adapted Hoskins et al's approach to employ Version 2, in place of Version 1, of the Land Use Harmonization product (<http://lulh.umd.edu/>), thereby generating downscaled estimates of 12, rather than the original five, land-use classes, and MODIS Vegetation Continuous Fields (<https://modis-land.gsfc.nasa.gov/VCC.html>) as remote sensing covariates in place of discrete land-cover classes (DI Marco et al 2019). Applying this downscaling



- Environmental variables
- Species Occurrence records
- Land-use



- Species populations
- Ecosystem structure
- Ecosystem function

Ecosystem Area Index

Indicator description

The Ecosystem Area Index (EAI) quantifies the average loss of ecosystem extent using data from Red List of Ecosystem risk assessments, or other relevant sources. The indicator reveals the mean proportion of ecosystem area remaining over a given timeframe, relative to the initial area at the beginning of a defined timeframe (see *Data and Methodology* section) and an ecosystem-specific collapse threshold. The risk of ecosystem collapse is the likelihood



Red List Index of Ecosystems

Indicator description

The Red List Index of Ecosystems (RLIE) measures trends in risk of ecosystem collapse for sets of ecosystems, using data from the Red List of Ecosystems criteria and categories. It is based on the proportion of ecosystems in each Red List risk category and was designed to complement the Red List Index of species survival ([link](#)).

Metadata used: The RLIE is calculated using data from Red List of Ecosystems risk assessments, specifically the risk of ecosystem collapse that is determined based on assessment of five quantitative criteria. Ecosystems are assessed using five criteria: change in ecosystem area over a specified timeframe (criterion A), restricted ecosystem distribution (criterion B), change in environmental conditions (criterion C) and biotic processes and interactions (criterion D) over a specified timeframe, and a quantitative analysis of the probability of ecosystem collapse in the future (criterion E). The timeframes include since ~1750, over the past 50 years, next 50 years, any 50-year period including the past, present and future, the next 50 years. Data on to complete Red List of Ecosystems assessments can be derived from a range of sources.

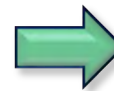
Methodology: The Red List Index of ecosystems (RLIE) measures trends in ecosystem collapse risk based on the proportion of ecosystems in each risk category (for details see Rowland et al. 2020a). The RLIE is calculated for the overall risk category (which are defined based on the IUCN Red List of Ecosystems protocols) and separately for each IUCN Red List of Ecosystems criterion. The RLIE is the mean of ordinal ranks assigned to each risk category and is defined as:

$$RLIE_t = 1 - \frac{\sum_{i=1}^n W_{c(i,t)}}{W_{CO} \cdot n}$$

where $W_{c(i,t)}$ is the risk category rank for ecosystem i in year t (Collapsed=5, Critically Endangered=4, Endangered=3, Vulnerable=2, Near Threatened=1, Least Concern=0; following Butchart et al. 2007), W_{CO} is the maximum category rank (Collapsed=5), and n is the total number of ecosystems excluding Data Deficient or Not Evaluated ecosystems. The RLIE ranges from zero (all ecosystems Collapsed) to one (all Least Concern).



- Area change
- Environmental conditions
- Biotic processes/interactions
- Risk of collapse

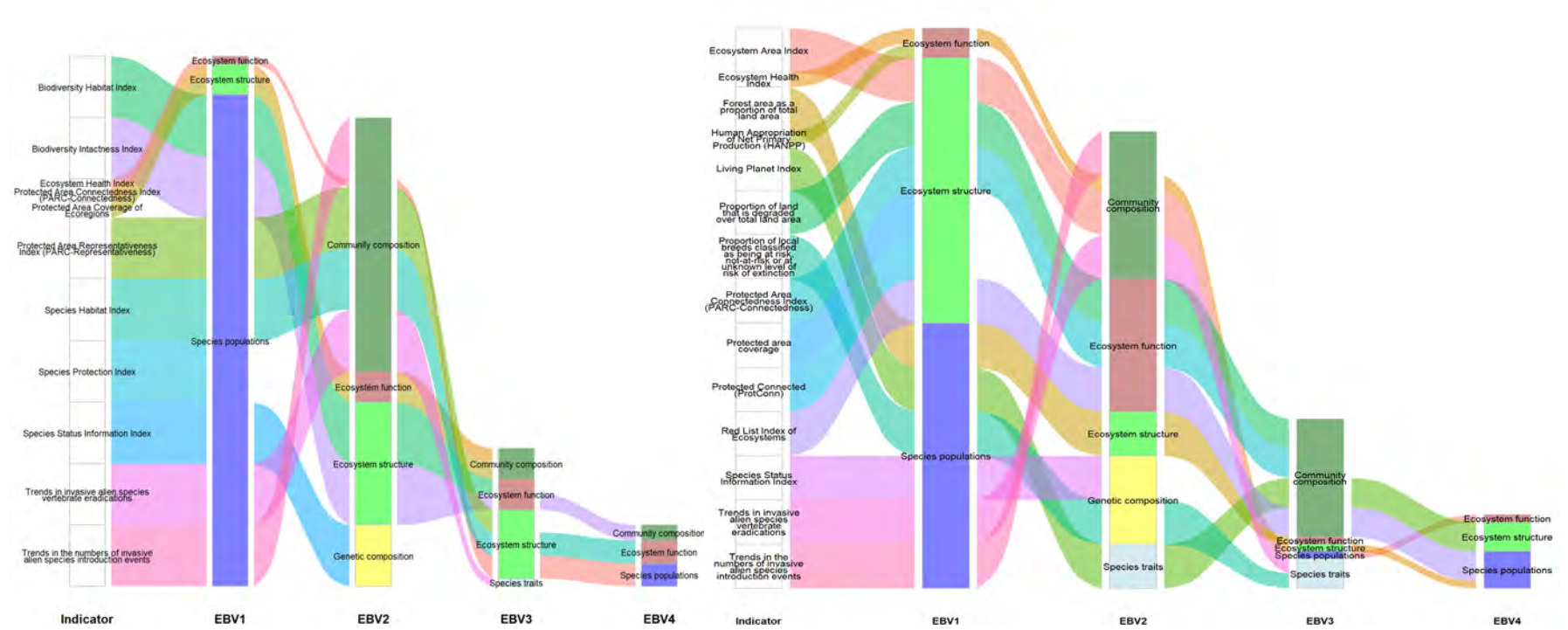


- Ecosystem structure
- Community composition
- Species populations
- Ecosystem function

Terrestrial

GEO BON

COP



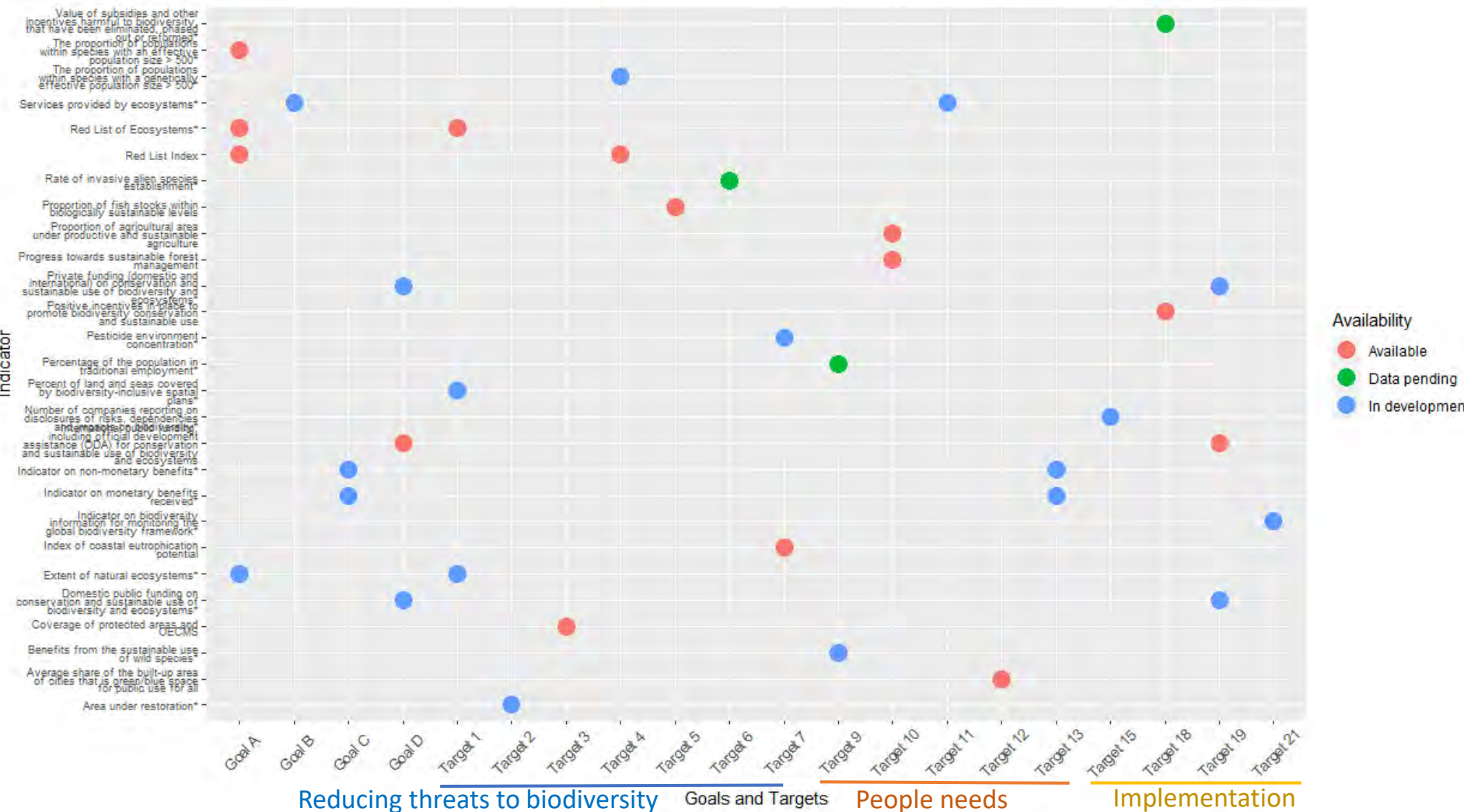
EuropaBON

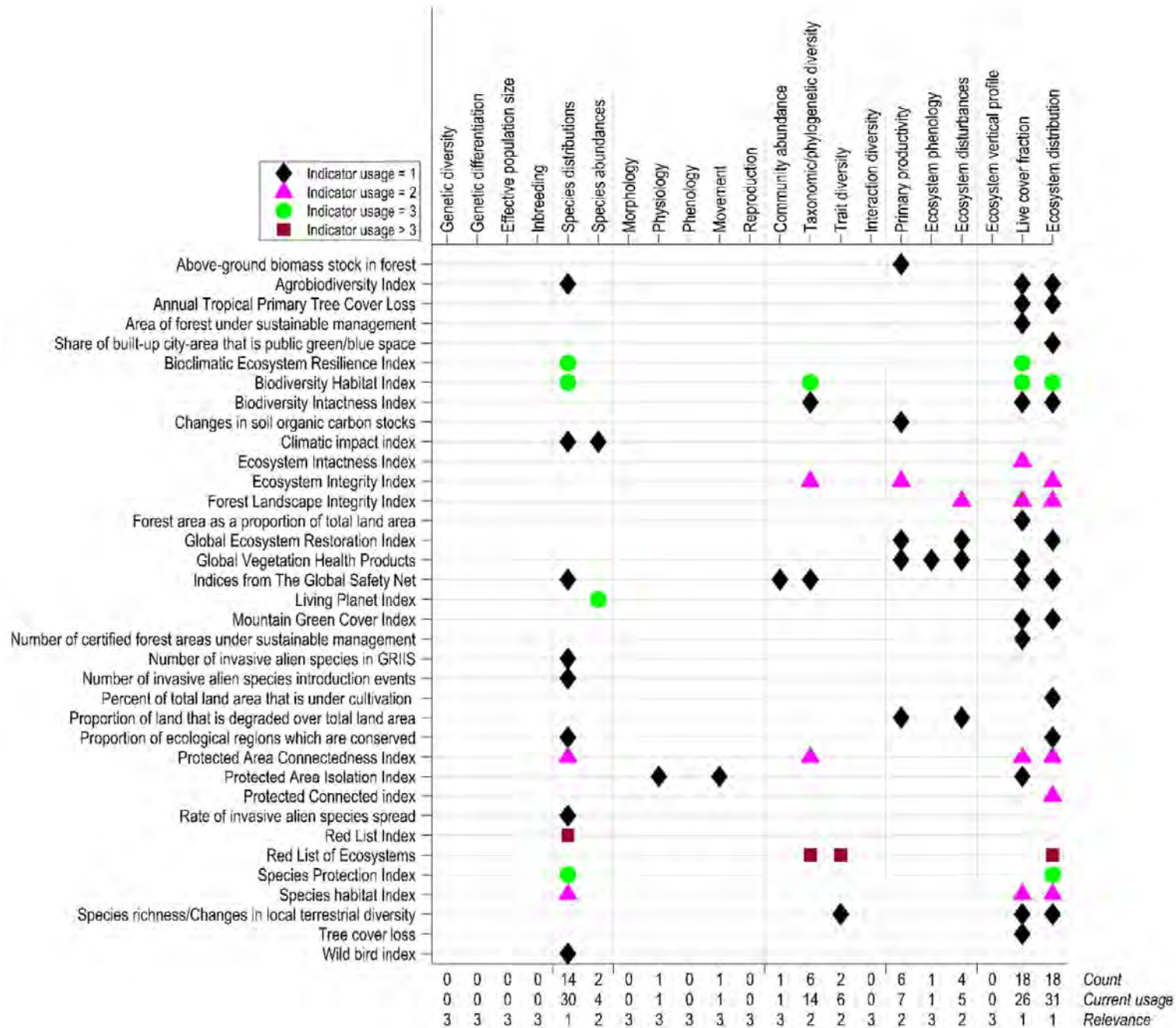
Metrics...or indicators...

EuropaBon	EBV					
Indicator	Species populations	Ecosystem function	Community composition	Ecosystem structure	Species traits	Genetic composition
Presence/absence of species	Yes		Yes	Yes	Yes	
Probability of occurrence	Yes			Yes		
Estimated count of individuals	Yes		Yes			
Modeled relative abundance	Yes		Yes		Yes	
Phenological timing		Yes			Yes	
Weight and mass incl carbon		Yes	Yes			
Weather data			Yes			
Functional diversity indices incl. richness			Yes			
Vegetation height				Yes		
Vegetation cover, gaps, penetrations				Yes		
Vegetation vertical variability				Yes		
Connectivity metrics				Yes		
Net Primary production		Yes				
Presence/absence of disturbance (fire)		Yes				
Disturbed area (fire)		Yes				
HANPP, HANPPInc, HANPPHarv		Yes				
Allelic richness						Yes
Nucleotide diversity						Yes
Expected heterozygosity						Yes
Observed heterozygosity						Yes

EuropaBon	Focus group																
	Birds																
Indicator	Terrestrial	Migratory	Mammals Bats (Chiroptera), Predators (Carnivora), Grazers (Artiodactyla)	Mammals European Red List species	Reptiles	Butterflies	Key pollinators	Insects	Plants European Red List species	Plants Main trees	Plants Flowering plants	Lichens	Mushroom and wild fruits	Invasive alien taxa	Disease vectors and crop pests	Soil and microbes	Habitats
Presence/absence of species	Yes	Yes		Yes	Yes		Yes		Yes	Yes		Yes		Yes			Yes
Probability of occurrence	Yes	Yes		Yes	Yes		Yes		Yes	Yes		Yes		Yes			Yes
Estimated count of individuals	Yes	Yes	Yes			Yes									Yes		
Modeled relative abundance	Yes	Yes	Yes			Yes									Yes		
Phenological timing		Yes				Yes				Yes	Yes		Yes				Yes
Weight and mass incl carbon		Yes	Yes				Yes	Yes		Yes						Yes	Yes
Weather data		Yes	Yes					Yes									
Functional diversity indices incl. richness																Yes	
Vegetation height										Yes	Yes						
Vegetation cover, gaps, penetrations										Yes	Yes						
Vegetation vertical variability										Yes	Yes						
Connectivity metrics																	Yes
Net Primary production																	Yes
Presence/absence of disturbance (fire)																	Yes
Disturbed area (fire)																	Yes
HANPP, HANPPInc, HANPPHarv																	Yes
Allelic richness	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes						
Nucleotide diversity	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes						
Expected heterozygosity	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes						
Observed heterozygosity	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes						

UN-WCMC

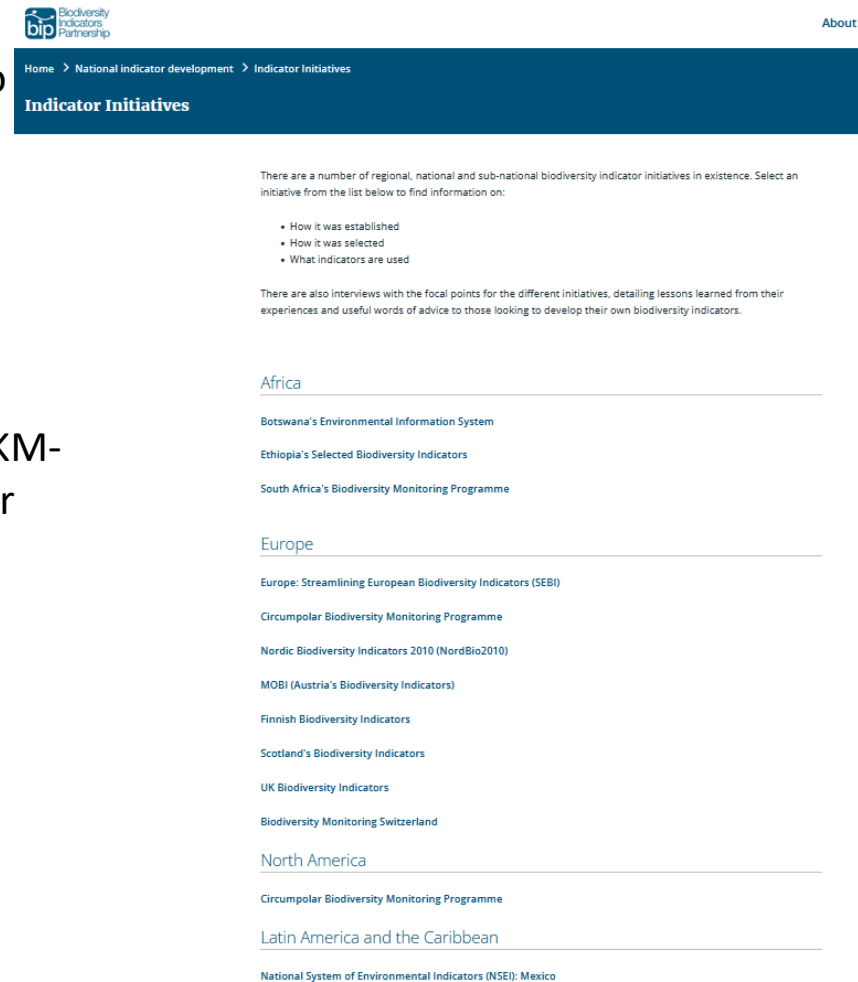




My thoughts

- BIP indicators are sometimes too complicated, too numerous
 - Lack of Asian Indicator Initiatives
- EuropaBon indicators are straightforward, easy to understand
- UN-WCMC indicators specifically connected with KM-GBF, still under development, manageable number
- To move forward:
 - Species populations
 - Ecosystem structure
 - Ecosystem function

Open resources (R, Python, ...)



Group discussion

Terms for Discussion EBVs and Indicators

- **Feasibility of EBVs and Indicators:** Assessing the practicality of implementing EBVs, including considerations of data availability, technological requirements, and methodological support.
- **Scale and Application:** Ensuring EBVs and Indicators are comprehensive enough for different spatial and temporal scales, and assessing their relevance to various ecosystems and biodiversity contexts.
- **Integration for Policy and Management:** Identifying which EBVs or indicators are specifically important for regional biodiversity or societal needs.
- **Asia-Pacific Region:** Exploring the specific challenges and opportunities for implementing and utilizing EBVs in the Asia-Pacific region's diverse ecosystems. Consideration of any missing items beyond EBVs.

Potential Questions :

- Are there any aspects of biodiversity that cannot be observed or adequately captured using the current EBVs or indicators?
- Are there any additional EBVs that should be considered for inclusion to address gaps or emerging issues?