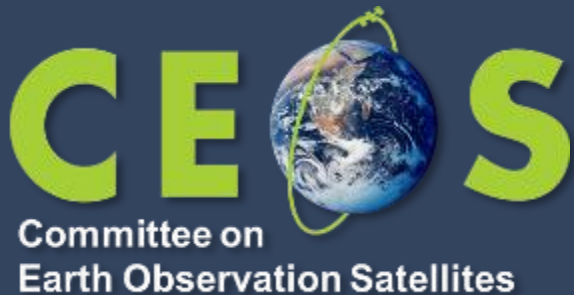


Biodiversity observation from space

Viewing Earth, Serving Society



Osamu Ochiai, JAXA
CEOS SIT Chair Team 2024-2025
AOGEO Symposium TG2
3 September 2024, Tokyo



CEOS Mission & Objectives



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.

Primary Objectives:

- ❖ To optimise the benefits of space-based Earth observation
- ❖ To serve as the focal point for international coordination of space-based Earth observation activities
- ❖ To encourage complementarity and compatibility

CEOS Membership



Established in 1984, 2024 is the CEOS 40th Anniversary!

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

All contributions to CEOS are on a 'best efforts' and voluntary basis.





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**.

CSA's CEOS Chair Priority for 2024 – Biodiversity



- ❖ 2022: Kunming-Montreal Global Biodiversity Framework (GBF).
- ❖ CEOS Agencies producing datasets and time series of relevance for many years. 2022: CEOS Ecosystem Extent Task Team.
- ❖ 2024: CSA CEOS Chair exploring a broader and structured CEOS response to biodiversity
- ❖ Seek stronger linkages and understanding of the biodiversity community and policy world
- ❖ Various stakeholders: UN CBD, UN SEEA, and GEO (GEO BON, EBVs, GBiOS; Global Ecosystems Atlas)
- ❖ Clear overlap between climate and biodiversity



<https://svs.gsfc.nasa.gov/4836/>



System of
Environmental
Economic
Accounting



Convention on
Biological Diversity



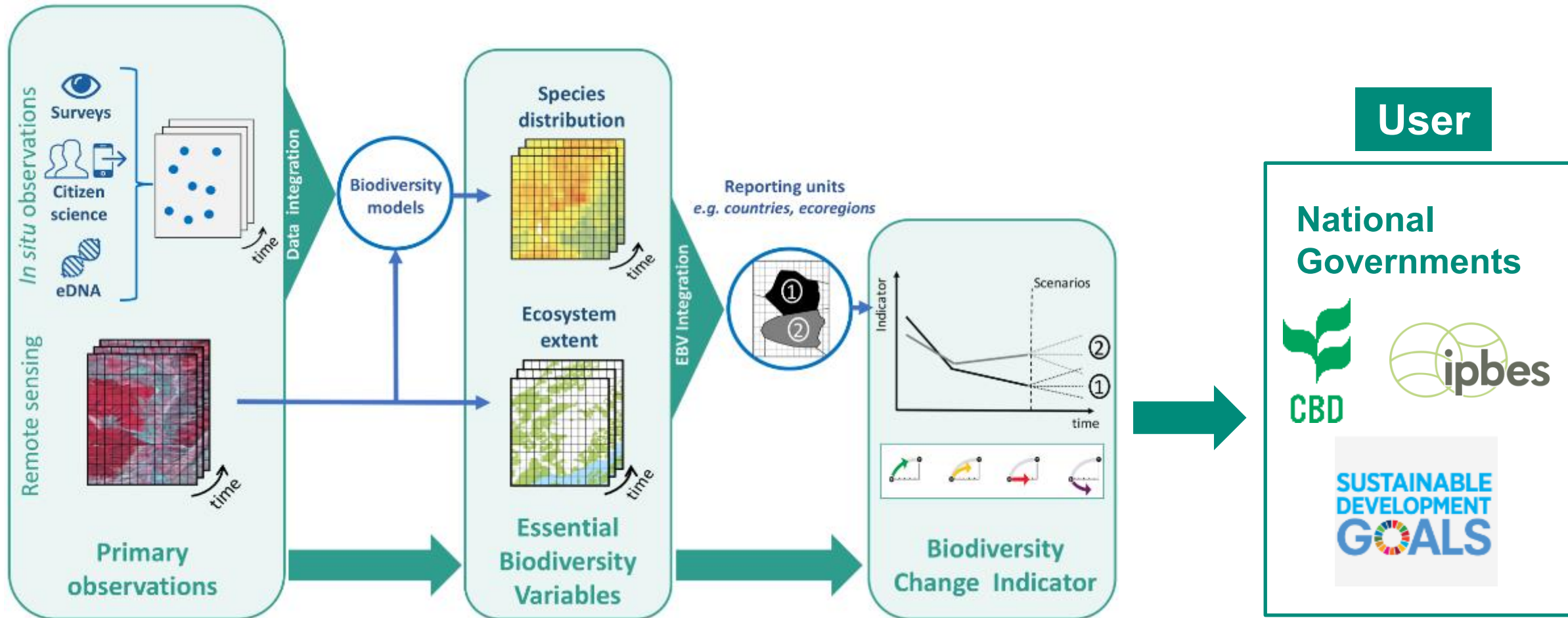
<https://www.nature.com/articles/s41559-023-02171-0>

What can we measure with RS?



- ★ Environmental characteristics (Temperature, precipitation, topography...)
- ★ Optical characteristics of vegetation
 - Greenness
 - + in situ data => Species distributions
 - Leaf & canopy “traits” (water content, structural compounds...)
- ★ Radar and lidar
 - Ecosystem structural characteristics (height, profiles)
- ★ Soil characteristics & content
 - Agriculture
- ★ Complementarity: Combine sources

Workflow: from raw observations to users



Navarro et al. 2017 COES

Purpose: To assess the utility for mapping Ecosystem Extent using current and forthcoming space-based observations.

Deliverables

- A **white paper** on space-based Earth observations for mapping and monitoring ecosystem extent
 - A **demonstrator** on the use of EO for ecosystem extent mapping and monitoring
- Overarching goal: Increased CEOS and Agency activity in Biodiversity

This is the driver behind formation of the TT

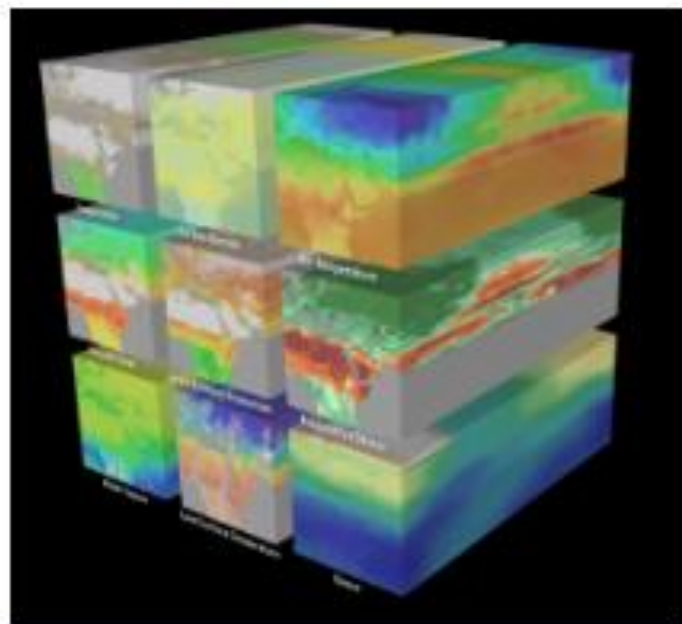


Ecosystem Extent Task Team work: 3 demonstrators have emerged:

- ❖ Objective: Demonstrate the use of EO for ecosystem extent mapping and monitoring
 - ❖ Delivery during fall 2024
 - ❖ Relevant to:
 - Convention on Biological Diversity (CBD)
 - UN System of Environmental Economic Accounting (SEEA)
-
- 1. Hudson's Bay Lowlands (HBL)- led by ECCC**
 - 2. Costa Rica Forested ecosystems - led by CNES/INRAE**
 - 3. Great Western Woodlands (GWW) - led by CSIRO**

❖ All three demonstrators

- Designed around data cubes
- Combine data from different sensors
- Are cutting edge activities
- Have life beyond 2024



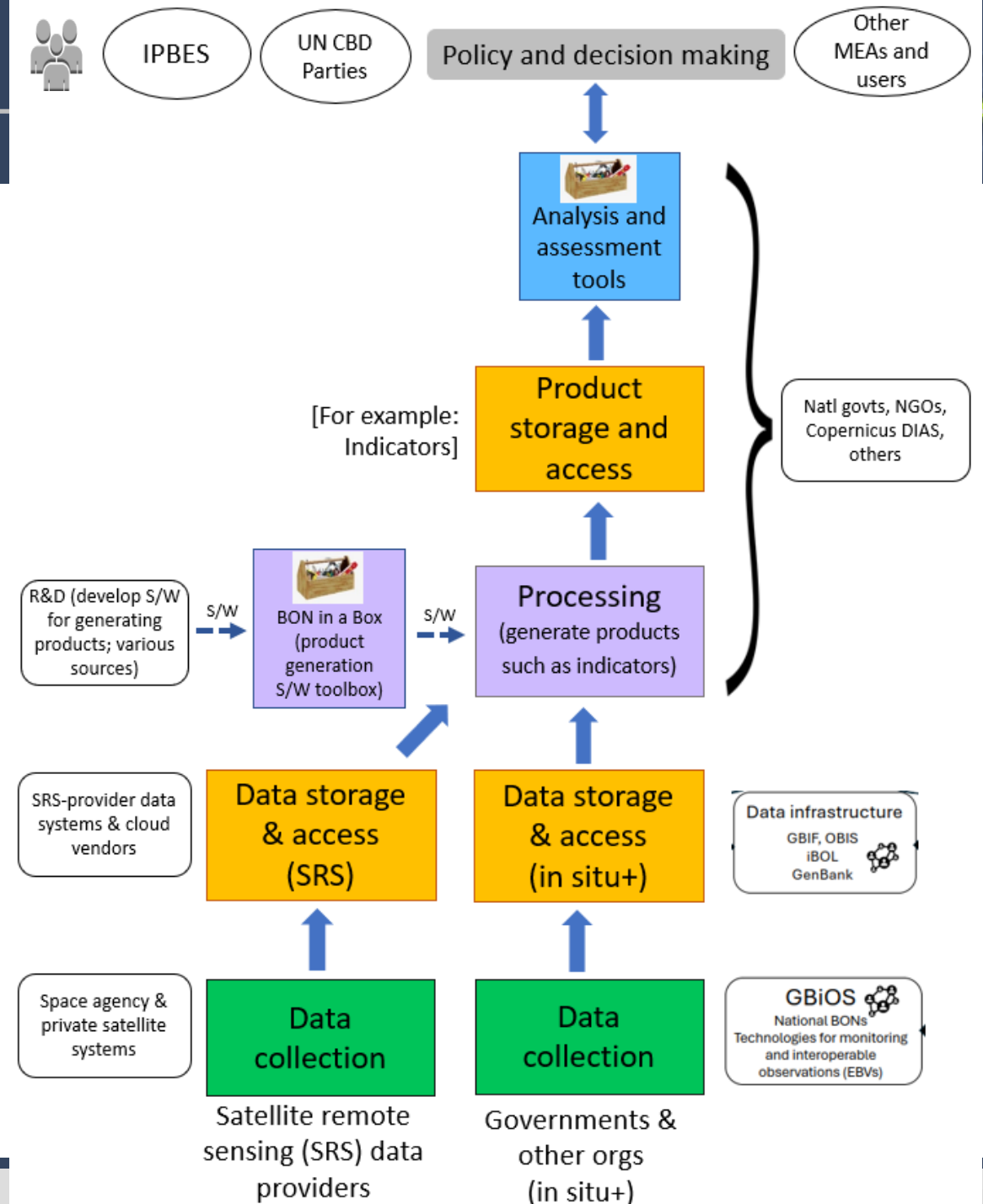
Sensor type	Key Ecosystem Characteristics
Optical - Multispectral	Composition (coarsely) Functional traits (coarsely)
Optical - Hyperspectral	Composition Functional traits
Radar	Physical structure Height
Lidar	Physical structure Vertical structure

Space Segment of GBiOS(?)

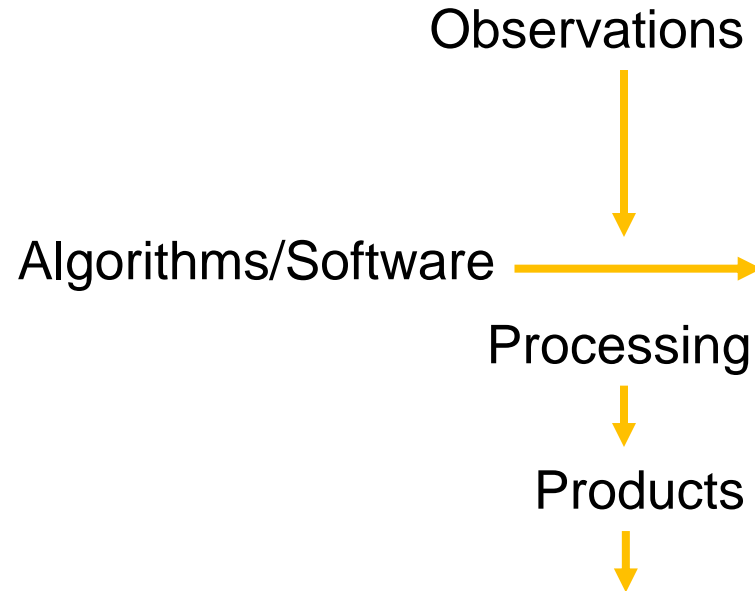
Very preliminary!

Left side of figure
Acquisition
Storage and access

Also, algorithm development



Who Does What? (Some thoughts)



What*	Who	Dependencies
Collect observations	<ul style="list-style-type: none"> Space agencies Private satellite companies Models Various (in situ) 	<ul style="list-style-type: none"> In situ data (including drone, airborne) User needs to guide collection <p>Also</p> <ul style="list-style-type: none"> Instrument technology (e.g., resolution)
Store & provide access to observations & products	<ul style="list-style-type: none"> Space agencies Private satellite companies Big tech companies 	<p>Access depends on</p> <ul style="list-style-type: none"> Search & access tools/ease of use FAIR principles
Process, to create products	<ul style="list-style-type: none"> Space agencies Private satellite companies Big & other tech companies ICOs Researchers 	<ul style="list-style-type: none"> Prioritized user needs (what to produce) Access to needed input data Algorithms/software to generate products Compute resources (IT capacity)
Analyze products	<ul style="list-style-type: none"> Space agencies Private satellite companies Big & other tech companies National governments, NGOs, ICOs, UN agencies, IPBES, researchers 	<ul style="list-style-type: none"> Prioritized user needs (what questions to answer) Access to products Quality products Analytical tools Capacity (knowledge & skills; IT)
Act	<ul style="list-style-type: none"> Governments at all levels Policy orgs 	<ul style="list-style-type: none"> Prioritized needs (what is important to acting org) Access to analyses

ICO: International Collaborative
Organization such as GBIF, OBis, IUCN

- **Ecosystems: mapping and monitoring**
 - ✓ Land cover maps and seascapes
 - ✓ Vertical structure
 - ✓ Function
- **Species: feedstock into models**
 - ✓ Species distribution
 - ✓ Forecasting CC impact
- **Genetics & phylogenetics**
 - ✓ Genetic variation reflects environment
 - ✓ Evolutionary history via functional traits



- ❑ Full coverage of in situ data is unlikely in the near future
- ❑ RS data are global, periodic, available, free
 - Use them to fill gaps
 - Combine with models
 - Interpolate
- ❑ Product uncertainty and probably accuracy will suffer
 - But this may be better than no product

Thank you!

