



8th International  
Conference on  
**BIG DATA**  
& Data Science for Official Statistics

**BILBAO 2024**

Informing Climate Change and  
Sustainable Development Policies  
with Integrated Data

**BILBAO. SPAIN** | **10-14 JUNE 2024** | **#UNBigData2024**

# Earth Observation data for biodiversity Perspectives from the Committee on Earth Observation Satellites (CEOS)

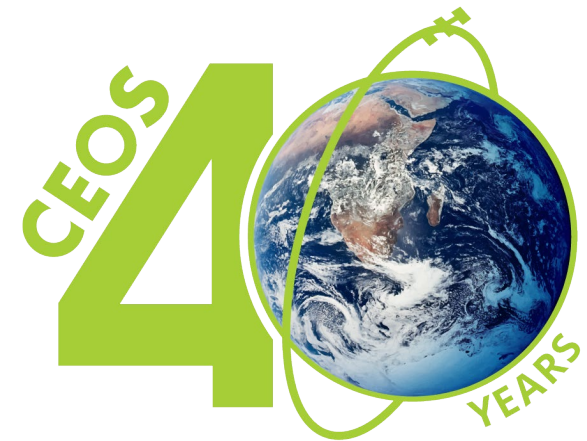
Informing biodiversity policies through use of big data, remote sensing and citizen science  
Marc Paganini (European Space agency)



Mission: CEOS ensures international coordination of civil space-based Earth observation programs and promotes exchange of data to optimize societal benefit and inform decision making for securing a prosperous and sustainable future for humankind.

## CEOS Primary Objectives:

- To optimise global societal benefit from space-based Earth observation missions
- To serve as the focal point for sustained international coordination among space-based Earth observation programs, remote sensing experts, and activities
- To promote complementarity and compatibility for the benefit of data user communities worldwide



# CEOS Membership



The Committee on Earth Observation Satellites (CEOS) was established in 1984 under aegis of the G7 Economic Summit of Industrial Nations Working Group on Growth, Technology, and Employment

CEOS comprises

- **34 Members**  
(*Space Agencies*)
- **30 Associates**  
(*UN Agencies, Phase A programmes or supporting ground facility programmes*)

All of whom contribute to CEOS on a **best efforts and voluntary basis.**

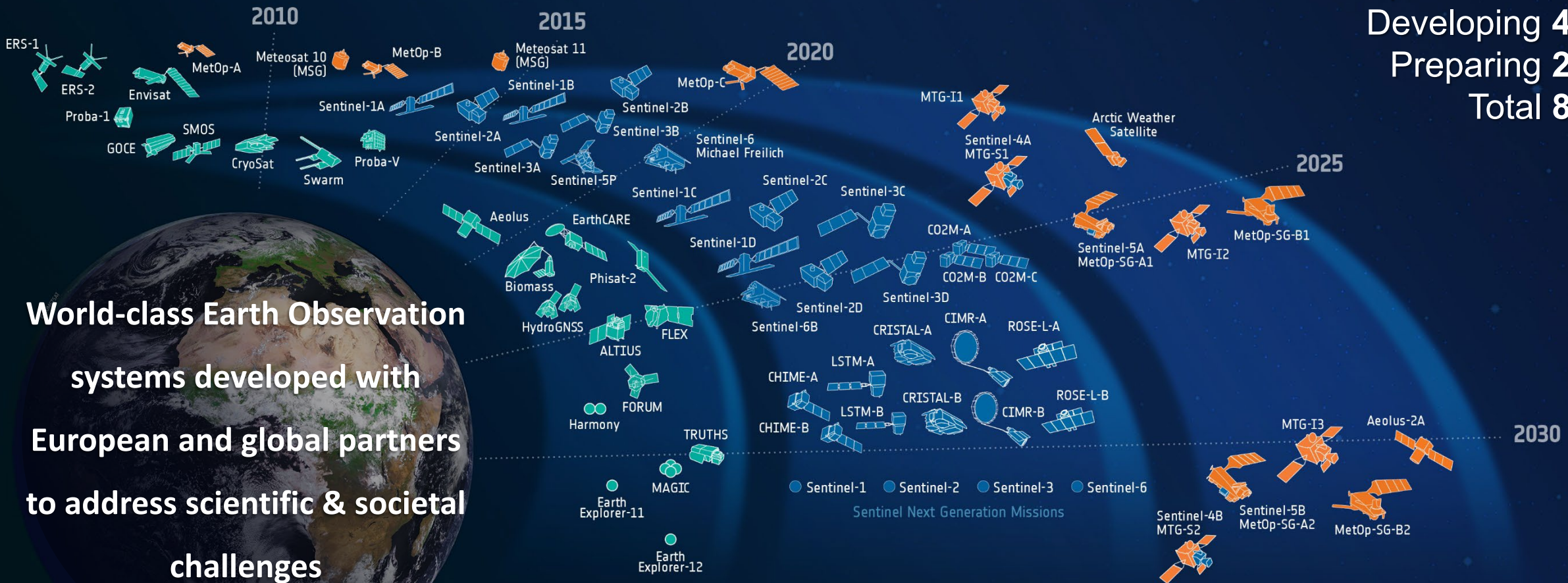


# ESA's Earth Observation Missions



## Satellites

Heritage 06  
 Operational 14  
 Developing 41  
 Preparing 22  
 Total 83



World-class Earth Observation systems developed with European and global partners to address scientific & societal challenges

Science Copernicus Meteorology



# The European Copernicus Programme



**State-of-the-art  
observations with  
unprecedented coverage**

**sentinel-1**

**→ RADAR VISION**



**Systematic data availability**

**sentinel-2**

**→ COLOUR VISION**



**Full, free and open data  
policy**

**sentinel-3**

**→ A BIGGER PICTURE**



**Long-term availability**

**sentinel-4**

**→ EUROPEAN AIR MONITORING**



**sentinel-5p | sentinel-5**

**→ GLOBAL AIR MONITORING**



**sentinel-6**

**→ SURFING THE SEAS**



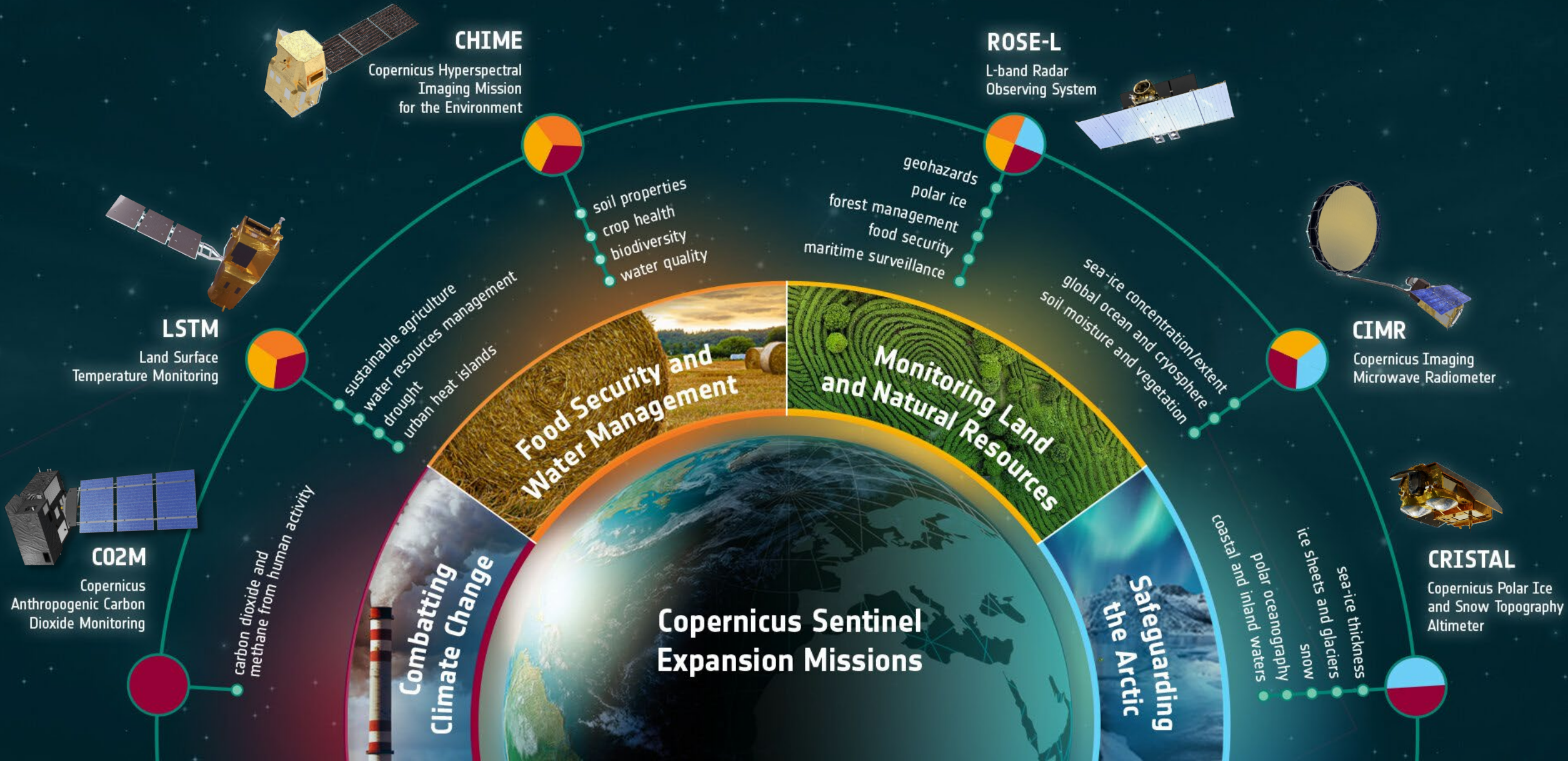
→ Know more: <https://copernicus.eu> and <https://sentinels.copernicus.eu>



PROGRAMME OF THE  
EUROPEAN UNION



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Ensure that climate observation requirements identified by the Global Climate Observing System (GCOS) – and implications of the **Paris Climate Agreement** – are addressed.



Ensure, in the context of the **Sendai Framework for Disaster Risk Reduction 2015-2030**, that CEOS Agency data are made available in support of disaster risk reduction and that CEOS continues engagement with UN agencies and authorities.



Ensure that space-based Earth observation data and products are integral to the success of the next decade of the Group on Earth Observations (GEO), and that CEOS contributions to, and engagement in, GEO governance and leadership are further enhanced.

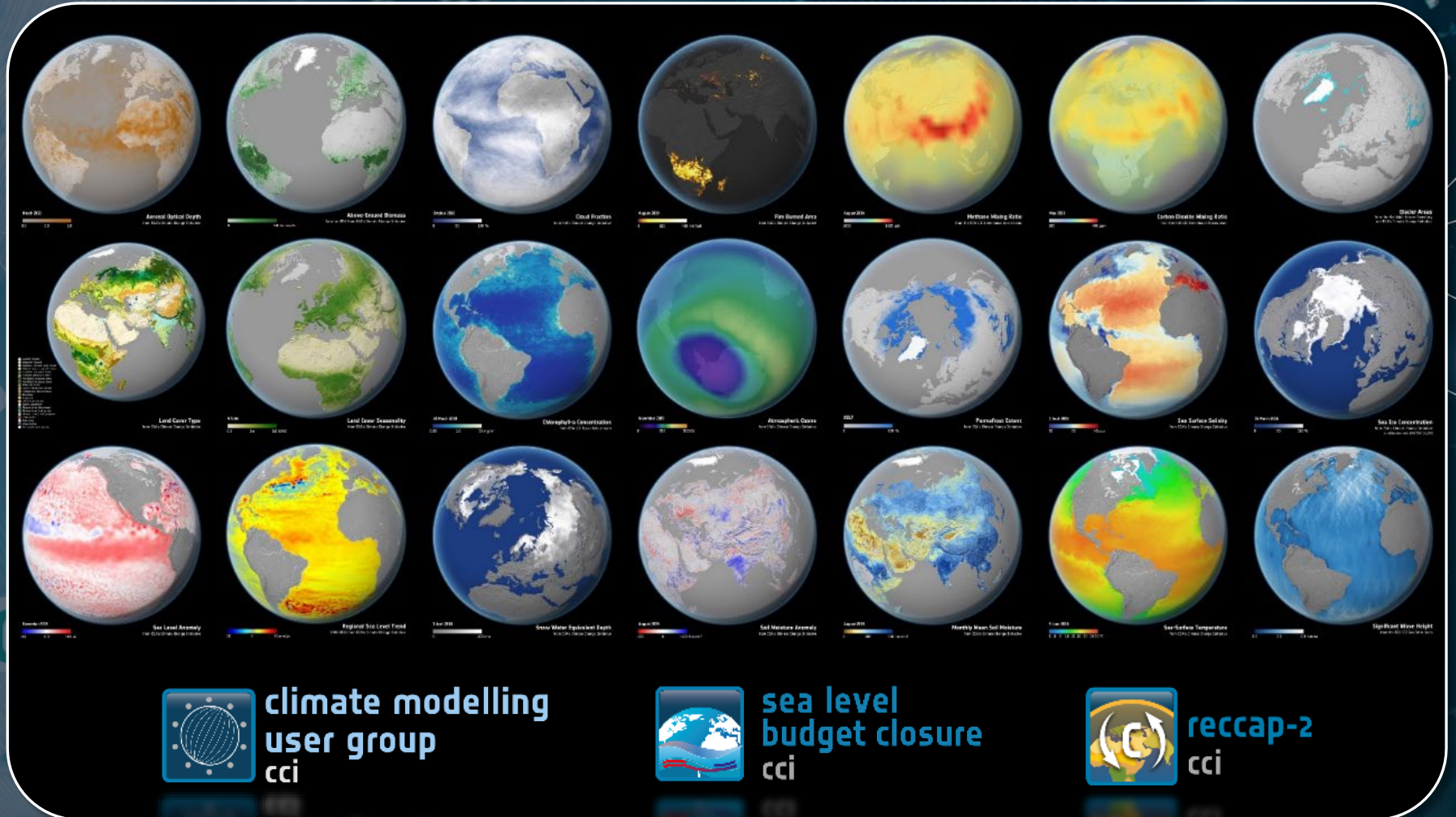


Systematically engage in and contribute to global efforts on the critical challenges that face humanity in support of the **UN 2030 Agenda for Sustainable Development**.

# ESA's Climate Change Initiative: Climate Space

## 27 Essential Climate Variable (ECV) Being Monitored

- Response to UNFCCC and IPCC needs for **systematic global climate observation**
- ECV datasets provide **long-term empirical evidence** to predict & understand key parts of the climate
- 54 defined ECVs, 36 monitored from space, **27 under development** by ESA under CEOS coordination.






## White paper on Ecosystem Extent

- Explore new opportunities for using space-based Earth observation from current and future satellite missions for mapping the extent and distribution of ecosystems on Earth

## Ecosystem Extent Demonstrators

- Designed around data cubes
- Combine satellite data from different sensors
- allow cutting edge ecosystem mapping

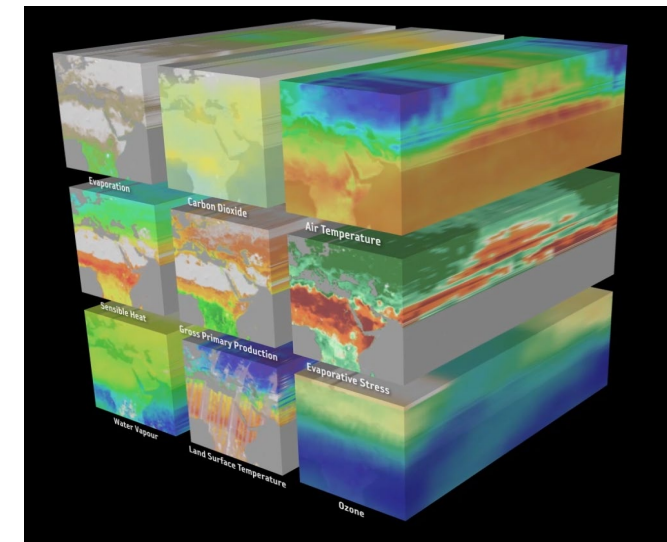
Space-based Earth Observation and Ecosystem Extent



CEOS Ecosystem Extent Task Team White Paper V1.0

**Space-based Earth Observation and Ecosystem Extent: Exploring Opportunities**

Sensor type	Key Ecosystem Characteristics
Optical - Multispectral	Composition (coarsely) Functional traits (coarsely)
Optical - Hyperspectral	Composition Functional traits
Radar	Physical structure Height
Lidar	Physical structure Vertical structure



1

Exploring a Post-2024 Strategy for CEOS on Biodiversity

2

Increase Policy Footing and Linkages of CEOS in the Biodiversity Community

## 2050 Vision

“by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people”

## GBF Mission for 2030

“To take urgent action to halt and reverse biodiversity loss to put nature on a path to recovery for the benefit of people and planet by conserving and sustainably using biodiversity and by ensuring the fair and equitable sharing of benefits from the use of genetic resources, while providing the necessary means of implementation”.

4 overarching  
long-term  
Goals for 2050

23 targets  
for 2030

GBF  
Monitoring  
Framework

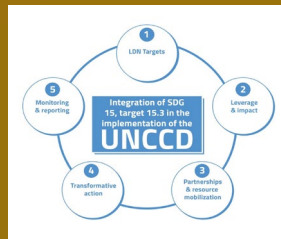
Resource  
Mobilisation

# SEEA EA underpins the GBF and other Multilateral Environmental Agreements

## UN Convention to Combat Desertification (UNCCD)

### UNCCD 2018-2030 Strategic Framework

Strategic Objective 1: to improve the conditions of ecosystems



## Convention on Biological Diversity (CBD)

### Kunming Montreal Global Biodiversity Framework (GBF) and its monitoring framework



## UN Framework Convention on Climate Change (UNFCCC)

### UNFCCC Paris Agreement



### Glasgow Climate Pact



## Ramsar Convention on Wetlands

### Ramsar Strategic Plan (2016 – 2024)

Conservation and wise use of all wetlands



## UN SEEA Ecosystem Accounting

International standard on Ecosystem Accounting that regulates the production of statistical accounts on ecosystem extent, condition and services, underpinning the development of monitoring frameworks of other MEAs.



## Sustainable Development Goals (SDGs)



### SDG Target 6.6

Protect and restore water-related ecosystems



### SDG Target 14.2

Sustainably manage and protect marine and coastal ecosystems



### SDG Target 15.1

Ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems.

# GEO BON Mission and Structure



## Mission:

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

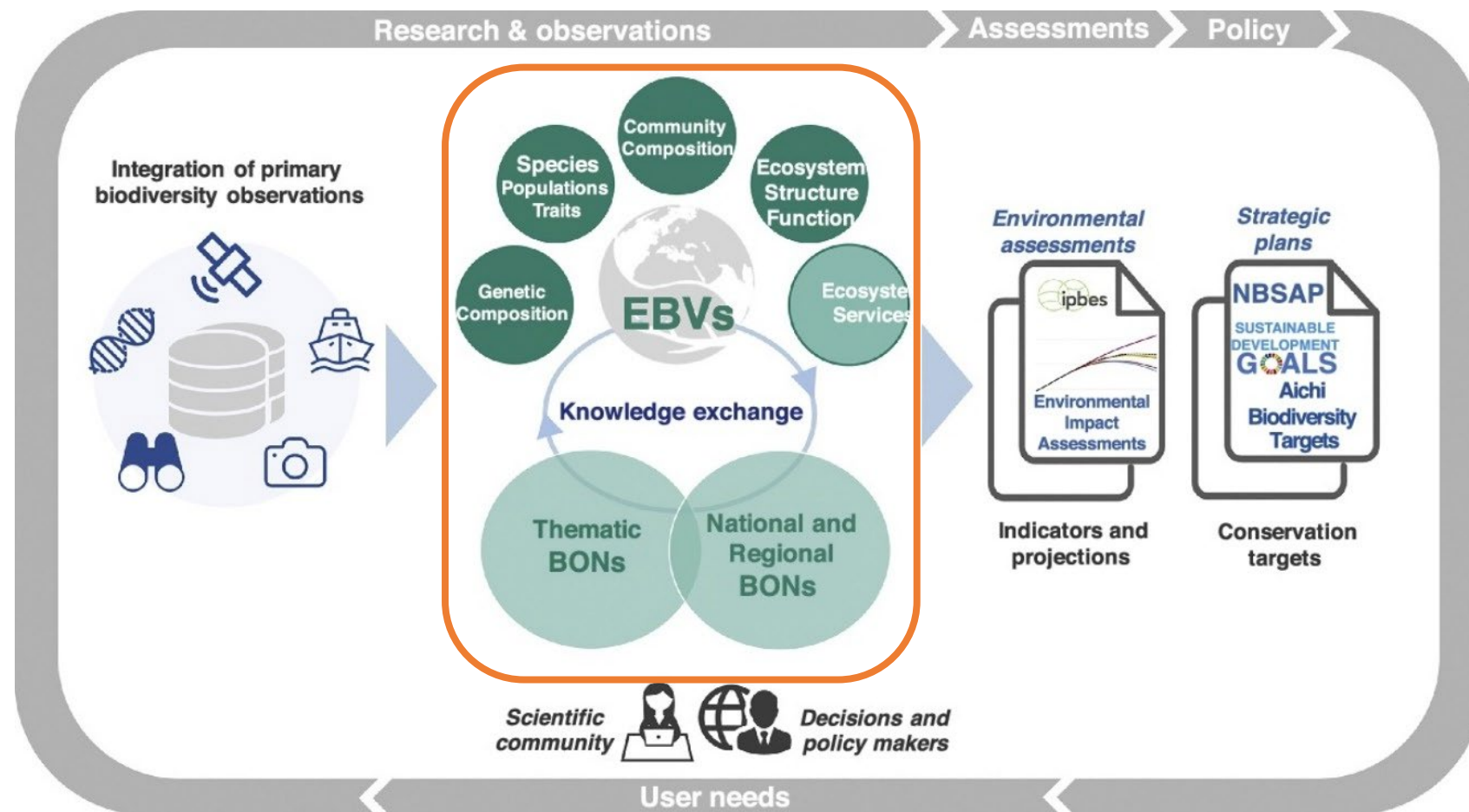


Andrew Gonzalez

Co-chairs



Maria Cecilia Londoño



A global network: 2462 registered members, 140 countries, 1525 institutions

# Essential Biodiversity variables for monitoring

EBV classes

Genetic Composition

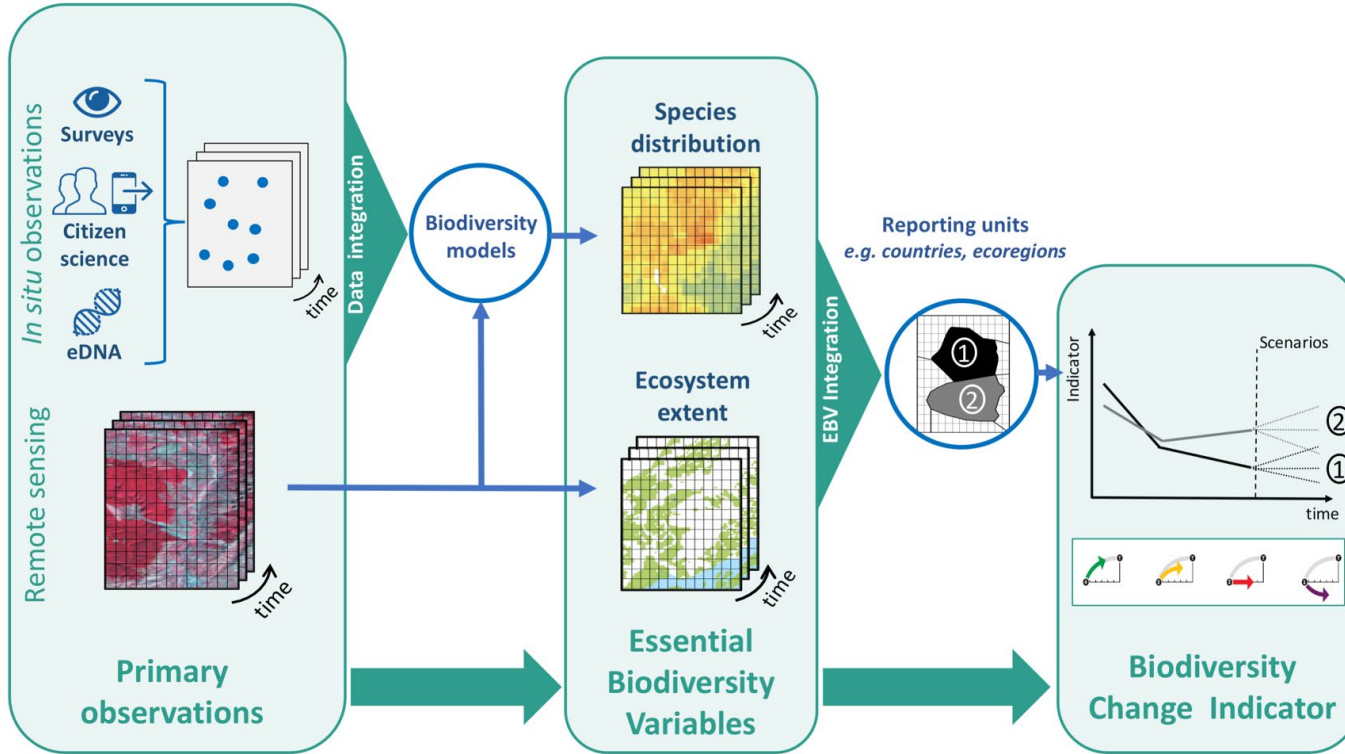
Species Populations

Species Traits

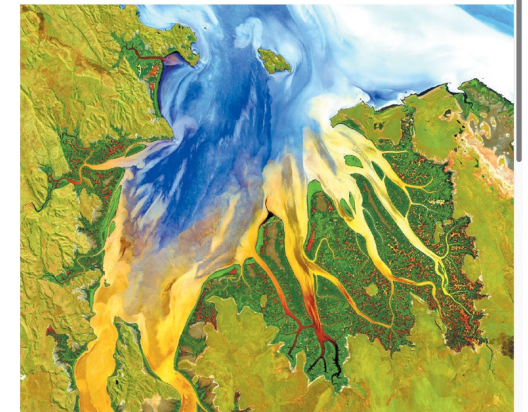
Community Composition

Ecosystem Structure

Ecosystem Functioning



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

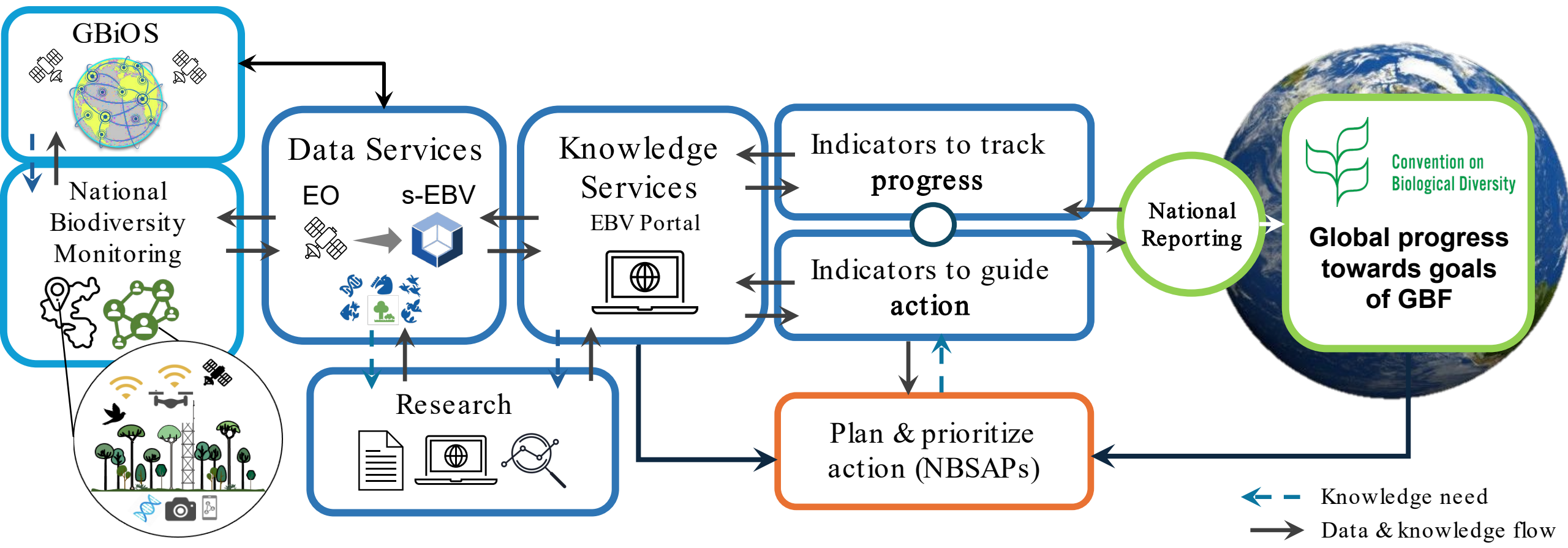
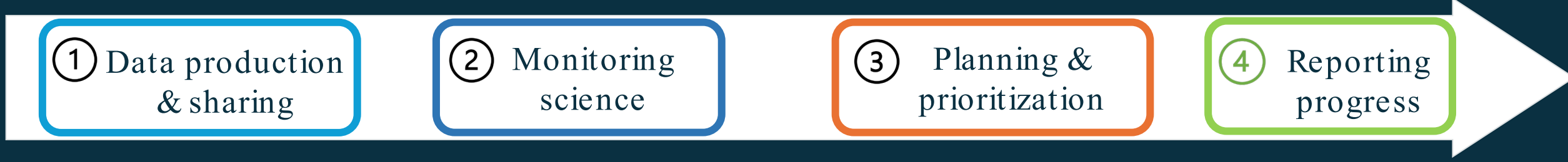


Estuary sediment and vegetation patterns in Australia, captured by NASA's Landsat 8 satellite in 2013.

Agree on biodiversity metrics to track from space

Priority list of biodiversity metrics to observe from space

# Linking national monitoring to indicators, reporting and action



- Address the **data and knowledge gaps in the mapping of ecosystem extent** (Global Ecosystem Typology Level 3) in support of the GEO Global Ecosystem Atlas partnership.
- Support the development of methods for the **detection of changes in ecosystem extent and ecosystem conditions**.
- Support the development of scientifically robust, **globally applicable and scalable methods for RS-enabled EBVs** (essentially EBVs on ecosystem structure and function), supporting the work of GEO BON in defining and delivering the Essential Biodiversity Variables required by the CBD and its parties (NBSAPs).
- Review and assess the **generation of Biodiversity Data Records (BDRs) from satellite observations** which can support the development of Essential Biodiversity Variables (EBV) and Essential Ecosystem Service Variables (EESV) products.
- Support the development of the **Global Biodiversity Observation Network (GBIOS)** led by GEO BON.





# BIOSPACE25

Biodiversity Insight from Space

10–14 February 2025 | ESA-ESRIN | Frascati (Rome), Italy