

Essential Biodiversity Variables from Space



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SPACED - Brussels, January 10th 2018

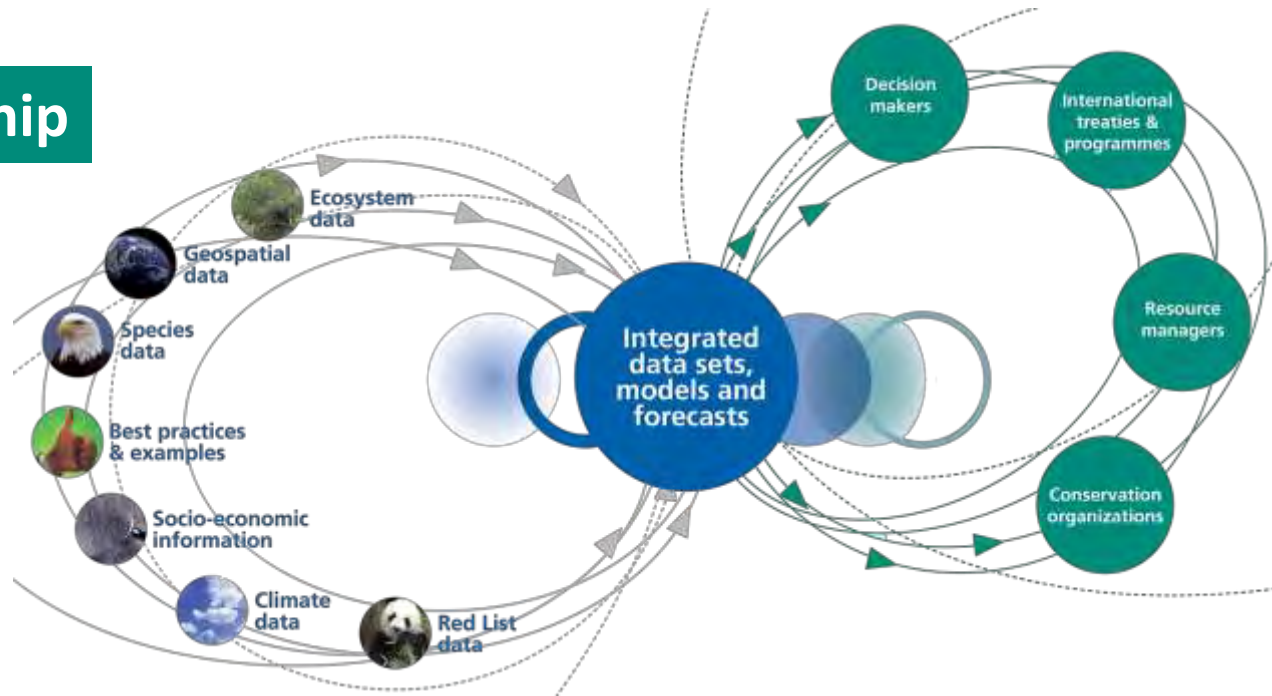


GEO BON in a nutshell

Mission

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

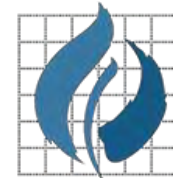
GEO Flagship



Vision

A **global biodiversity observation network** that contributes to effective **management policies** for the world's biodiversity and ecosystem services.

A Global Partnership



Convention on Biological Diversity



ITC
UNIVERSITY OF TWENTE.



iDiv



GBIF



UNIVERSITY OF AMSTERDAM



ECOSCOPE
PÔLE DE DONNÉES
Observation pour la Recherche
sur la Biodiversité



International Long Term Ecological Research



USGS
science for a changing world



esa



MOL
MAP OF LIFE



SASSCAL
Southern African Science Service Centre for Climate Change and Adaptive Land Management



ASIAN CENTRE FOR BIODIVERSITY

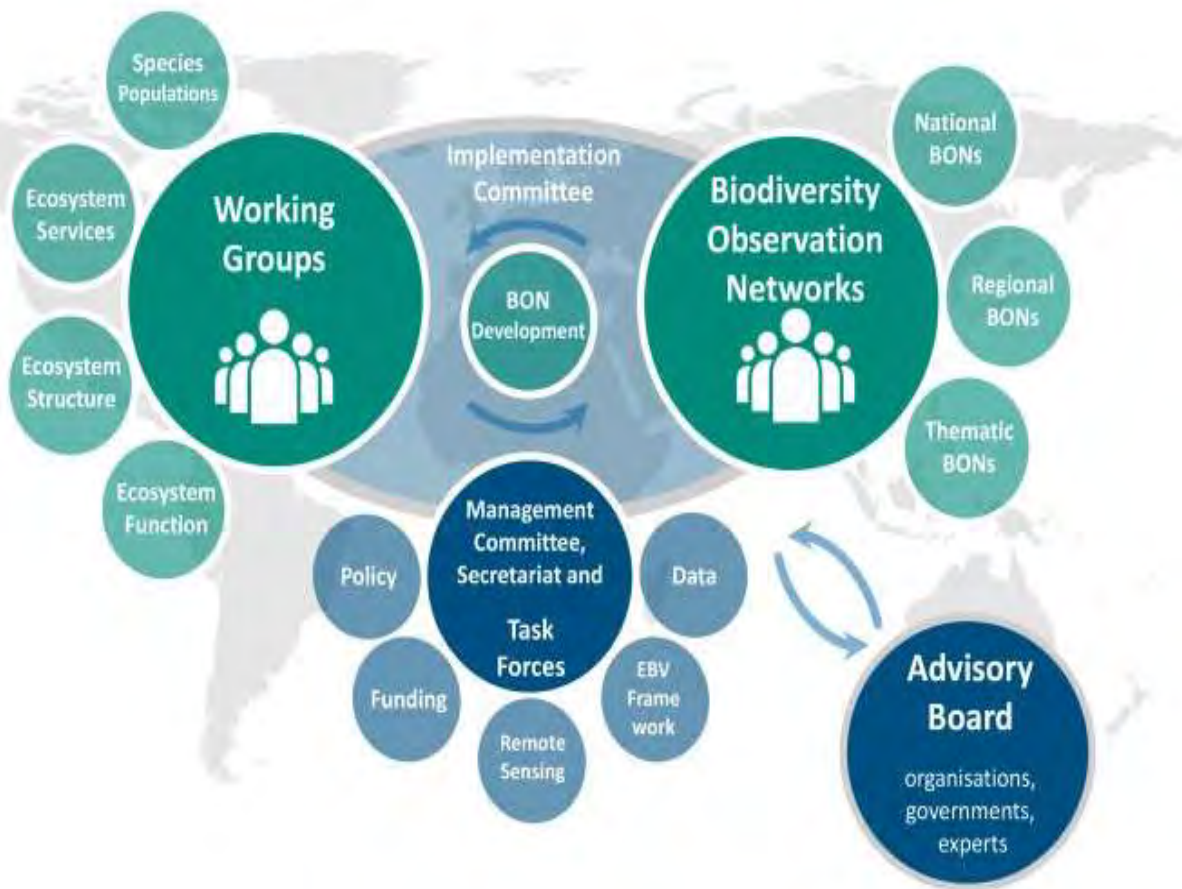


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CSIRO

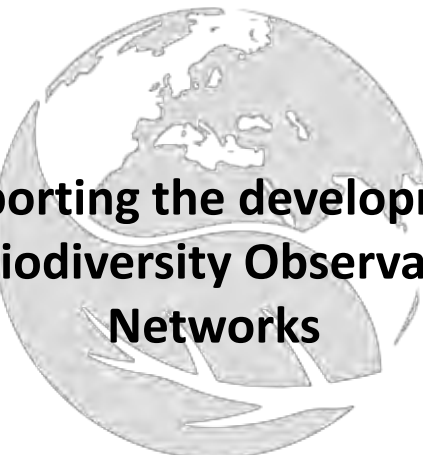
Structure and governance



GEO BON core focus



Developing a standard and flexible framework for biodiversity observations



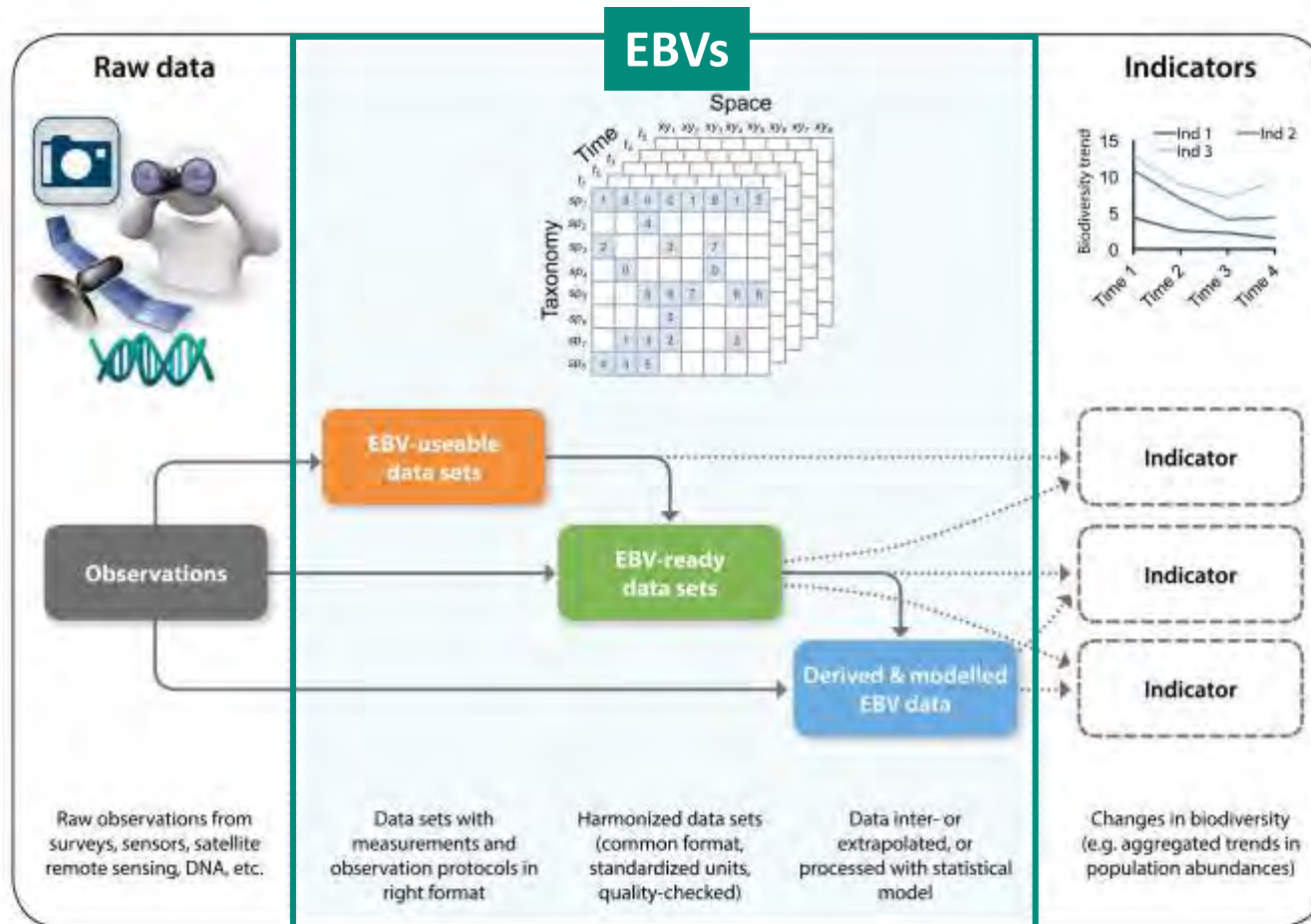
Supporting the development of Biodiversity Observation Networks



Producing Policy Relevant Outputs

The Essential Biodiversity Variables

EBVs: Minimum set of measurements, complementary to one another, that can capture major dimensions of biodiversity change.



Users

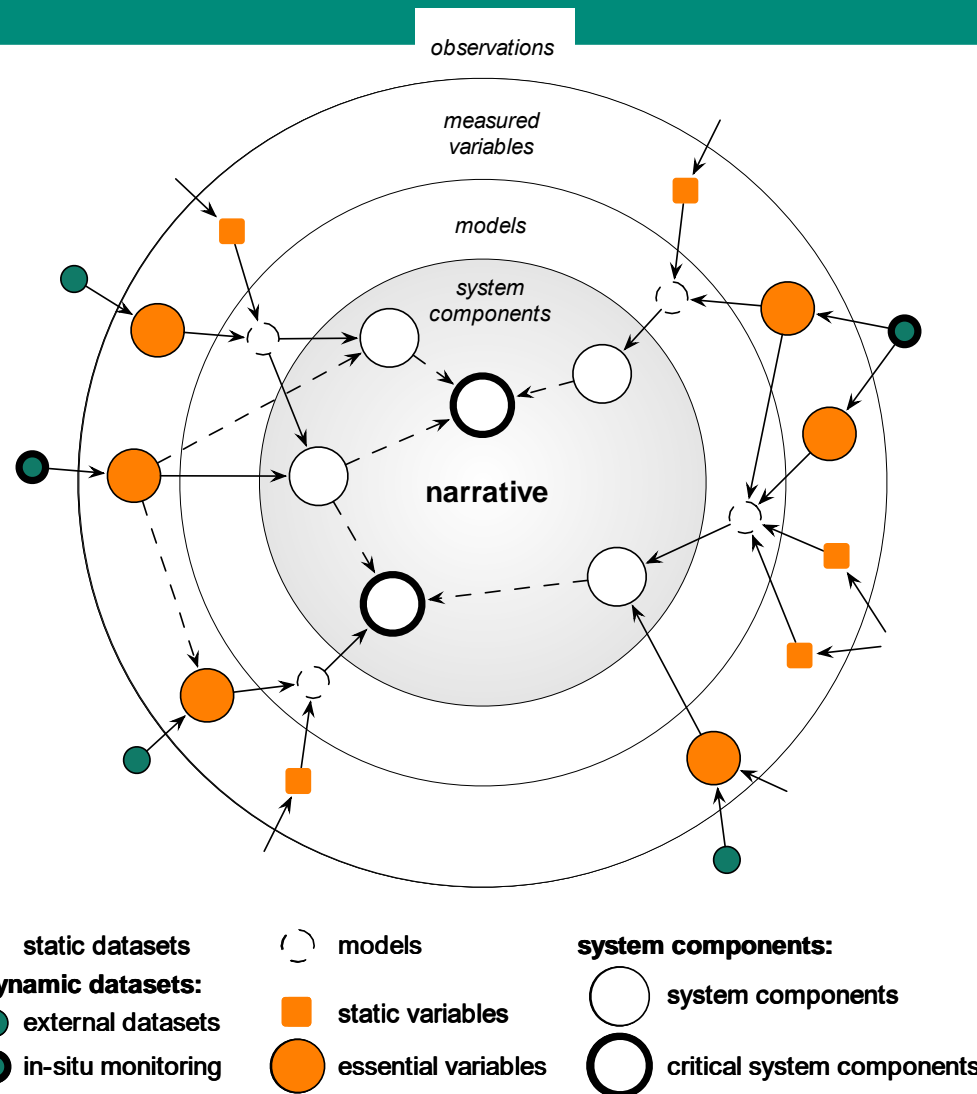
National Governments



CBD



How to identify EBVs and what is their role in the development of monitoring systems?



Work Package 2

EBVs from Space



Ecosystem Structure

Ecosystem composition
Ecosystem extent and Fragmentation
Vertical distribution



Ecosystem Functions

Productivity
Disturbance regimes
Carbon stocks
Phenology
Biotic water dynamics
Canopy biochemistry



Species Populations

Species distributions
Population abundances



Community Composition

Plant taxonomic diversity
Plant functional diversity



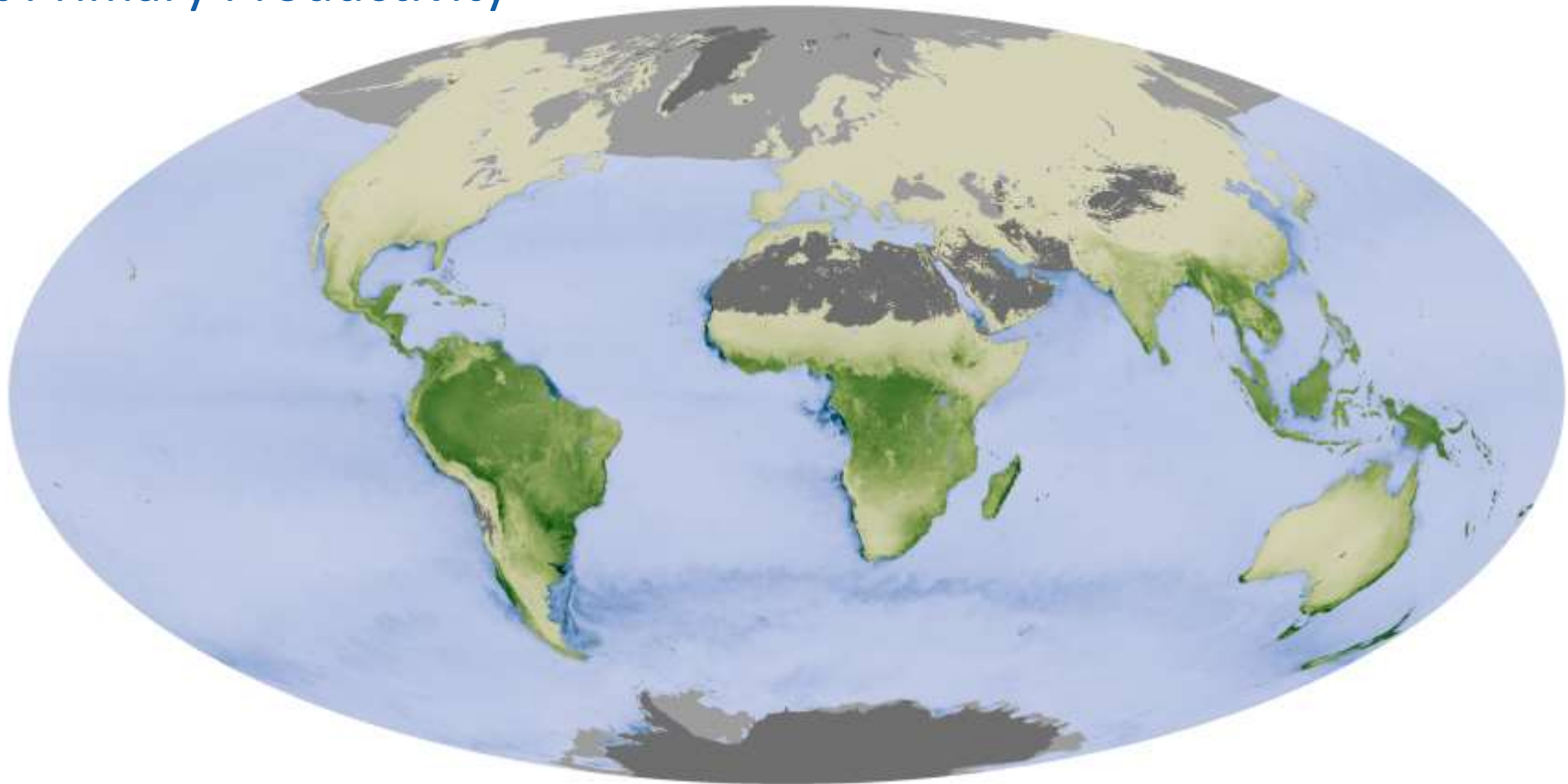
Species Traits

Plant traits (e.g., specific leaf area, leaf nitrogen content)

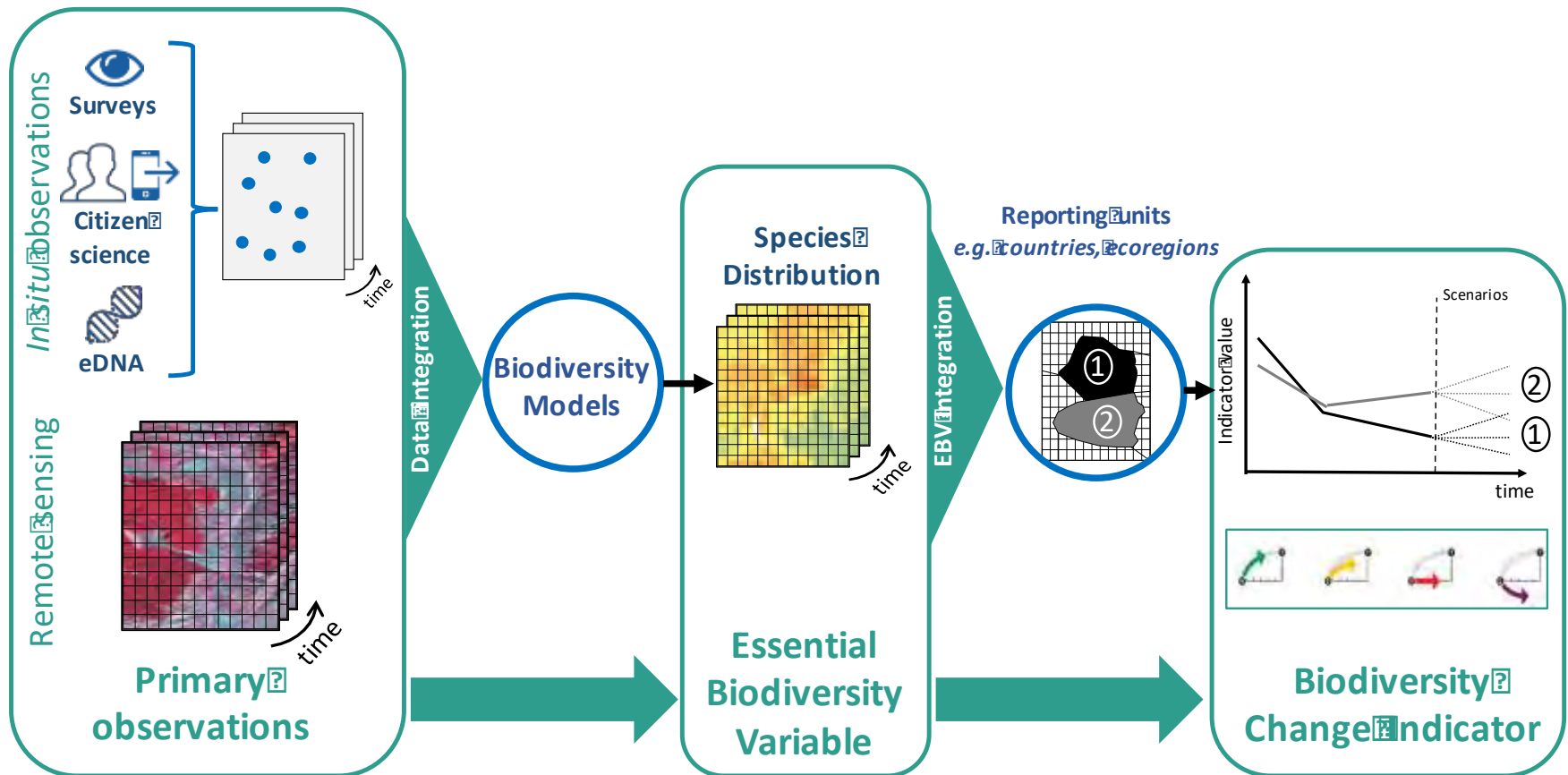
EBVs from space: Ecosystem Functions



Net Primary Productivity



EBVs from space: Species Populations



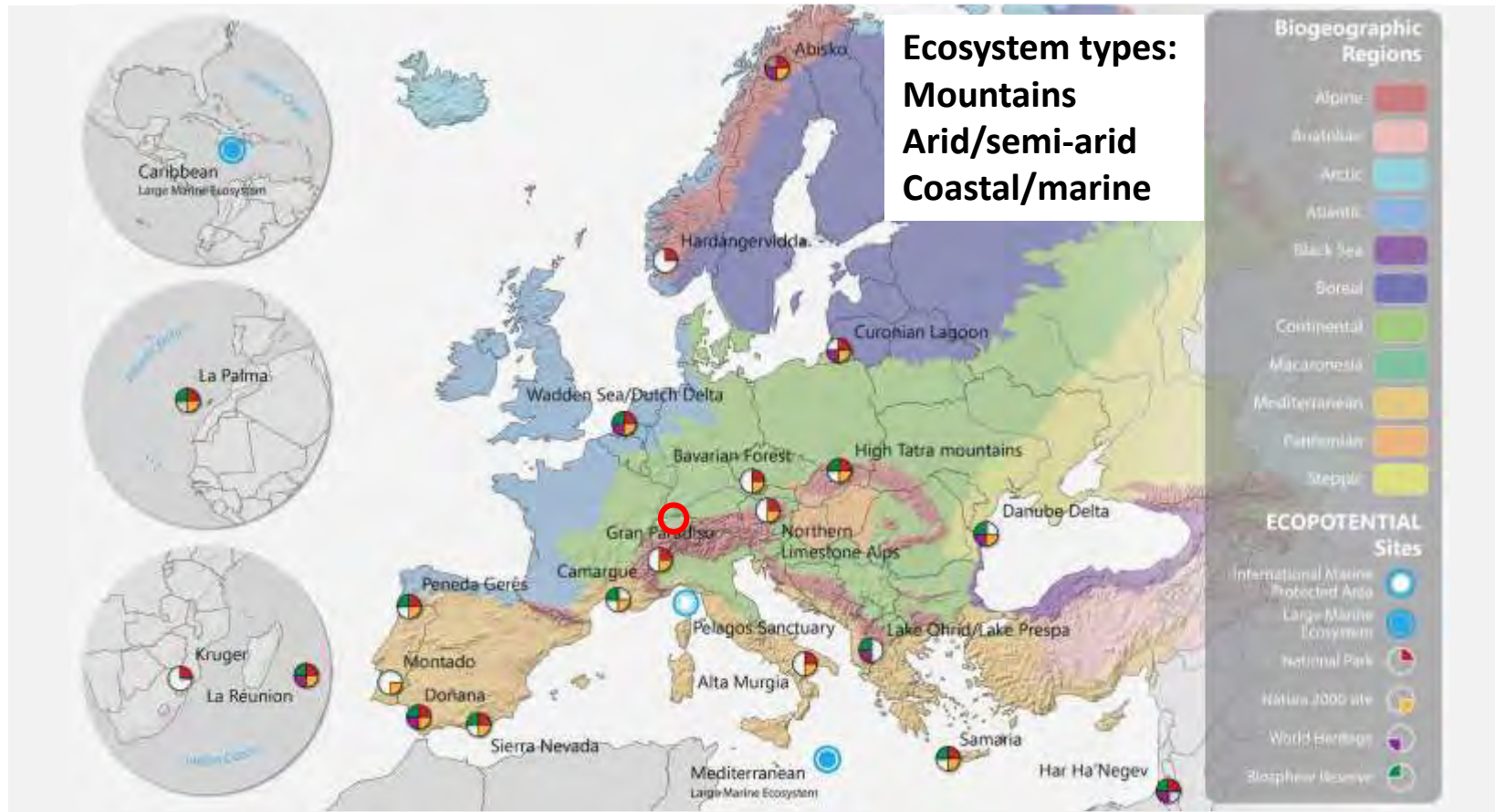
EBVs from Space: ongoing projects



This project is funded by the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 641762. Copyright by Ecopotential Consortium.

Working in partnership with 23 Protected Areas in Europe and beyond



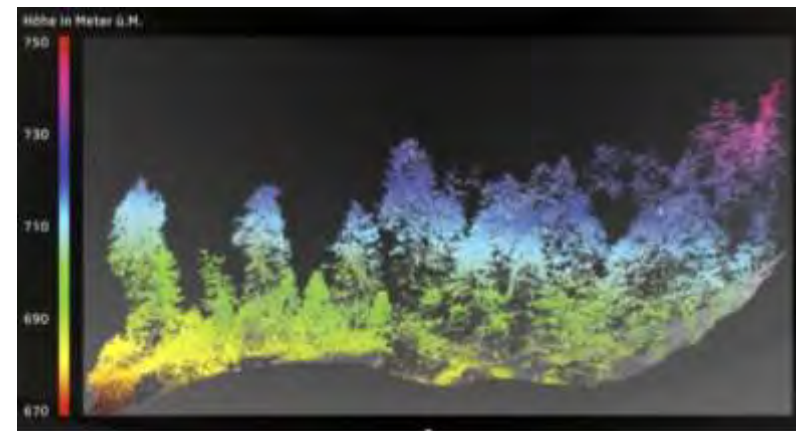
EBVs from Space: ongoing projects



Engineering of **High Spatial Resolution RS enabled EBVs** on the **structure and function of terrestrial ecosystems**,

in support to the collaborative efforts of CBD, IPBES and GEO BON to build a comprehensive and global knowledge of biodiversity of terrestrial ecosystems.

- essentially **Sentinel 1, Sentinel 2 and Landsat 8** based
But impact of spatial scales studied
- engineering of **3 critical RS enabled EBVs** on ecosystem function and structure
- Validation** on key terrestrial biomes
(10 sites / 4 biomes)
- 4 use case demonstrations** for ecological modeling & biodiversity indicators
- Up-scaling** demonstration



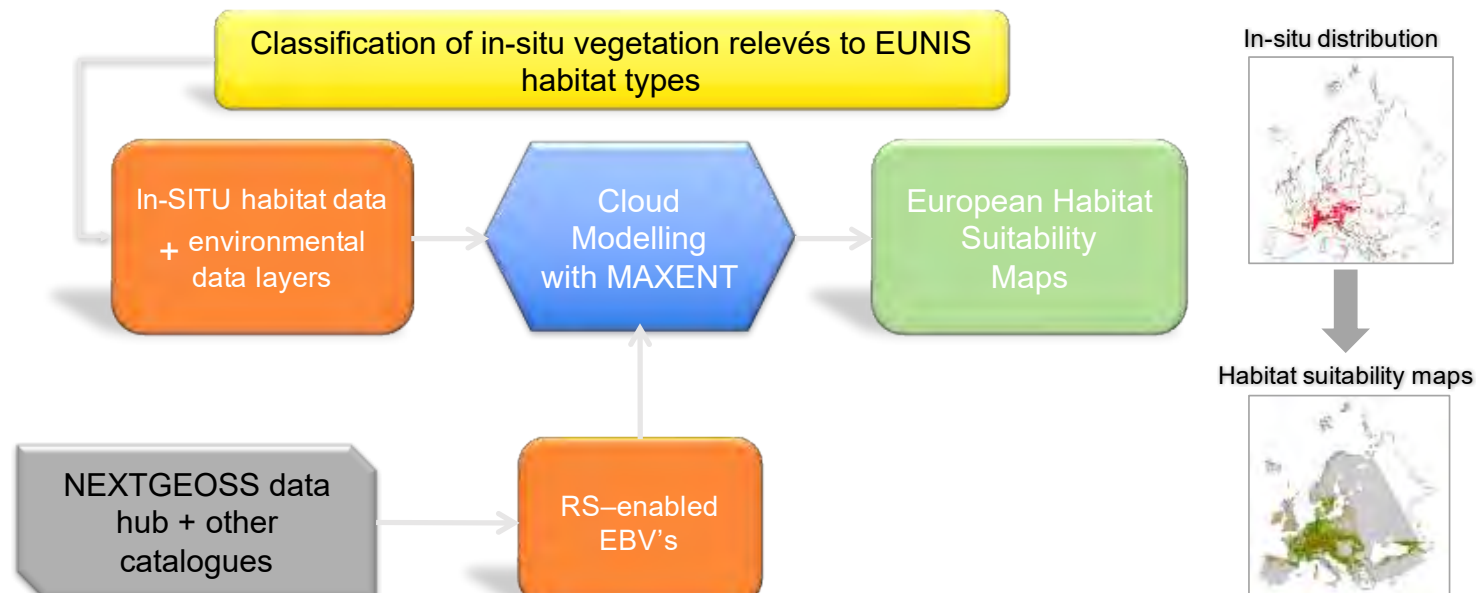


EBVs from Space: ongoing projects

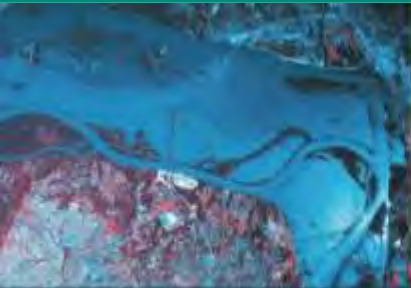
NextGEOSS is a European contribution to GEOSS and is implementing a federated data hub for access and exploitation of Earth Observation Data.

Pilot 6.2 – Biodiversity

European Habitat Modelling using RS-EBVs



EBVs from Space: ongoing projects



NASA Earth Science

Introducing 32 Projects Supporting
the Group on Earth Observations

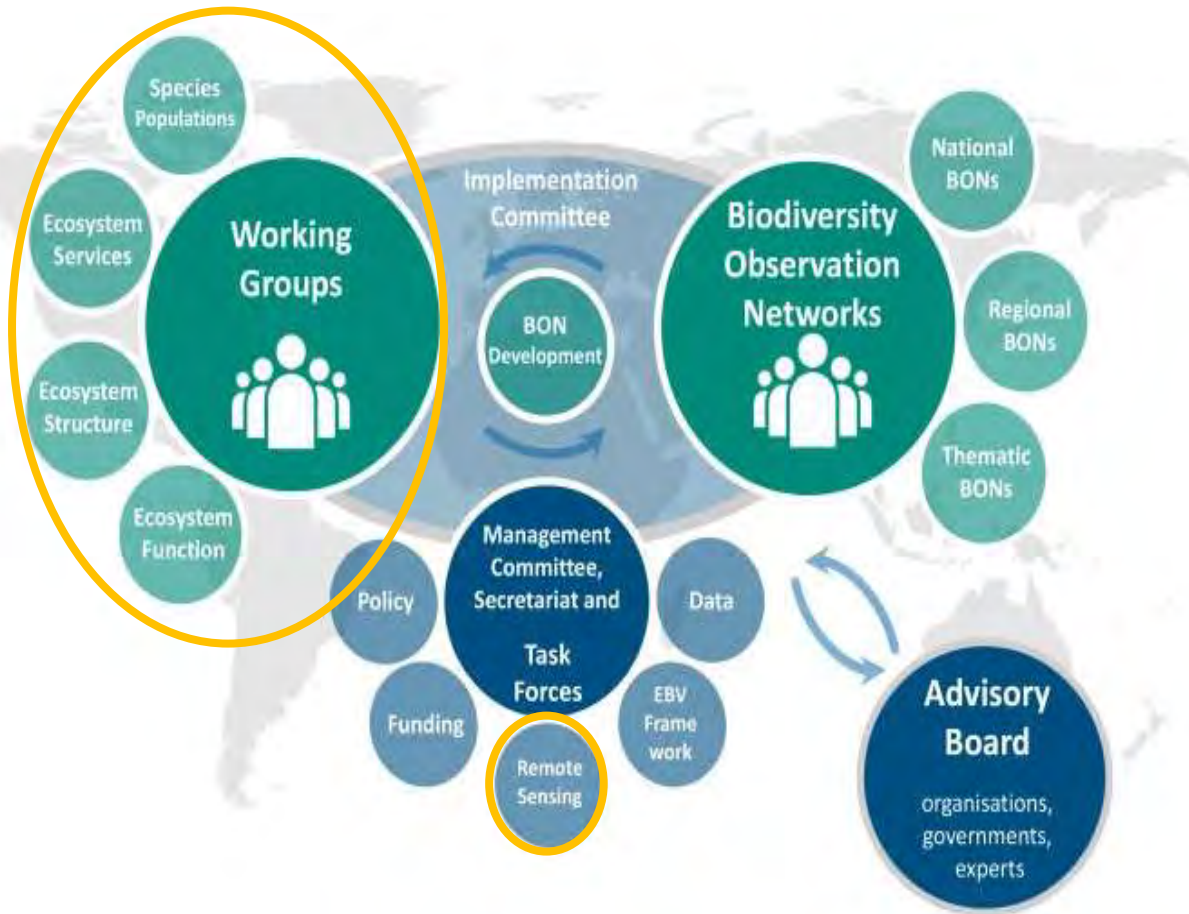


These projects advance nine elements in the GEO Work Programme. The projects broaden the involvement in GEO by U.S. organizations, adding their expertise and contributions to realize societal benefits from Earth observations.

- **Expanding Wallace biodiversity modeling software to support national biodiversity change indicator calculations for GEO BON assessment and reporting.** *Mary Blair, American Museum Of Natural History*
- **Activities to advance, build, and deliver remote-sensing supported species distribution and species abundance EBVs.** *Walter Jetz, Yale University*
- **Improving linkages between Earth observations and ecosystem service models with EBVs.** *Gretchen Daily, Stanford University*
- **Dynamic seascapes to support a biogeographic framework for a global marine biodiversity observing network.** *Maria Kavanaugh, Woods Hole Oceanographic Institution*
- **Integration of Earth observations for decision making on biodiversity management and conservation in Colombia: Consolidation of the Colombian BON.** *Victor Gutierrez-Velez, Temple University*
- **Ecosystem Functional Diversity of the Circumpolar Arctic.** *Howard Epstein, University of Virginia*
- **Quantifying Forest Vertical Structure Using Spaceborne Lidar: An Application in Colombia.** *Patrick Jantz, Northern Arizona University*
- **Laying the foundations of the Pole-to-Pole Marine BON of the Americas.** *Enrique Montes, University Of South Florida-Tampa*

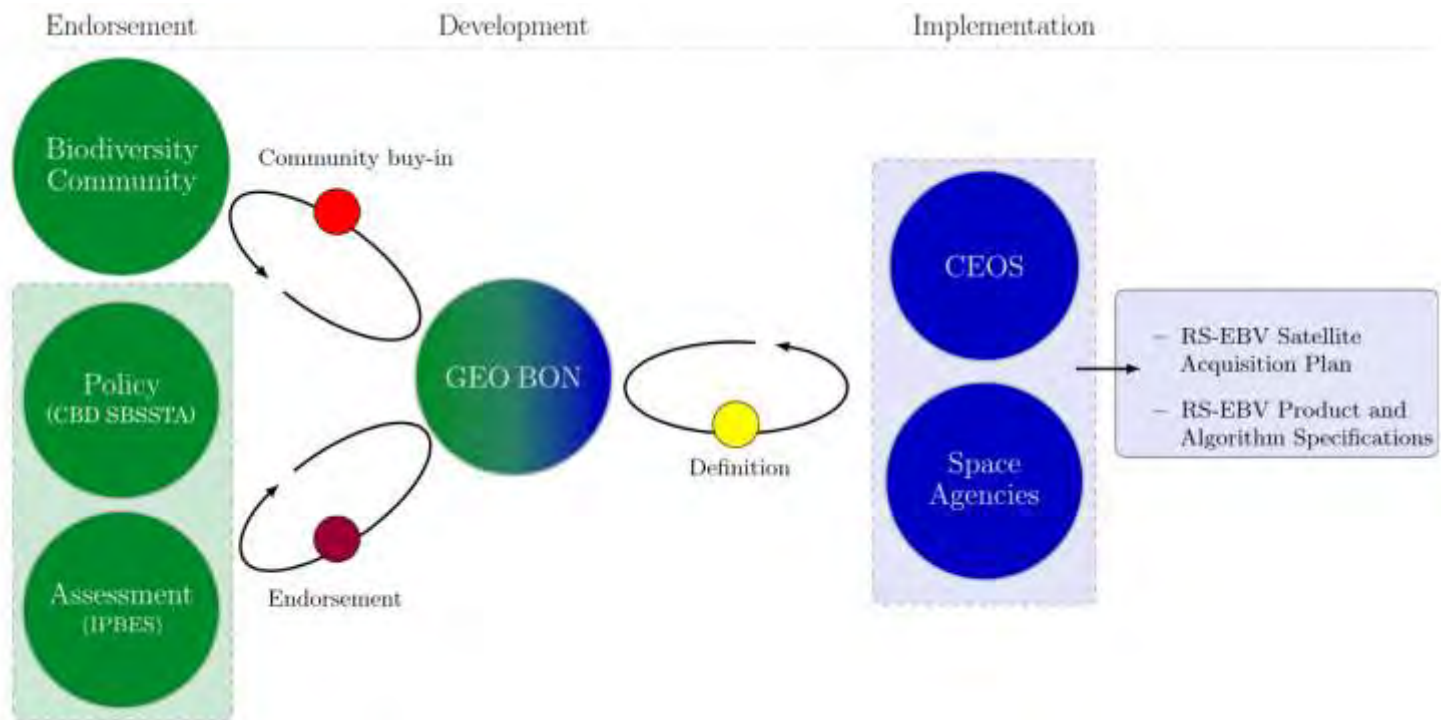
EBVs from Space within GEO BON

EBV Development



Remote Sensing Task Force

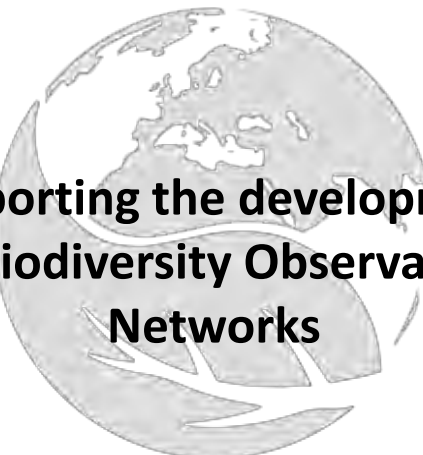
- Identify EBVs that can be produced using Remote Sensing
- Inform CEOS on the requirements for RS biodiversity observations
- Engage with users for feedback and "buy-in"



GEO BON core focus



Developing a standard and flexible framework for biodiversity observations



Supporting the development of Biodiversity Observation Networks



Producing Policy Relevant Outputs

Policy relevant outputs: Supporting users' reporting needs









EBV based indicators: Integrating in situ and remote sensing observations for open access & real-time indicators

<p>SHI Species Habitat Indices</p>		<p>Essential Biodiversity Variables: Species distributions Ecosystem extent and fragmentation</p>
<p>BHI Biodiversity Habitat Index</p>		<p>Essential Biodiversity Variables: Ecosystem extent and fragmentation Taxonomic diversity</p>
<p>SPI Species Protection Index</p>		<p>Essential Biodiversity Variables: Species distributions Ecosystem extent and fragmentation</p>
<p>PARC Protected Area Representativeness & Connectedness (PARC) Indices</p>		<p>Essential Biodiversity Variables: Ecosystem extent and fragmentation Taxonomic diversity</p>
<p>GERI Global Ecosystem Restoration Index</p>		<p>Essential Biodiversity Variables: Ecosystem extent Net primary productivity</p>
<p>SSII Species Status Information Index</p>		<p>Essential Biodiversity Variables: Species distributions Taxonomic diversity</p>

Policy relevant outputs: Supporting users' reporting needs

SUSTAINABLE DEVELOPMENT GOALS

Candidate EBV classes

	2.4	Ecosystem structure
	2.5	Ecosystem function Genetic composition
	3.D	Species populations
	6.3	Ecosystem function
	6.6	Species Populations Ecosystem Structure
	11.3	Ecosystem Structure
	14.4	Species Populations
	14.5	Ecosystem Structure
	15.1, 15.2, 15.3, 15.4, 15.5, 15.7, 15.8, 15.c	Ecosystem Structure Species Populations Ecosystem Function



MBON
Marine Biodiversity
Observation Network








Indicator 14.5.1.
Coverage of protected areas
in relation to marine areas



Target 14.2
Prototype product to
integrate EO, OBIS data,
local surveys



The way forward...

-  Biodiversity is a relatively new topic for space agencies...
-  The biodiversity community needs to articulate and voice its observational needs, mapped to research, assessments, and decision-support objectives
-  EBVs are a strong mechanism to communicate to space agencies.
-  Need for a refined and approved list of RS-enabled EBVs
-  Requirements to produce those EBVs need to be communicated to CEOS
-  Biodiversity community and remote-sensing expert collaborations
-  Funding agencies need to continue to support this process

If you want to know more

COMMENT



Convention on
Biological Diversity

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1 December 2017

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE

Twenty-first meeting
Montreal, Canada, 11–14 December 2017
Item 7 of the provisional agenda*

REMOTE SENSING ENABLED ESSENTIAL BIODIVERSITY VARIABLES

Remote Sensing in Ecology and Conservation

Open Access

ZSL

POLICY FORUM

Earth observation as a tool for tracking progress towards the Aichi Biodiversity Targets

Brian O'Connor¹, Orliana Socades¹, Johannes Penner², Ruth Sonnenzheim³, Andrew Skidmore⁴, Neil G. Burgess⁵, A. Jon M. Hutton⁶

PUBLISHED IN *BIODIVERSITY CONSERVATION* ON 22 JULY 2018

comment

Monitoring plant functional diversity from space

The world's ecosystems are losing biodiversity fast. A satellite mission designed to track changes in plant functional diversity around the globe could deepen our understanding of the pace and consequences of this change, and how to manage it

Walter Jetz¹, Jeanine Cavender-Bares¹, Ryan Patrick¹, David Söllner¹, Frank W. Davis¹, Gregory P. Asner¹, Robert Guralnick¹, Jens Kattig¹, Andrew M. Latimer¹, Paul Mueserlich¹, Mikko E. Schaepman¹, Mark P. Schillhofer¹, Tobias D. Schuster¹, Franziska Schmidt¹, Linke Stahl¹ and Susan L. Huber¹

Remote Sensing in Ecology and Conservation

Open Access

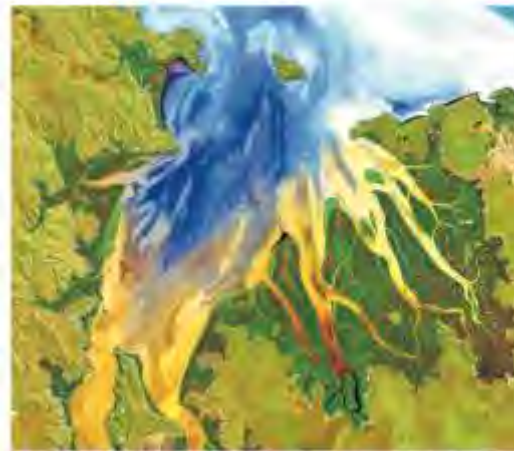
ZSL

POLICY FORUM

Satellite remote sensing of ecosystem functions: opportunities, challenges and way forward

Nathalie Pettorelli¹, Henrike Schirre¹ to Bühne¹, Ayesha Tildner², Grigore Nădăreț³, Cătă Mădălina Nădăreț³, Ana M. Quiroz⁴, David A. Kesteven⁵, Martin Weigmann⁶, Franziska Schirre¹, Marion Stelbrink⁷, Ruth Sonnenzheim⁸, Gary H. Geller^{9,10}, Shourenqiang Ray¹¹, Ben Sotnick¹², Nicholas Murray¹³, Lucie Blain¹⁴, Ben Gjeltensoffer¹⁵, Jeremy T. Kane¹⁶, Stéphanie Brostier¹⁷, Pedro J. Lehner¹⁸, Claire Duncan¹⁹, Ghana El Sereny²⁰, Kato S. Hsu²¹, Julia L. Bianchi²², Richard Lucas²³, Paola Meloni²⁴, Thomas J. Webb²⁵ & Emily Mitchell²⁶

22 JULY 2018 | VOL 266 | NATURE | 20



Coastal sediment and vegetation patterns in Australia, captured by NASA's Landsat 8 satellite in 2013.

Agree on biodiversity metrics to track from space

Ecologists and space agencies must forge a global monitoring strategy, say **Andrew K. Skidmore**, **Nathalie Pettorelli** and colleagues.

Global biodiversity loss is intensifying. But it is hard to assess progress towards the Aichi Biodiversity Targets for 2011–20 set by the Convention on Biological Diversity (CBD). Target 5, for instance, aims to halve global deforestation rates by 2020, but reliable indicators for deforestation that can be monitored remotely have not been developed or agreed on. National biodiversity monitoring programmes differ widely, most data sets are inconsistent, and few data are shared openly.

To focus priorities, ecologists have proposed classes of 'essential biodiversity variables' — including species traits and populations, and ecosystem function and structure. But measuring these on the ground is laborious and limited.

Satellite remote sensing is crucial to getting long-term global coverage. It can rapidly reveal where to reverse the loss of biological diversity at a wide range of scales in a consistent, borderless and repeatable manner. Quantities such as vegetation productivity or leaf cover can be measured across continents from space. But there is no agreement on how to translate these measurements into metrics that are relevant for biodiversity monitoring.

We call on conservation and space agencies to agree on a definitive set of biodiversity variables and how these will be tracked from space, to address conservation targets. Methods to derive these variables and the set of satellites needed to observe them must also be decided, to ensure continuous

Michele Walters
Robert J. Scholes
Editors

Open Access

The GEO Handbook on Biodiversity Observation Networks

GEOBON

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Thank you

For more information:

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