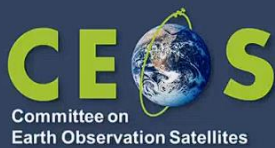


Essential Biodiversity Variables (EBVs)



Marc Paganini, ESA

Agenda Item 3.9
WGCV-53
5-8 March 2024

The Essential Biodiversity Variables (EBVs)

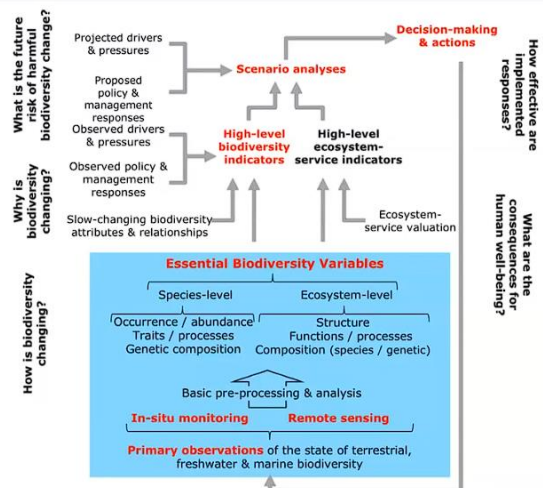


EBVs = key variables essential to be collected globally and regularly for studying, reporting, and managing changes to biodiversity, and monitoring progress towards Biodiversity Targets.

EBV characteristics

- Ability to detect changes in biodiversity.
- Biological / Ecological significance.
- Biodiversity policy relevance.
- Globally measurable.
- Quantifiable with accuracy estimation.
- Repeatable.
- Independent from measurement platforms.
- Scale free (allowing scalability).
- Allow aggregation and disaggregation.
- Emphasis on State.

Pereira, H.M. et al., (2013) Essential Biodiversity Variables, Science



Remotely Sensed EBVs



EBV class	EBV name
Genetic composition	Genetic diversity (richness and heterozygosity)
	Genetic differentiation (number of genetic units and genetic distance)
	Effective population size
	Inbreeding
Species populations	Species distributions
	Species abundances
Species traits	Morphology
	Physiology
	Phenology
	Movement
	Reproduction
Community composition	Community abundance
	Taxonomic/phylogenetic diversity
	Trait diversity
	Interaction diversity
Ecosystem functioning	Primary productivity
	Ecosystem phenology
	Ecosystem disturbances
Ecosystem structure	Live cover fraction
	Ecosystem distribution
	Ecosystem Vertical Profile

Little RS



Much RS



The role of space agencies in remotely sensed essential biodiversity variables



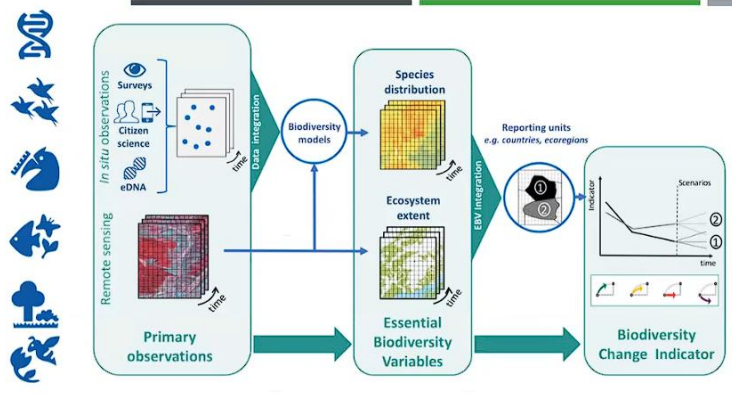
Agree on biodiversity metrics to track from space



Priority list of biodiversity metrics to observe from space



Essential Biodiversity Variables for monitoring



EBV production workflows:

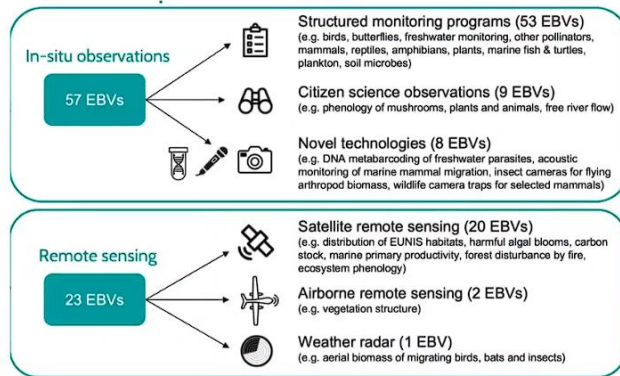
1. Collection of primary observations
2. Standardization of primary monitoring observations
3. Data integration and model-based estimation
4. Publication of trends following data guidelines

Navarro et al., (2017) Current Opinion in Environmental Sustainability

Table 2 | The 30 remote sensing biodiversity products with the highest rankings

Number	Remote sensing biodiversity product	Remote sensing-enabled biodiversity variable	EBV class
1	Biological effects of fire disturbance (direction, duration, abruptness, magnitude, extent and frequency)	Ecosystem disturbance Habitat structure	Ecosystem function Ecosystem structure
2	Biological effects of irregular inundation	Ecosystem disturbance Habitat structure	Ecosystem function Ecosystem structure
3	LAI	Ecosystem physiology Habitat structure Species physiology	Ecosystem function Ecosystem structure Species traits
4	Land cover (vegetation type)	Habitat structure	Ecosystem structure
5	Ice cover habitat	Habitat structure	Ecosystem structure
6	Above-ground biomass	Habitat structure	Ecosystem structure
7	Foliar N/P/K content	Ecosystem physiology Species physiology	Ecosystem function Species traits
8	Net primary productivity	Ecosystem physiology Species physiology	Ecosystem function Species traits
9	Gross primary productivity	Ecosystem physiology Species physiology	Ecosystem function Species traits
10	Fraction of absorbed photosynthetically active radiation	Ecosystem physiology	Ecosystem function
11	Ecosystem fragmentation	Spatial configuration	Ecosystem structure
12	Ecosystem structural variance	Spatial configuration	Ecosystem structure
13	Urban habitat	Habitat structure	Ecosystem structure
14	Vegetation height	Habitat structure	Ecosystem structure
15	Plant area index profile (canopy cover)	Habitat structure	Ecosystem structure
16	Habitat structure	Habitat structure	Ecosystem structure
17	Fraction of vegetation cover	Habitat structure	Ecosystem structure

Skidmore et al., (2021) Priority list of biodiversity metrics to observe from space. *Nature Ecology and Evolution*



The EuropaBON project,
Designing an EU-wide framework for monitoring biodiversity

Lumberges M, Kissling WD (2023) Important first steps towards designing the freshwater, marine and terrestrial Essential Biodiversity Variable (EBV) workflows for the European Biodiversity Observation Network. *Research Ideas and Outcomes*

Collaboration with WGCV on EBVs



- Support the development of **RS-enabled EBVs best practice workflows**.
(including multi sensor approaches)
- For EBVs essentially on **ecosystem traits** (ecosystem function and structure)
- Starting from the **variables already addressed by WGCV** (e.g., Biomass, fAPAR, LAI)
- Development of **data quality standards** for EBV retrieval algorithms.
- Development of **scientifically sound validation frameworks**
(including EBV validation protocols, possibly algorithm intercomparisons)
- Support to EBV Cal/Val with sharing/provision of **in-situ measurements**
(fiducial reference measurements)
- Support the integration of **future CEOS missions** in the EBV workflows (e.g. CHIME, SBG)