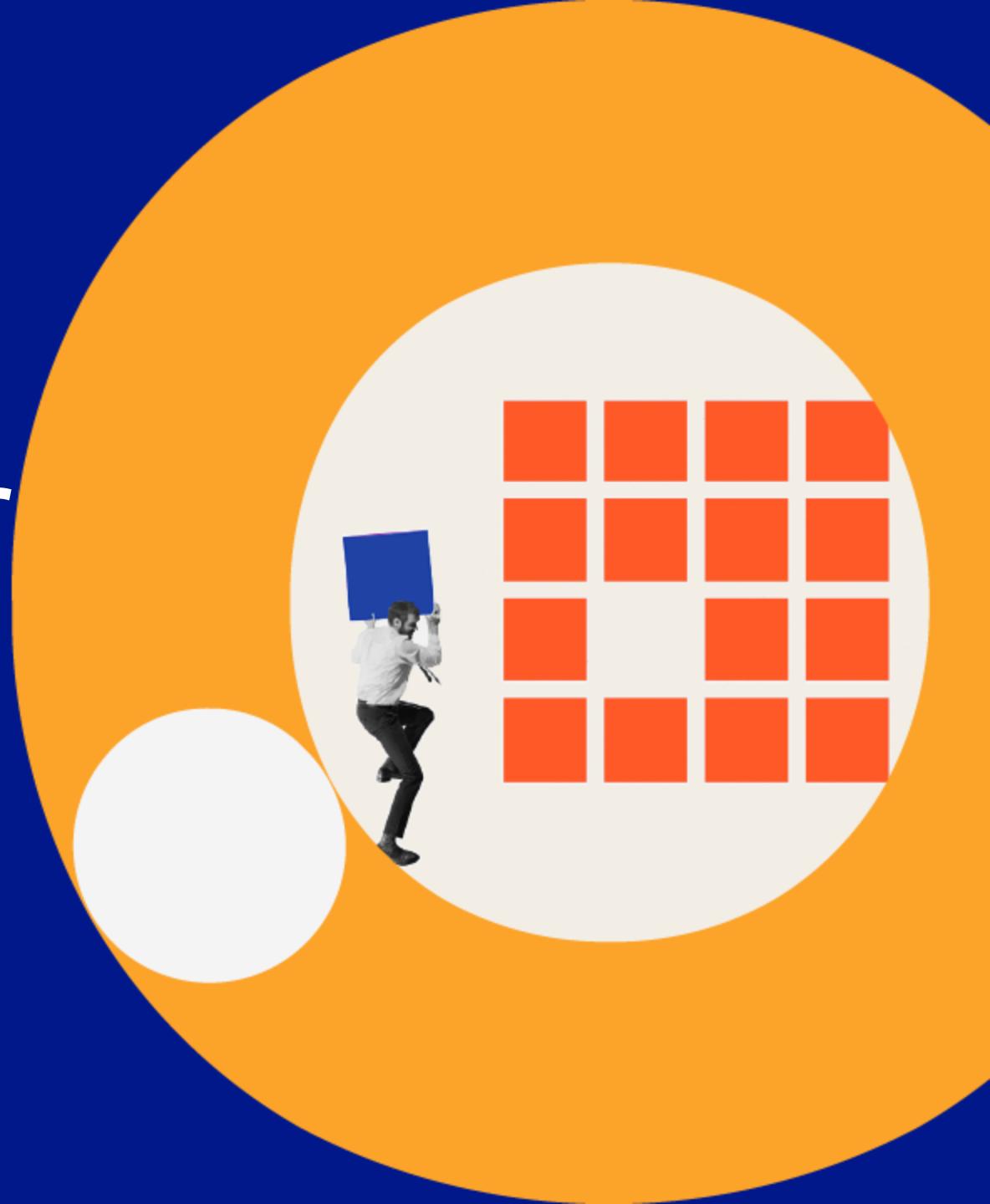


WEBINAR

'From space to species: using Earth Observation data for biodiversity'



Rules of the game



The webinar will be recorded and published on the data.europa academy



For questions, please use the ClickMeeting chat



Please reserve 3 min after the webinar to help us improve by filling in our feedback form



Today's speakers



Flora Kopelou
European Data Portal,
Publications Office of the EU



Federica Marando
Biodiversity Applications
Scientist, the European
Space Agency



Matthes Rieke
Managing Director,
52°North



Agenda

10.00 – 10.05

Opening and introduction – *Flora Kopelou*

10.05 – 10.25

Introduction to Earth Observation for biodiversity – *Federica Marando*

10.25 – 10:50

From data to biodiversity insights through real-world use cases – *Matthes Rieke*

10:50 – 11.15

Q&A and closing remarks



Earth Observation solutions for biodiversity monitoring

Federica Marando

Biodiversity Applications Scientist

Climate Action, Sustainability and Science Department

ESA ESRIN

federica.Marando@esa.int

data.Europa Academy Webinar 'From space to species: using Earth Observation data for biodiversity':
25/09/2026

ESA UNCLASSIFIED – For ESA Official Use Only

What is the European Space Agency?



**Make Space
for Europe**

**Promoting cooperation among
European States in space research,
technology and applications, for
exclusively peaceful purposes**

23

Member States



ESA in a Nutshell

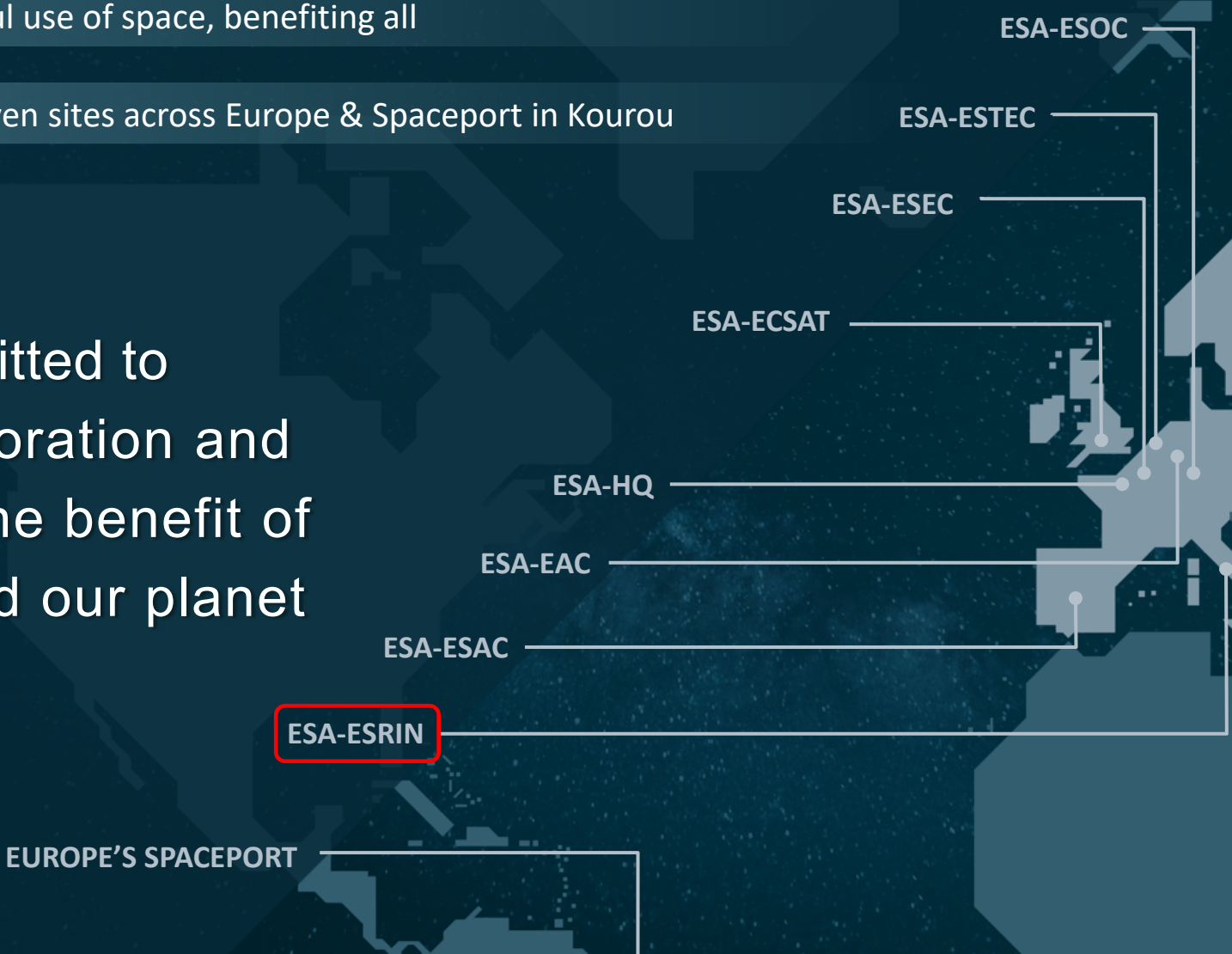


WHO 23* Member States, 2500+ staff members and total workforce of 6000+

WHY For the peaceful use of space, benefiting all

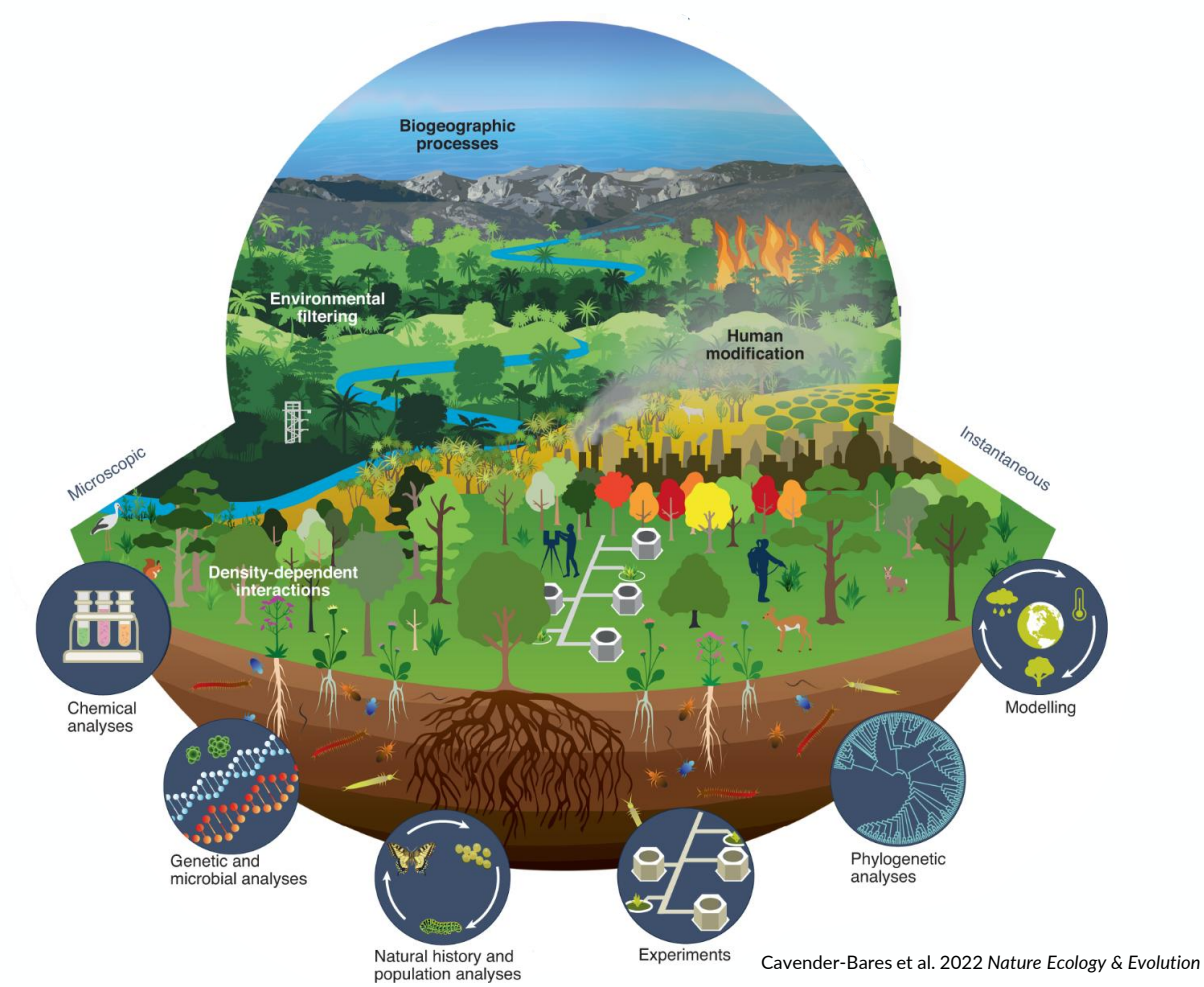
WHERE HQ in Paris, seven sites across Europe & Spaceport in Kourou

ESA is committed to the peaceful exploration and use of space for the benefit of people society and our planet



EO for biodiversity and ecosystem monitoring

Biodiversity and ecosystem changes happen locally, but tracking them at geographical scales and across decades is challenging with ground monitoring alone.



EBV classes

Genetic Composition



Species Populations



Species Traits



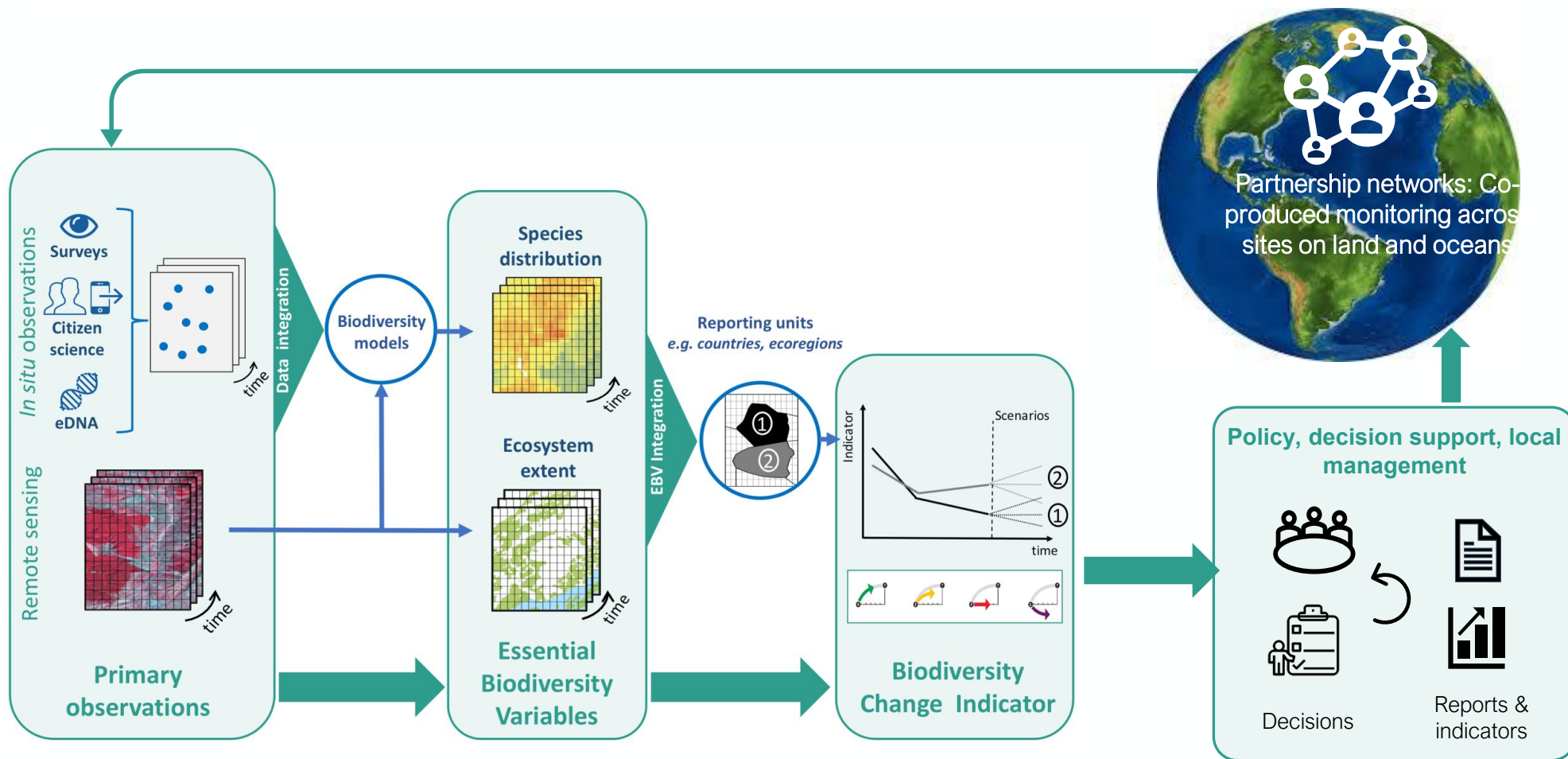
Community Composition



Ecosystem Structure



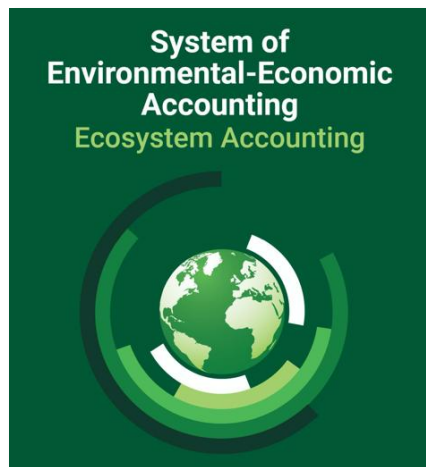
Ecosystem Functioning



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

Policy relevant | Feasible to monitor | Sensitive to change | Generalizable across realms | Scalable | Basis for indicators

Global and European Biodiversity Policies



Terrestrial, Freshwater, and Marine ecosystems

R&D priorities for Satellite RS Applications

- **Ecosystem Accounting** (Natural Capital Accounting)
- **Ecosystem Extent** (distribution of ecosystem types and their changes).
- **Ecosystem Condition** (condition indicators tailored to the different biomes)
- **Ecosystem Service modelling** (ecosystem regulating services related to climate adaptation and mitigation)
- **Ecosystem Conservation** (monitoring of PA / OECM management effectiveness, site suitability for new PAs)
- **Ecosystem Restoration** (ecosystem degradation, where to restore, monitoring of restoration projects)
- **Nature-based Solutions** (NBS)
- **Nature Finance** (Nature-related Financial Disclosures)

Building on the **Essential Biodiversity Variables** (EBVs)

Satellites

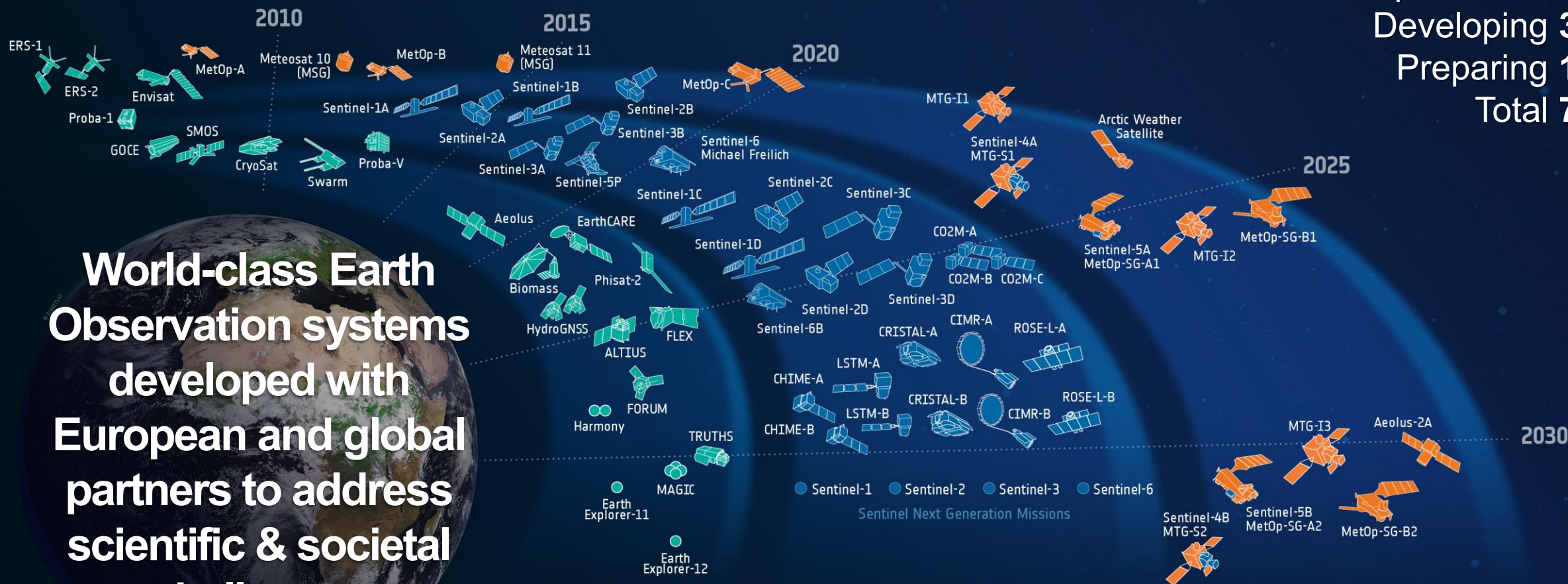
Heritage 06

Operational 14

Developing 39

Preparing 19

Total 78



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

Science



Copernicus



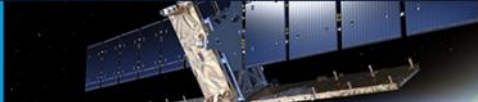
Meteorology



The Copernicus Space Component – Sentinels



PROGRAMME OF THE
EUROPEAN UNION



**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



sentinel-4

→ EUROPEAN AIR MONITORING



sentinel-5p | sentinel-5

→ GLOBAL AIR MONITORING



**Long-term
availability**

sentinel-6

→ SURFING THE SEAS



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

* ESA Sentinel Data Policy (Sep 2013) and
EU Delegated Act on Copernicus Data and Information Policy (Dec 2013)



→ THE EUROPEAN SPACE AGENCY

All global
landmass is
observed every
5 days at 10m
resolution

**30 TB of Daily Data
Production by Sentinels**

**350 TB of Daily Sentinel
Products Disseminated for
Services to Society**

**> 750.000
Registered Users**

Supporting 6
operational services



**Full, Free & Open
Data Policy***

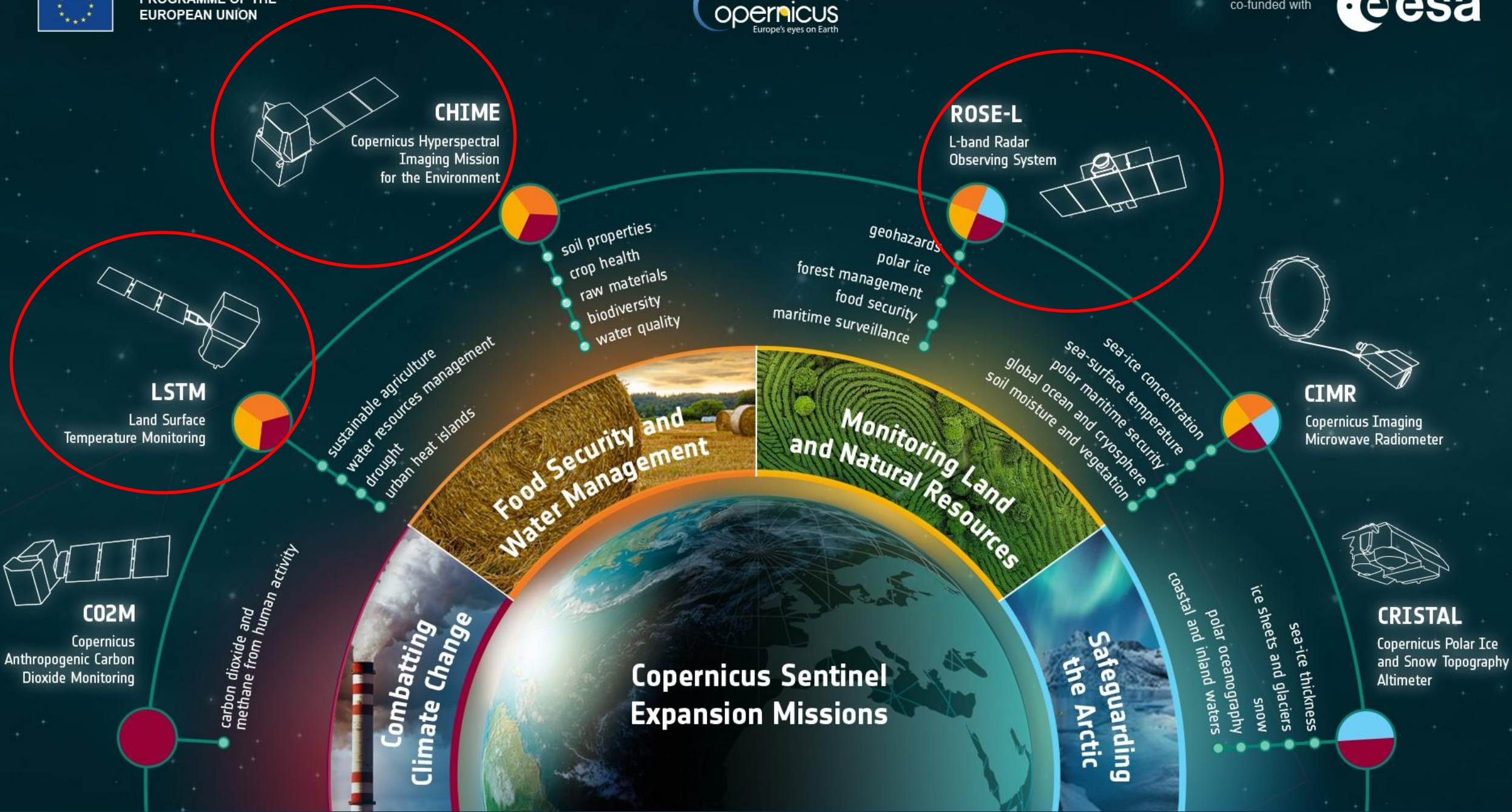
* ESA Sentinel Data Policy (Sep 2013) and
EU Delegated Act on Copernicus Data and Information Policy (Dec 2013)



PROGRAMME OF THE
EUROPEAN UNION



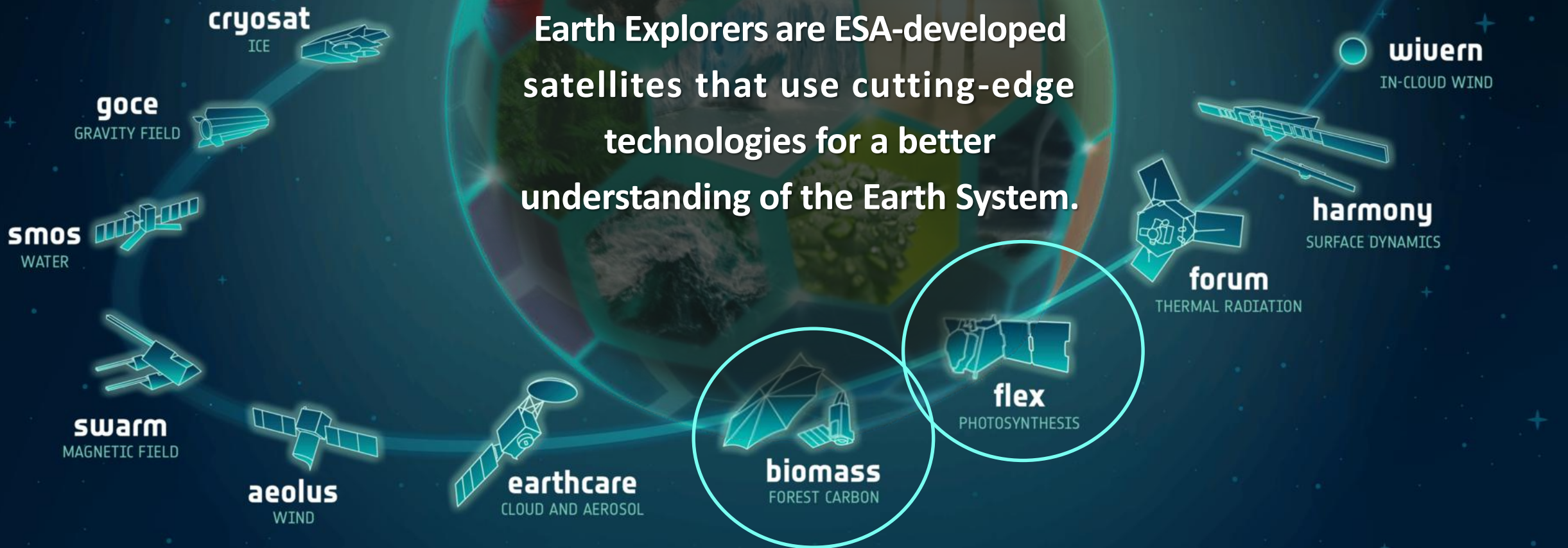
co-funded with



Earth Explorers

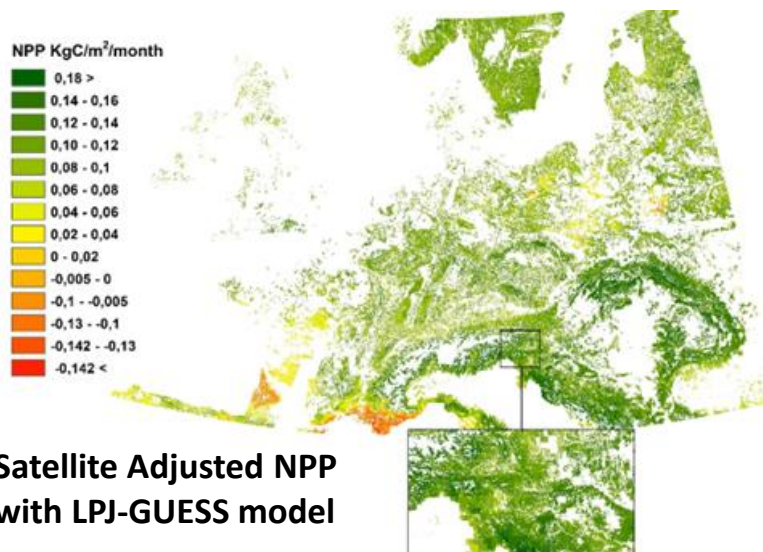
Pioneering Scientific and Technical Excellence

Earth Explorers are ESA-developed satellites that use cutting-edge technologies for a better understanding of the Earth System.



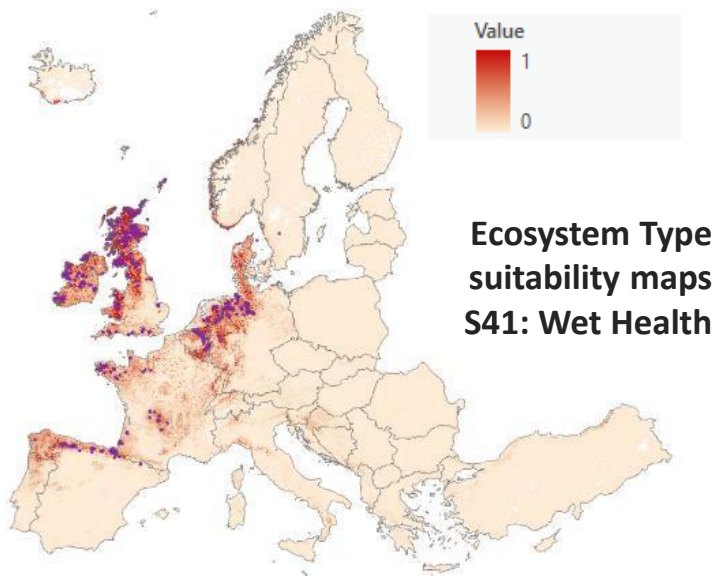
Selected ESA Projects on Biodiversity/ecosystems

Pilot 1 - Ecosystem Productivity and Health



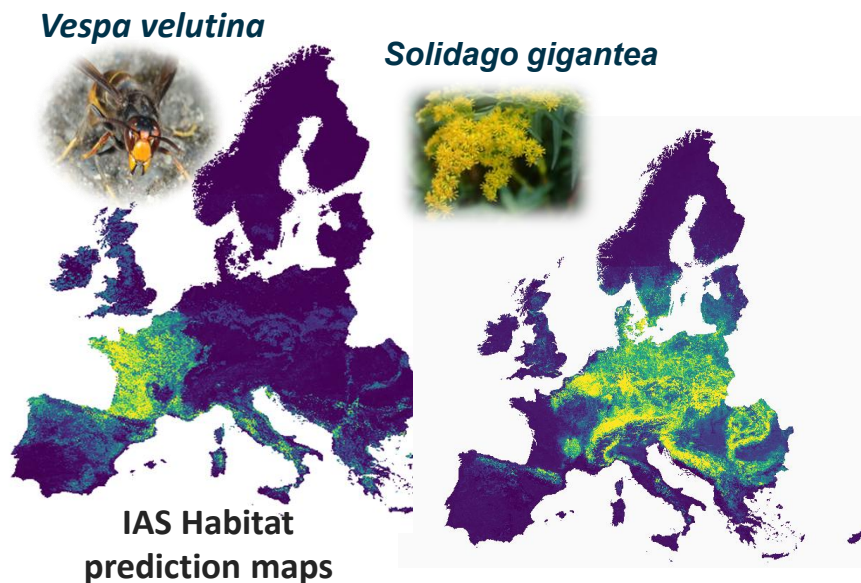
- Estimate forest productivity to assess forest health
- Quantify forest ecosystem conditions (resilience to drought)
- Potential areas for forest restoration

Pilot 2 – Terrestrial Habitat Modelling



- Integration of EO products within habitat modelling
- Improved European habitat modelling at the level 3 of the EUNIS classification
- European habitat suitability maps

Pilot 3 – Invasive Alien Species (IAS) Modelling

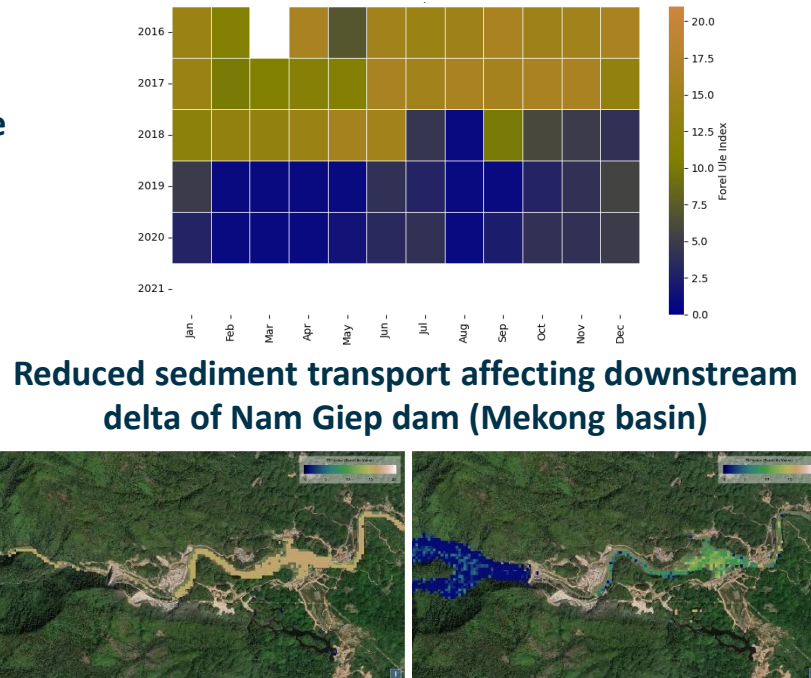
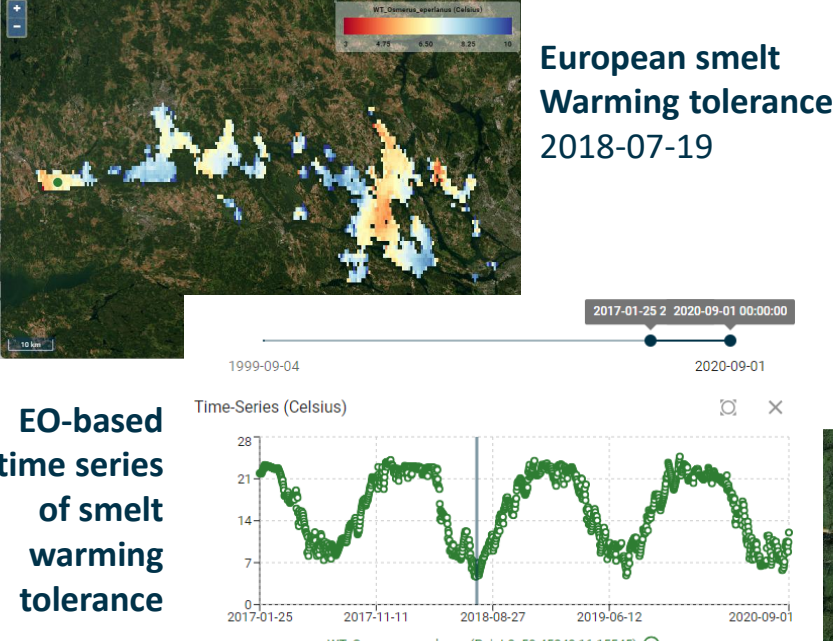
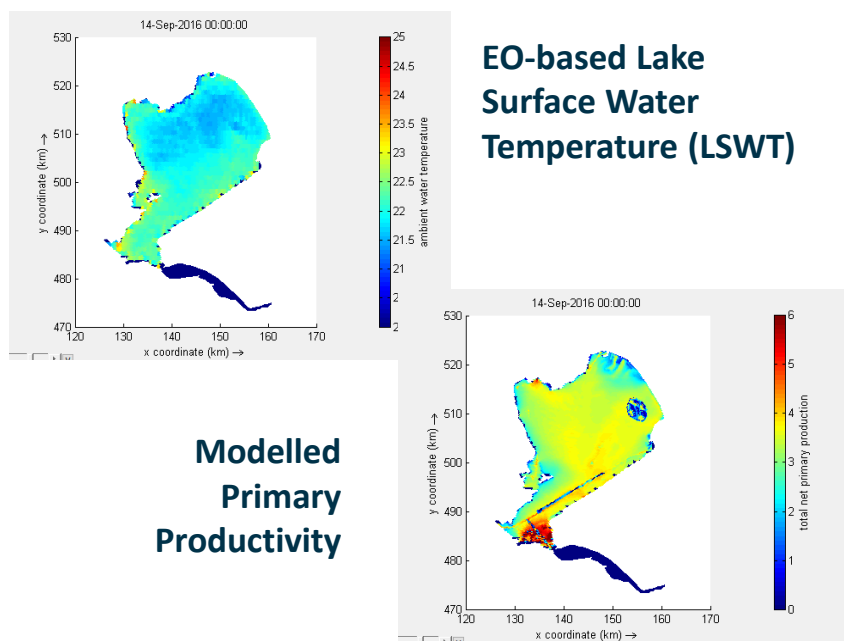


- Integrate advances in Deep Learning architectures & EO data within Species Distribution Models (SDM)
- Estimate potential distribution of invasive species

Pilot 1 – Pollution Lake Eutrophication

Pilot 2 – Climate Change Lake Surface Temperature

Pilot 3 – Land Use Change Connectivity



Impact of water pollution
on freshwater habitats in shallow lakes

Impact of water temperature increase
on freshwater fish diversity

Impact of dams
on river connectivity, sediment
transport and freshwater biodiversity



BiCOME - Variations of intertidal seagrass



Sentinel-2
April vs September 2021
Natura 2000 site



Read full story: [Sentinel-2 unveils the seasonal rhythm of intertidal seagrass](#)



Intertidal habitat mapping in France (Bay of Bourgneuf) with Sentinel 2

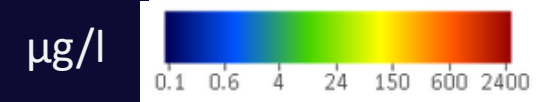


ALGAL CLASSES DIFFERENTIATION AND QUANTIFICATION IN LAKES



AQUA-SUP
project

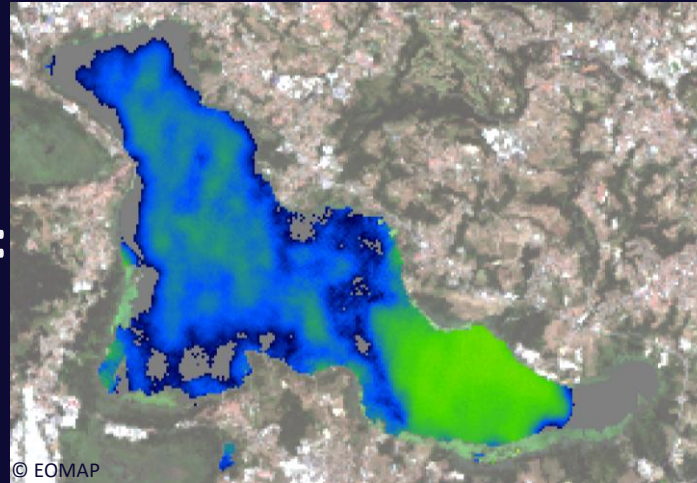
Scenario simulation with inverse modelling using hyperspectral data



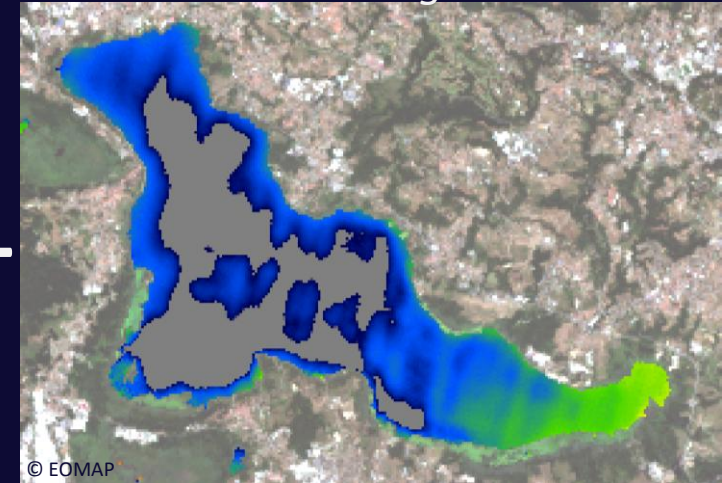
General Phytoplankton



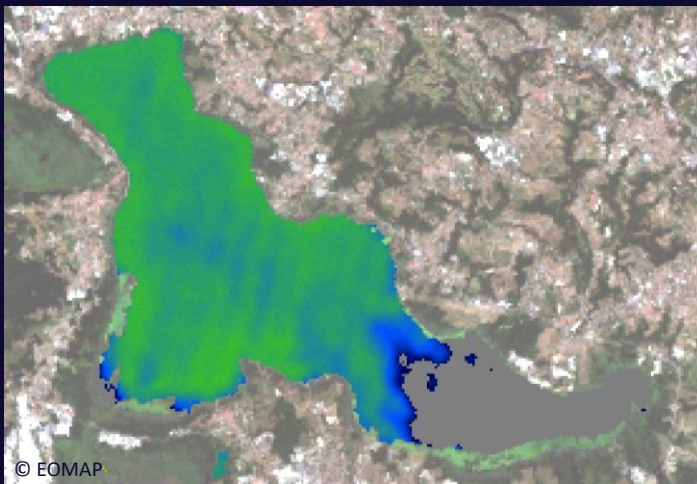
CHL-a dominated Phytoplankton



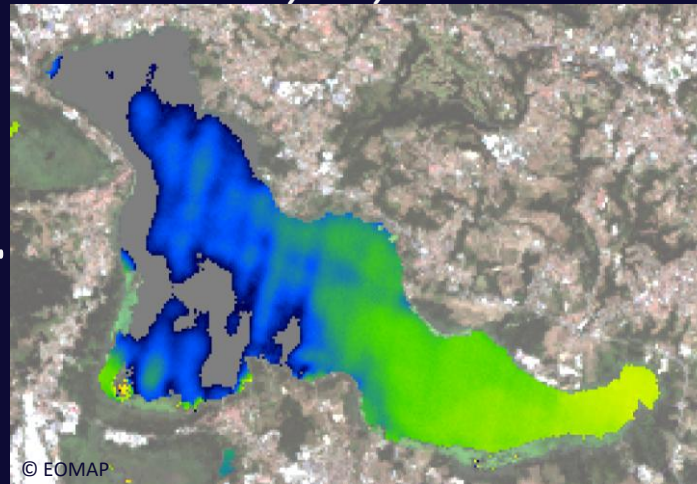
Green Algae



Diatoms



Phycocyanin



Phycoerythrin



Consortium
powered by



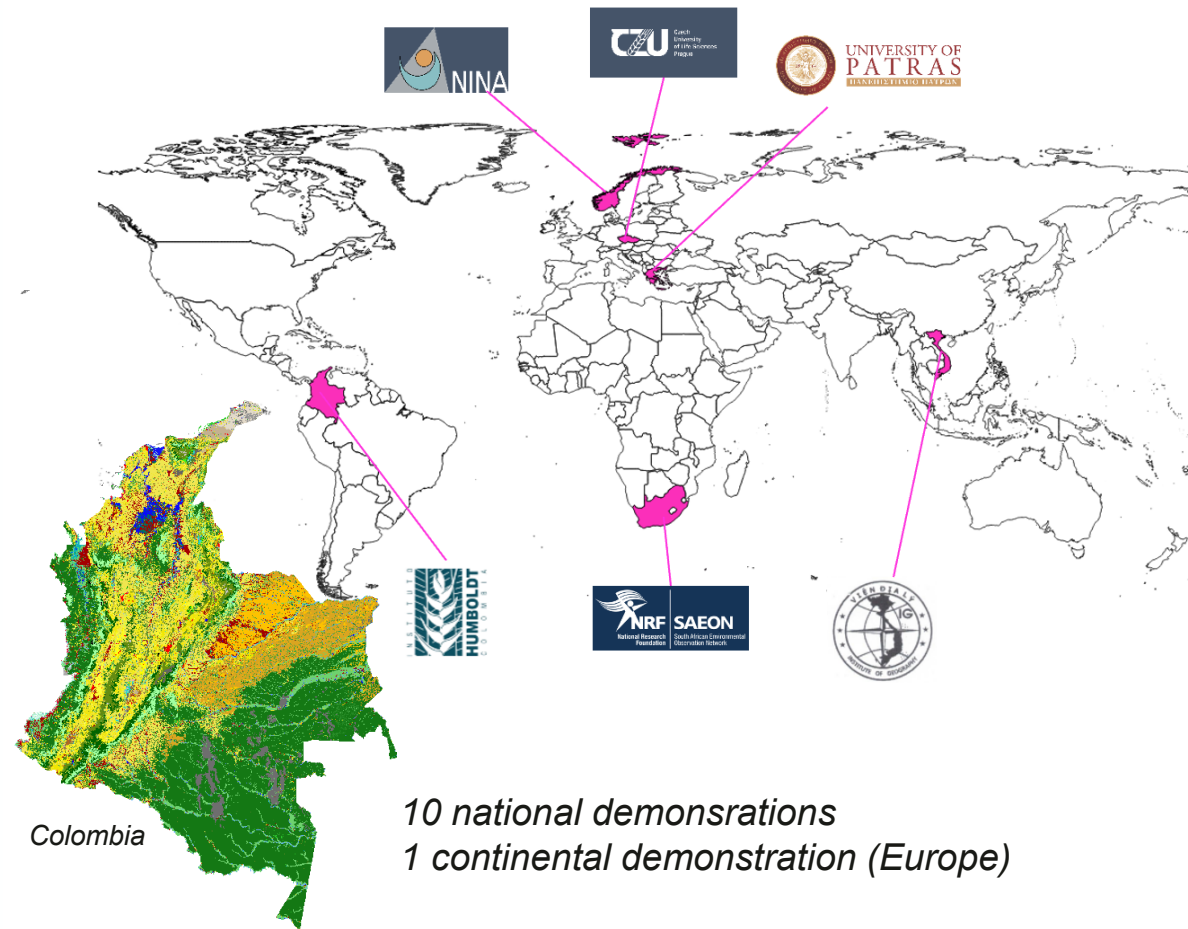
EOMAP

WEED - World Ecosystem Extent Dynamics

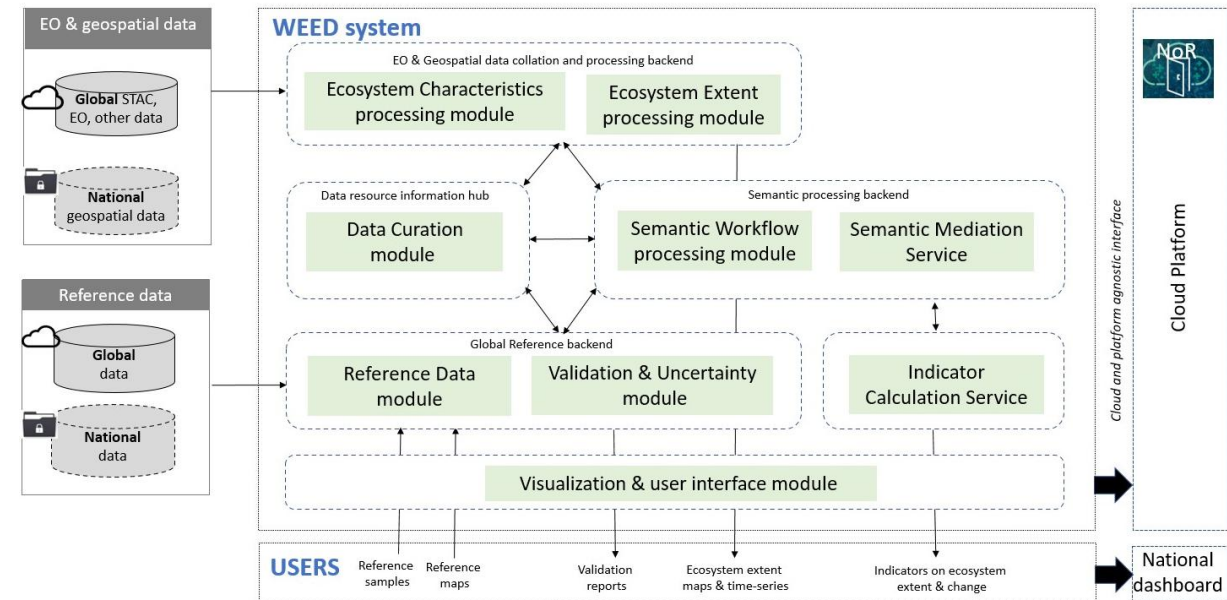


Ecosystems are an order of magnitude more difficult to classify than land cover/land use

Country Ownership: Co-creation & Capacity Building

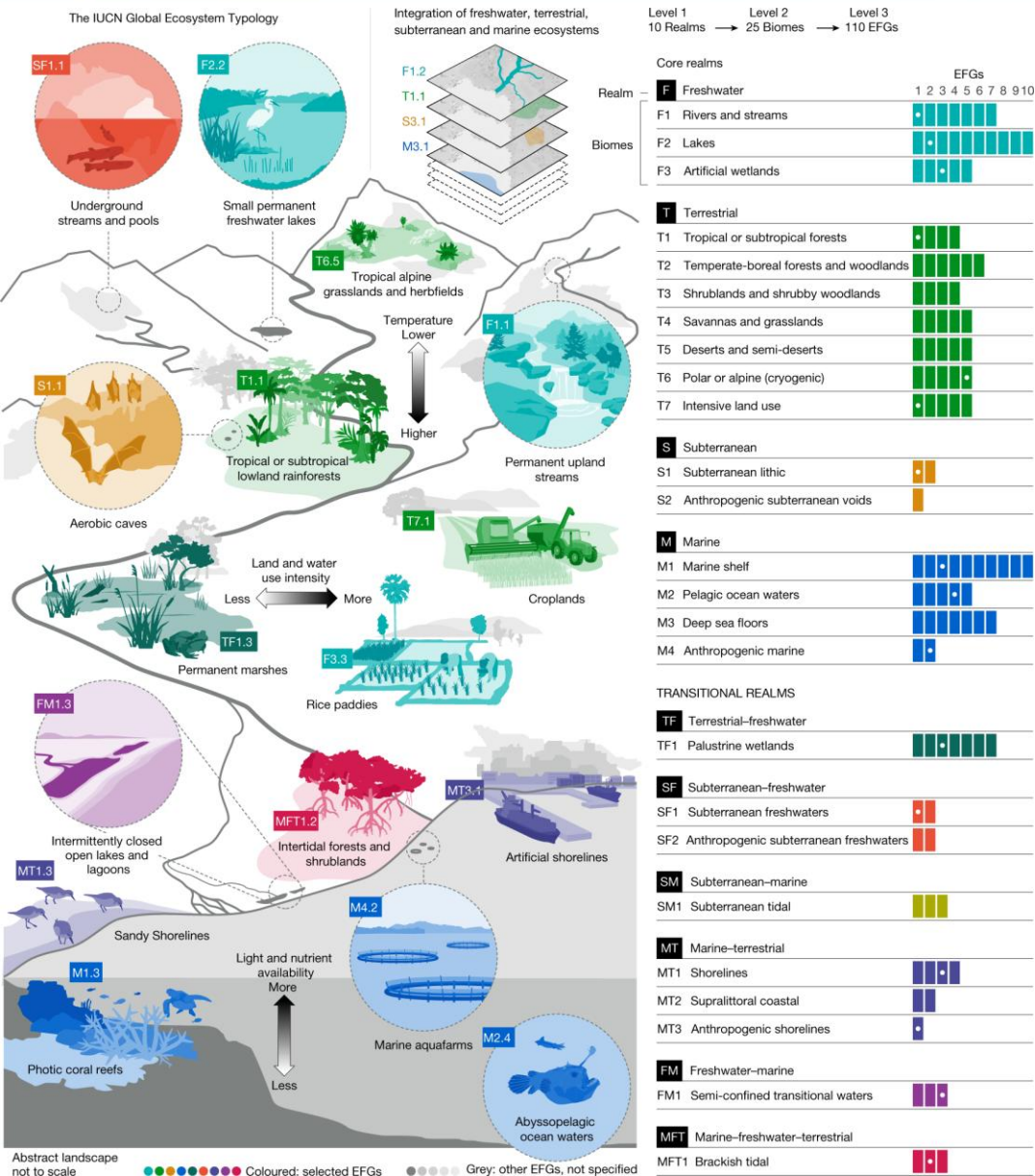


WEED Open Source Toolbox



<https://esa-worldecosystems.org/>

Coastal ecosystems in the IUCN Global Ecosystem Typology (GET)



Realm	Biome	EFG Code	EFG Name	Type
Marine–Terrestrial (MT)	Shorelines (MT1)	MT1.1	Rocky shorelines	Natural
		MT1.2	Muddy shorelines	Natural
		MT1.3	Sandy shorelines and dunes	Natural
	Supralittoral coastal systems (MT2)	MT2.1	Coastal shrublands and grasslands	Natural
		MT2.2	Large seabird and pinniped colonies	Natural
	Anthropogenic shorelines (MT3)	MT3.1	Artificial shorelines	Artificial
Marine–Freshwater–Terrestrial (MFT)	Brackish tidal biome (MFT1)	MFT1.1	Coastal River Deltas	Natural
		MFT1.2	Intertidal forests and shrublands	Natural
		MFT1.3	Coastal saltmarshes and reedbeds	Natural
Freshwater–Marine (FM)	Transitional waters (FM1)	FM1.1	Deepwater coastal inlets	Natural
		FM1.2	Permanently open riverine estuaries and bays	Natural
		FM1.3	Intermittently closed and open lakes and lagoons	Natural
Freshwater (F)	Artificial wetlands (F3)	F3.4	Freshwater Aquafarms	Artificial
Marine (M)	Anthropogenic marine systems (M4)	M4.1	Submerged artificial structures	Artificial
		M4.2	Marine aquafarms	Artificial
Terrestrial (T)	Intensive land-use systems (T7)	T7.1	Annual croplands	Intensive use
		T7.3	Plantations	Intensive use
		T7.4	Urban and industrial ecosystems	Artificial

Stock Accounts & changes in stocks (Physical accounts)

Ecosystem
Extent

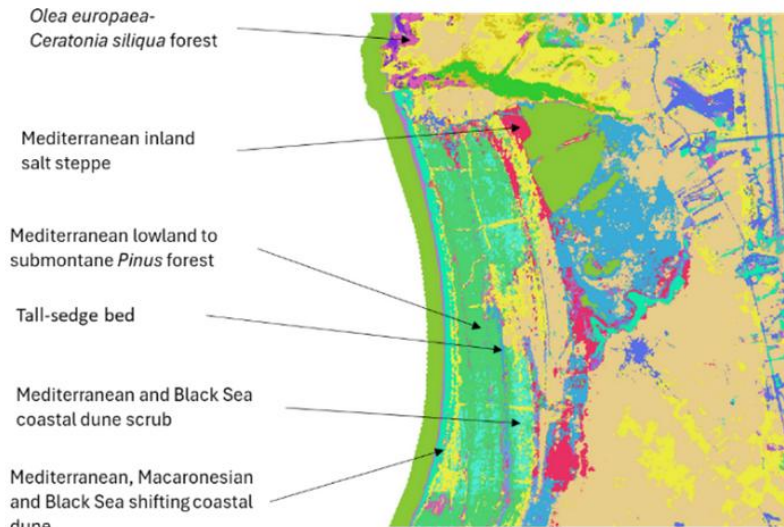
Ecosystem
Condition

Flow Accounts (Physical accounts)

Ecosystem
Services
(flow and use)

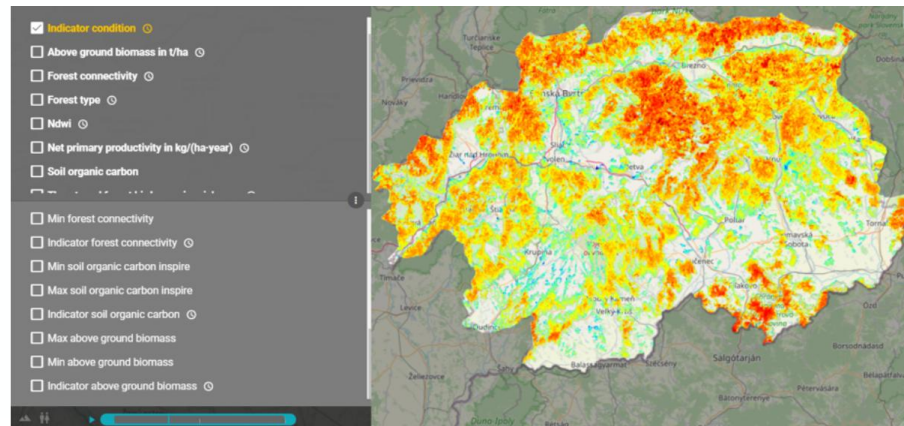
Ecosystem Extent

e.g., habitat mapping in Greece



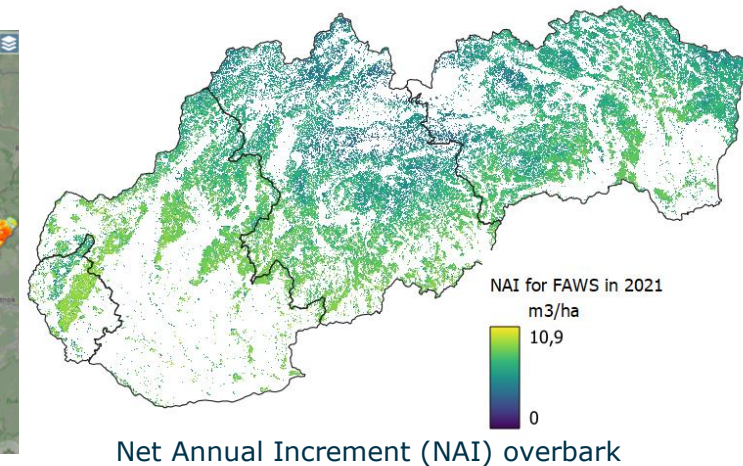
Ecosystem Condition

e.g., Forest Condition Account index map for Slovakia



Ecosystem Services

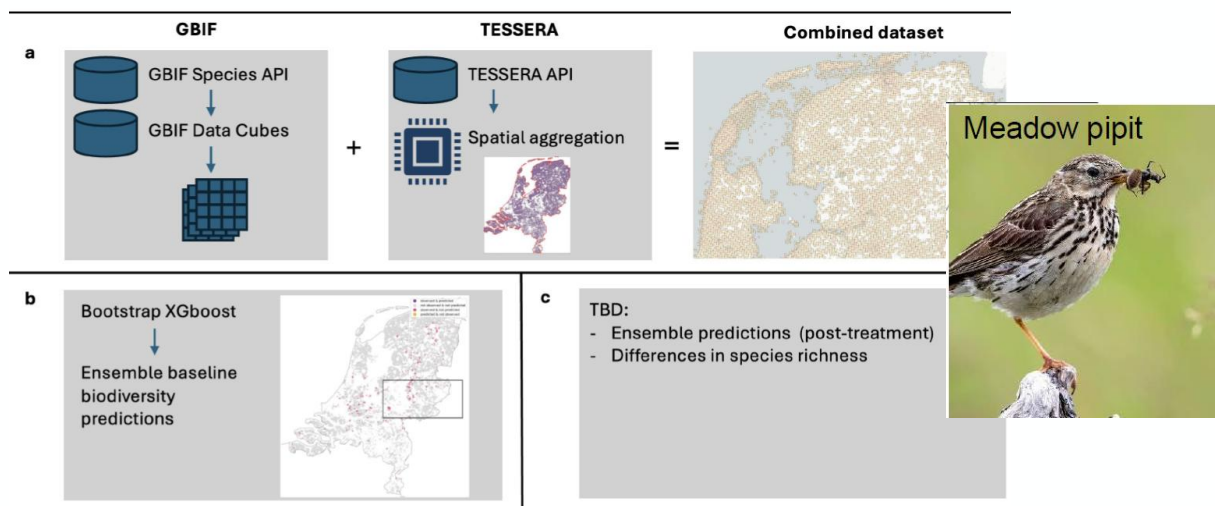
e.g., Wood Provision Service in Slovakia



LEON – Leveraging Earth Observation for Nature Finance

Six nature finance pilots:

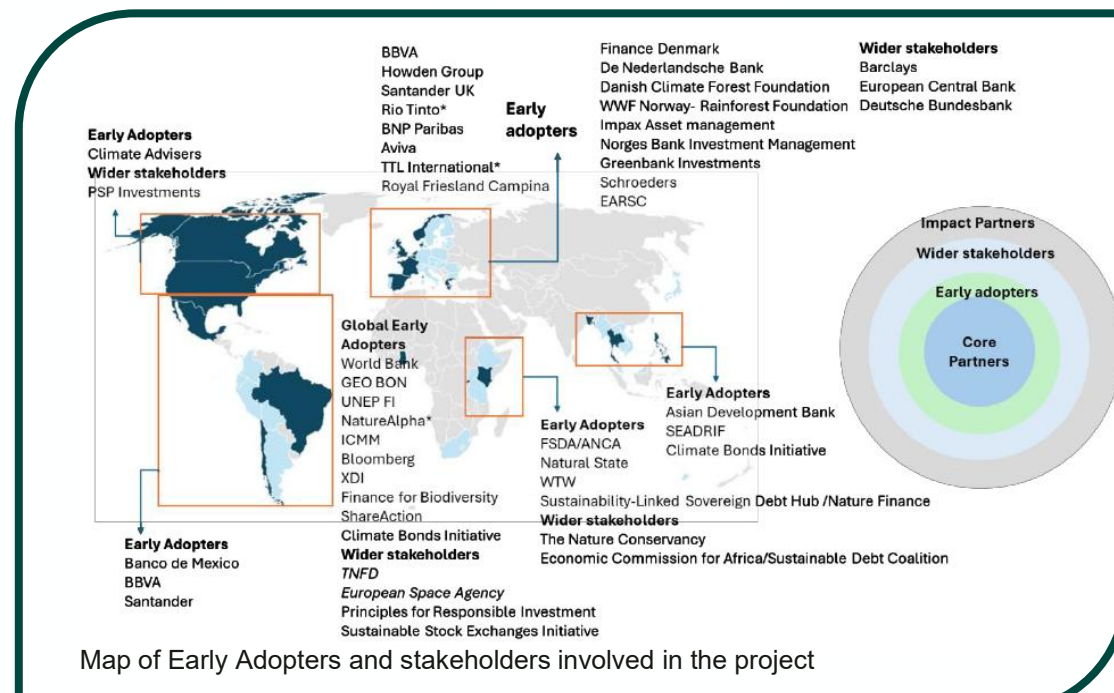
1. Monitoring water related impact and dependencies in mining
2. Agrifood Land Conversion
3. Nature-Related Financial Risks & Opportunities
4. Biodiversity Credits
5. Natural Capital Accounting
6. Debt for Nature Swaps



Example biodiversity credits methodology – estimating bird species baselines and impacts



In collaboration with:



EO for Essential Biodiversity Variables & GBF indicators



Objective: develop open-source pipelines that process Earth Observation data into **Essential Biodiversity Variables** (EBVs), that will act as building blocks for the calculation of selected indicators of **the Kunming-Montreal Global Biodiversity Framework (KM-GBF) Monitoring framework**.

By integrating EO data and providing practical monitoring and assessment tools, the project will enhance the capacity of Parties of the CBD to monitor biodiversity more effectively, inform national planning and reporting, improve the quality and consistency of the reporting and fulfil their commitments under the CBD.

Kick-off: October 2026

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
Goals for 2050

23 targets
for 2030

Monitoring
Framework

Resource
Mobilisation



Convention on
Biological Diversity



THE BIODIVERSITY PLAN
For Life on Earth

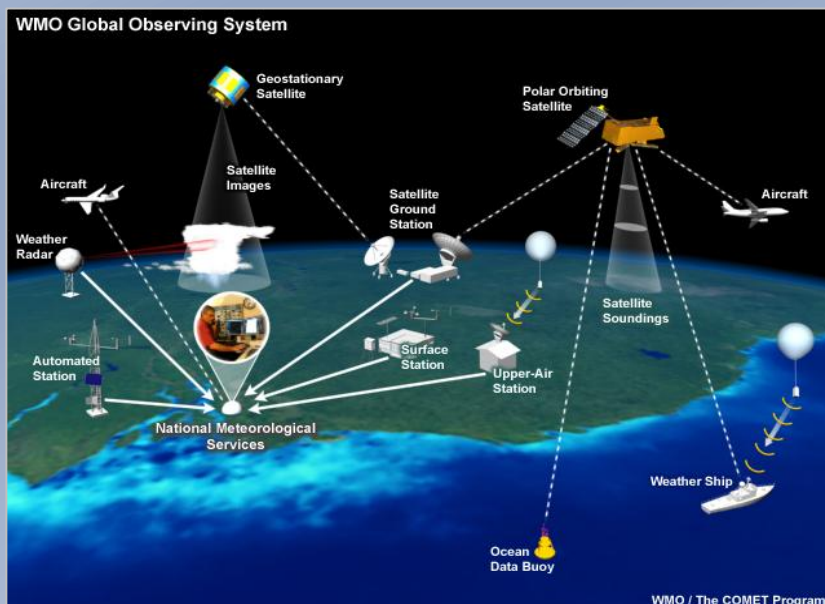


Biodiversity virtual constellation



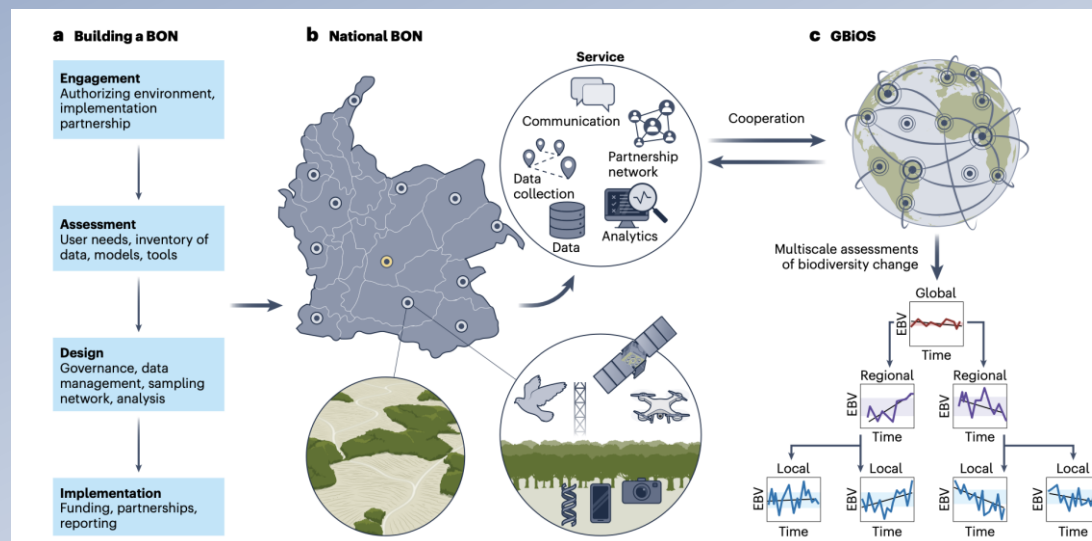
Mission Statement: Advance biodiversity understanding, monitoring, and applications for the benefit of society by strengthening the community's use of space-based Earth observations and data products for biodiversity

Weather and climate



Biodiversity?

B-VC serving as the “space arm” of a Global Biodiversity Observation System (GBIOS – GEO BON)



Gonzalez et al., 2023 Nature ecology & evolution



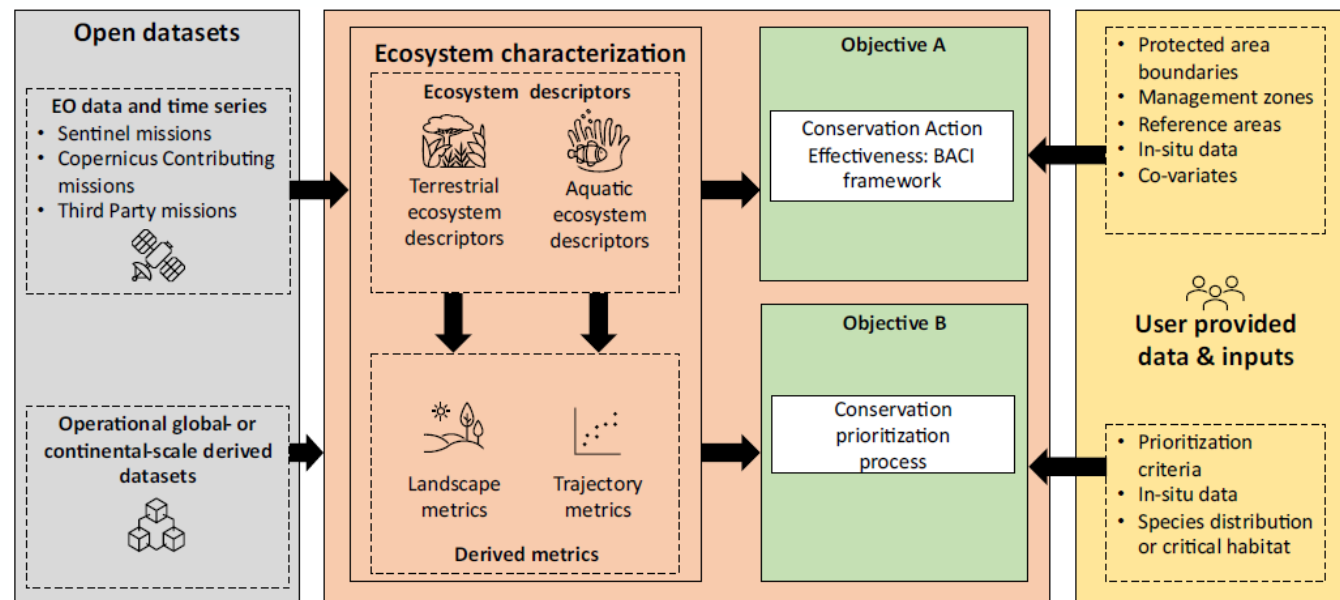
Co-led by



Response to community needs identified by CSOs/NGOs active in ecosystems conservation

Objectives:

- Monitoring and assessment of **existing** conservation actions
- Identifying **high-priority areas** for **new** conservation actions



SPACE FOR ALL

www.esa.int

federica.marando@esa.int

From space to species - EO data processing for biodiversity monitoring

Matthes Rieke – 52°North Spatial Information Research GmbH



UNIVERSITY
OF TWENTE.



Hatfield



The **PEOPLE (Pioneering Earth Observation Applications for the Environment)** initiative is funded by the European Space Agency (ESA) under the Earth Observation Science for Society (EO4Society) programme. It empowers Civil Society Organizations (CSOs) and NGOs with actionable Earth Observation tools for evidence-based environmental protection.

CORE FRAMEWORK

PEOPLE Series Projects

PEOPLE-EA

Environmental Assessment and actionable Earth Observation tools.

PEOPLE-ER

Ecosystem Restoration and habitat recovery monitoring.

PEOPLE Eco-schemes in the new CAP

EO solutions supporting Common Agricultural Policy eco-schemes.

PEOPLE Sustainable Blue Economy

EO applications for marine, coastal, and aquatic ecosystem sustainability.

Ecosystems Conservation

PEOPLE-ECCO

Enhancing Ecosystems Conservation through Earth Observation Solutions, Capacity Development and Co-design

Co-designing EO platforms for protected area monitoring and conservation site prioritization.

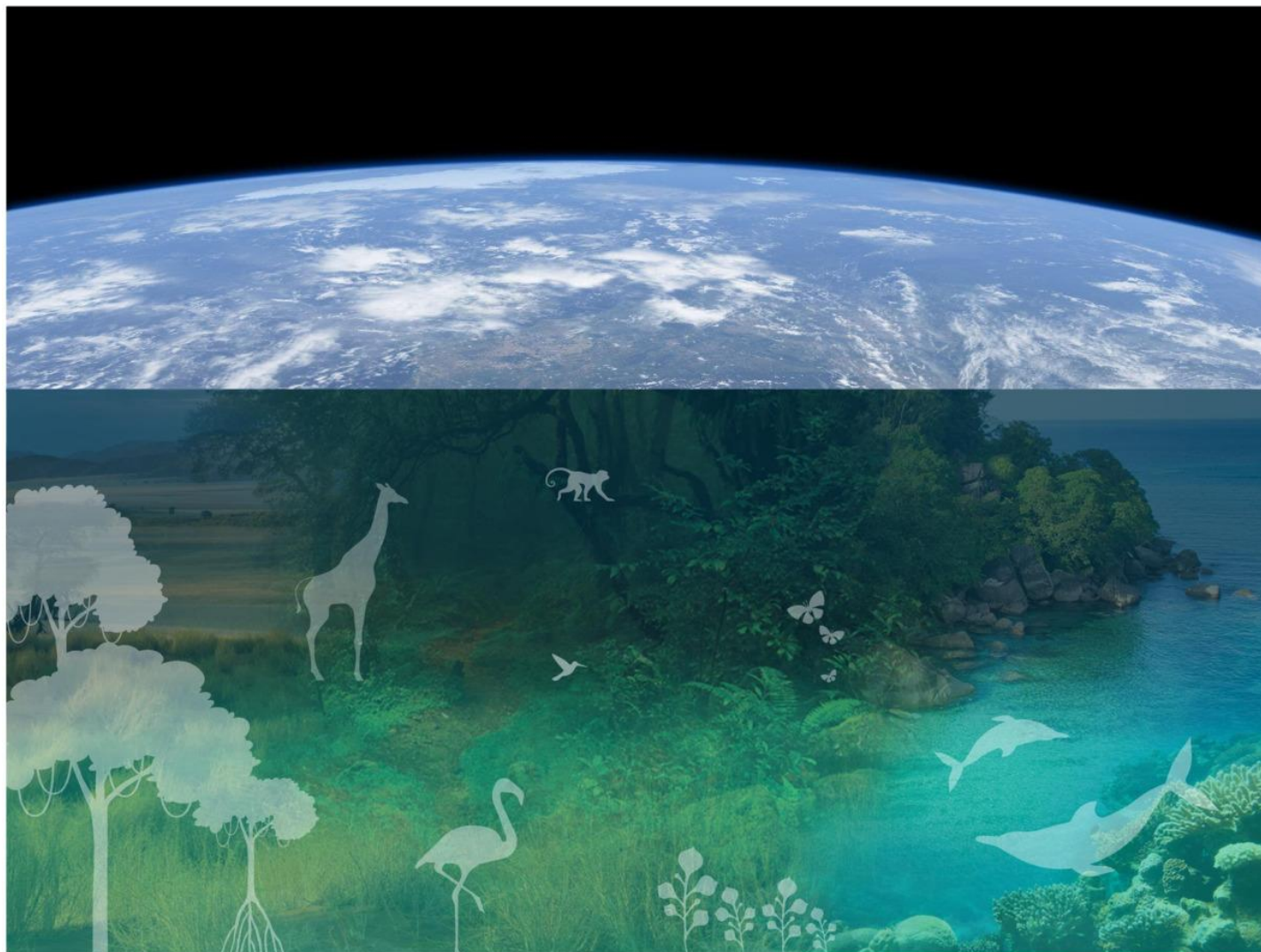
Key Focus Areas:

- Ecosystem health & intactness (scope)
- Innovative solutions and metrics (thematical)
- openEO & APEX (technical)
- Co-design with NGOs & CSOs (engagement)

Lead Partners:

ITC (Lead), DHI, Hatfield, 52°North

PEOPLE-ECCO is funded by the European Space Agency as one of the projects in the Pioneering Earth Observation Applications for the Environment (PEOPLE) series of the Earth Observation Science for Society (EO4Society) programme.



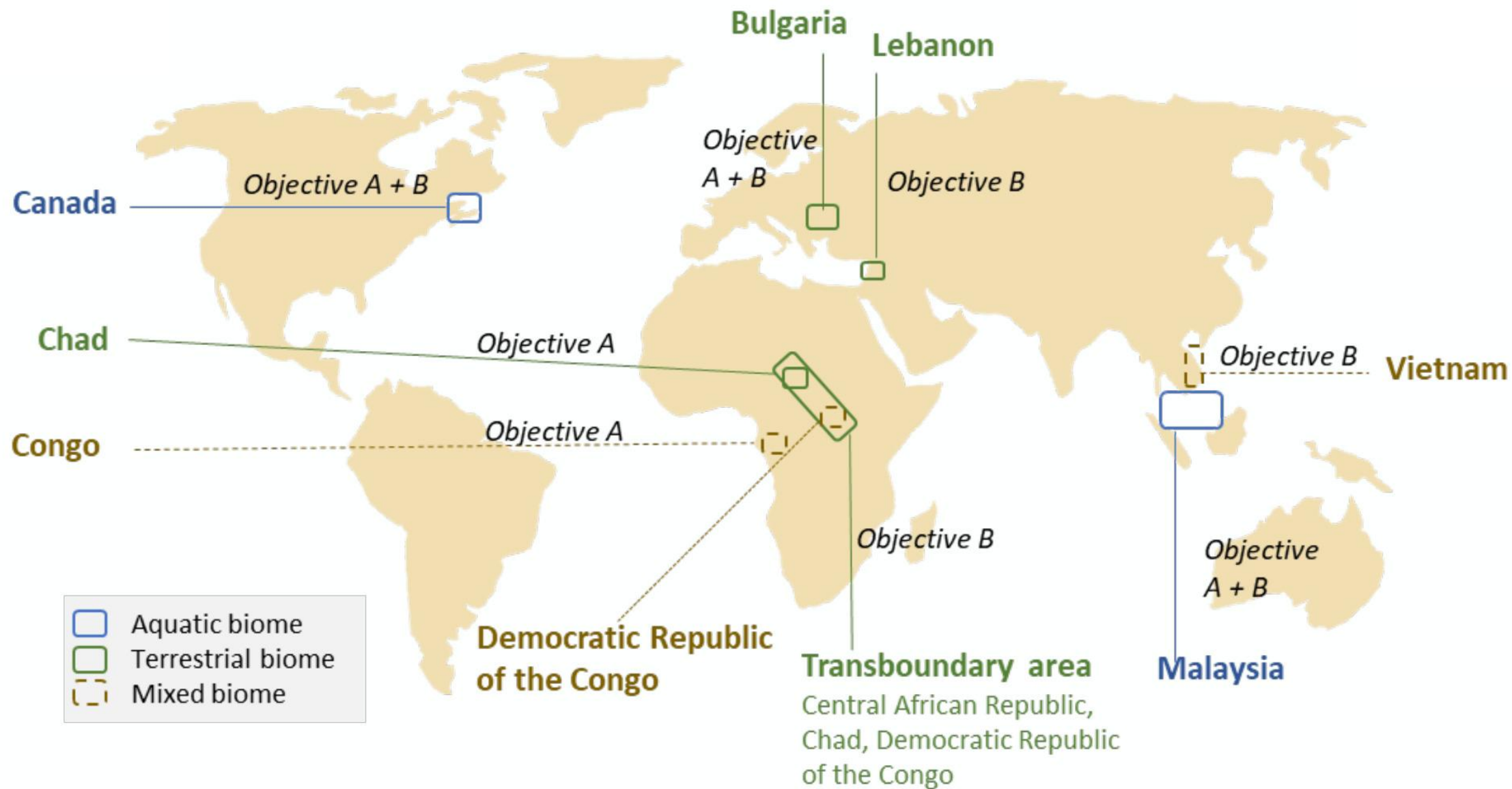
NGOs/CSOs: Crucial for nature conservation

EO methods: Important for keeping track and learning

→ Enhancing Ecosystems Conservation through **Earth observation** solutions, **Capacity development** and **Co-design**

- Goals: Engage & Develop methods to
- A. Monitor conservation action and assess their effectiveness
 - B. Prioritize areas to be protected

Application of PEOPLE-ECCO tools



Real World Applications

1. Bulgarian Society for the Protection of Birds
2. Reef Check Malaysia

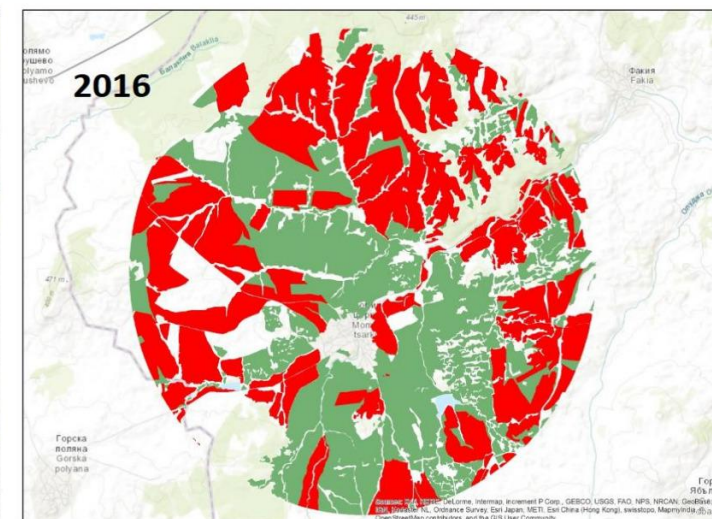
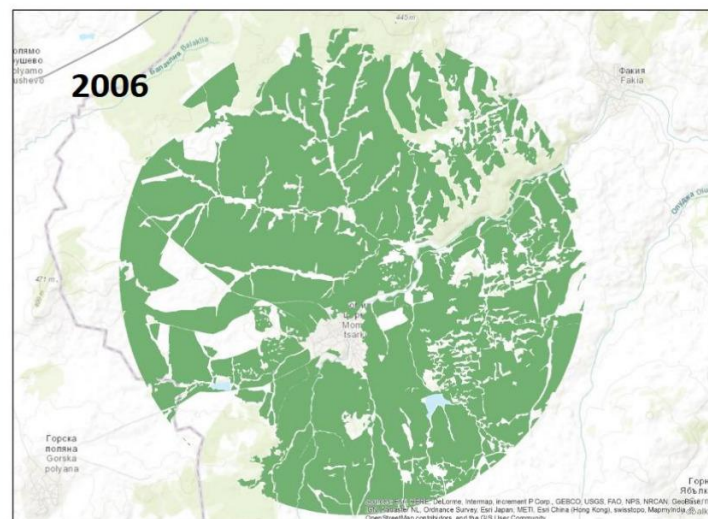
Remote monitoring of habitats critical to endangered bird species.

Grasslands is priority. They are under pressure from several factors:

- Land conversion to arable land, natural succession, and the development of solar power plants.
- Climate change, leading to drought and reduced grassland productivity.
- Overgrazing and undergrazing.

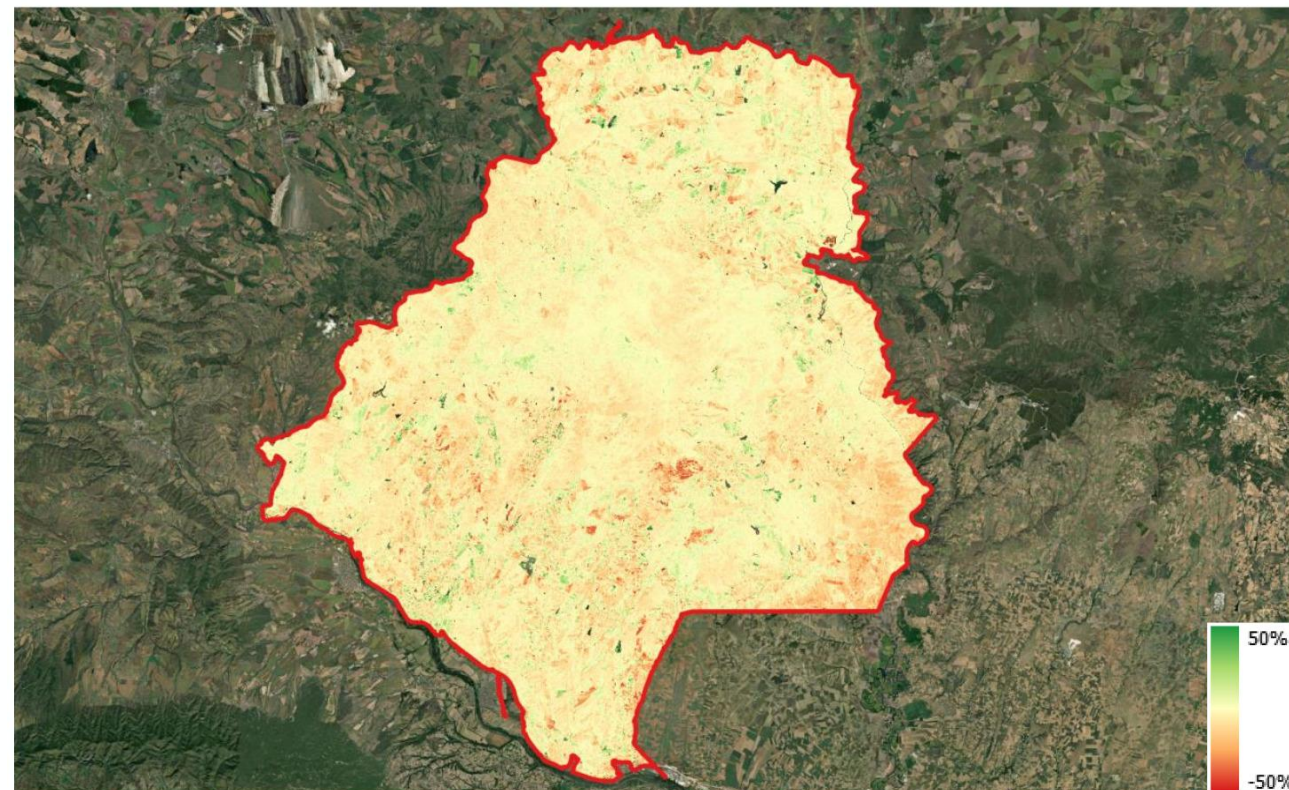
Feeding habitat destruction in Imperial Eagle territory.

Source: BSPB



Vegetation Productivity Trend

- Enabling the monitoring of grassland productivity across BSPB parcels and the surrounding landscape
- Enabling dataset integration to produce a conservation prioritization rating for parcels



SAVI % Change (derived from Seasonal Sen's Slope)

Tropical waters with coral reefs, mangroves and **Submerged aquatic vegetation**, characterized by high biodiversity and clearer waters outside storm seasons

- Semporna's reefs and seagrass beds support one of the richest coral reef ecosystems in Southeast Asia
- Pressures from overfishing, coral bleaching, and coastal development have affected habitat continuity.



Ecosystem characterisation (habitat extent)

Mapping submerged aquatic vegetation and coral reef extent using satellite data



PEOPLE-ECCO

Extent maps → where habitats exist

Temporal persistence and change

Quantify habitat frequency across years

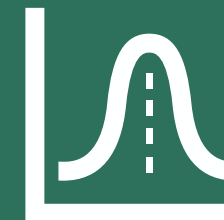


PEOPLE-ECCO

Frequency maps → where habitats persist

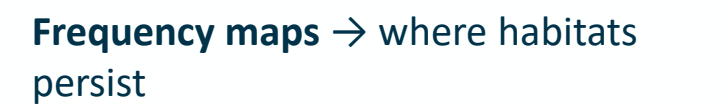
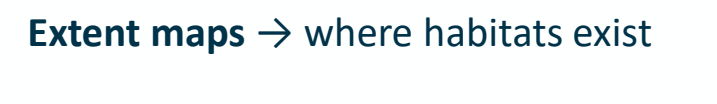
Habitat metrics

Compute individual and connected habitat patches and sizes



PEOPLE-ECCO

Connectivity metrics → where ecological value is highest



PEOPLE-ECCO Platform

User-focused Earth Observation analysis for Ecosystems

Earth Observation Data can be helpful in many workflows, can provide critical inputs for decision making

Challenge: Tooling exists (i.e. openEO Editor), but heavily geared towards *Experts / Power-Users*

- Difficult to run, development experience required
- Local, no (interactive) sharing of results

Proposed Solution: *PEOPLE-ECCO Platform*

- *Easy-to-use* web interface
 - No installations
 - Predefined algorithms & parameters
- Hosted processing, scalable to specific demand

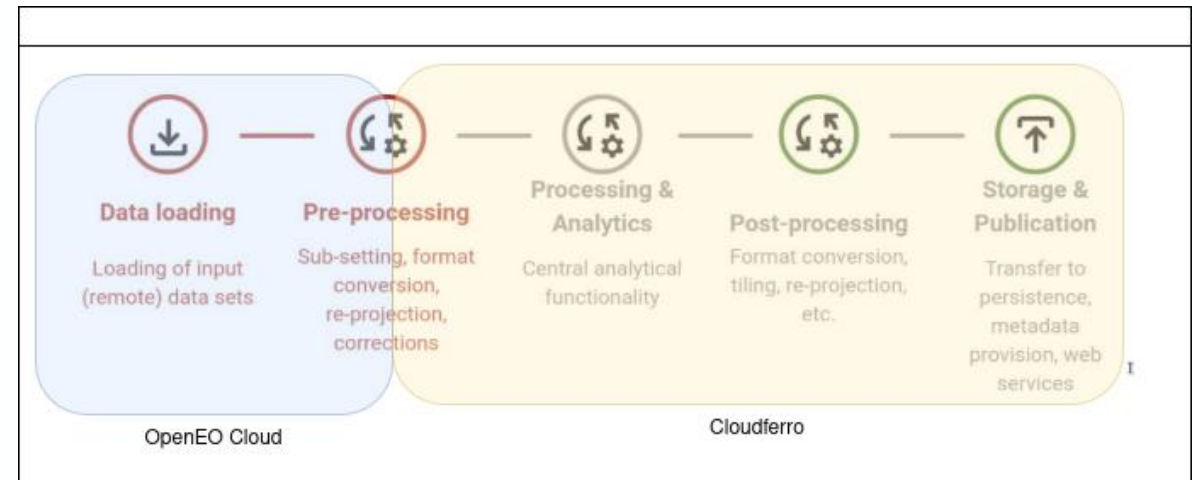


- GIS Experts
 - Data Preview
- Domain experts (or other non-technical users)
 - Direct Input for decision making
- Public
 - "Interactive Dashboard"

- Running existing algorithms with user-supplied parameters
- Viewer for processing results and ancillary data
- Long-term storage of results
- Fulfill ESA APEX requirements and compatibility



- Flexible processing capabilities depending on algorithm requirements
 - Some processes are efficient to run in the openEO cloud
 - Some processes cannot run in the openEO Cloud
- Dynamic scaling of backend infrastructure according to requirements
 - Scale-Up for Large-Scale demonstrations
 - Scale-Down for cost-optimization



Supported Functionality:

- Run parametrized algorithms
 - Availability of parameters dependent on algorithm
- Monitoring of job execution/status
- Long-Term storage of Results + Logs
- Lightweight User-Management
- Display of processing results
- Display of ancilliary data
- Simple tools (Measurements, Raw Data view)

PEOPLE-ECCO Platform – Web Interface





Lebanon

Case Study in Libanon



Malaysia

Case Study in Malaysia



Vietnam

Case Study in Vietnam



Canada

Case Study in Prince Edward Island and Nova Scotia



Egypt / Red Sea

Egypt / Red Sea test site



Garamba National Park

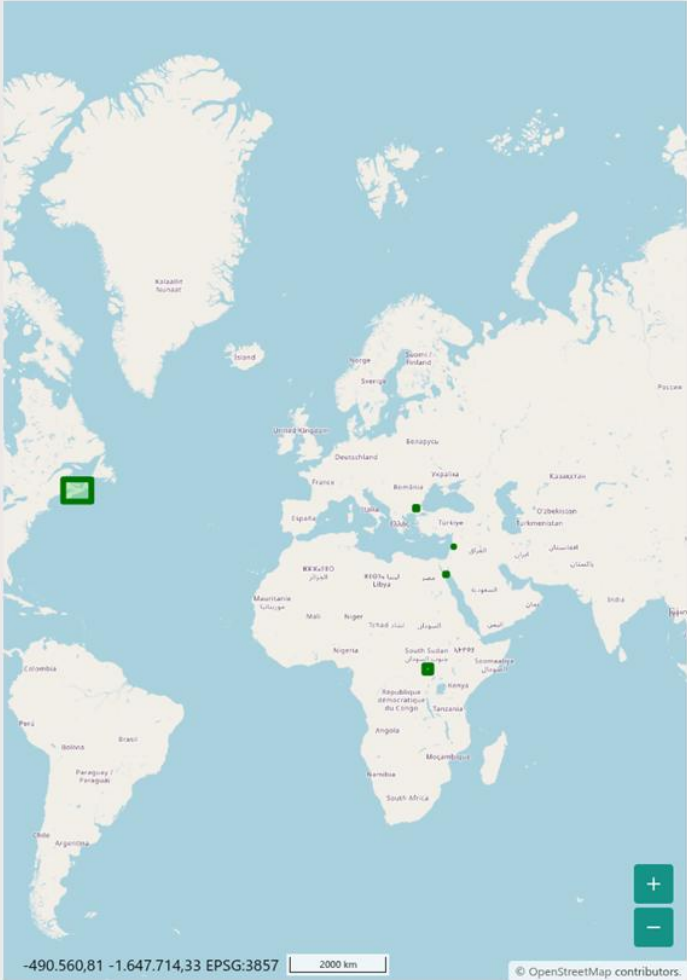
Case Study at the GNP

PEOPLE-ECCO Solutions Platform

Sites

Documentation

nor 52N



-490.560,81 -1.647.714,33 EPSG:3857 2000 km

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esa

Funded by the European Space Agency (ESA)

<> GitHub

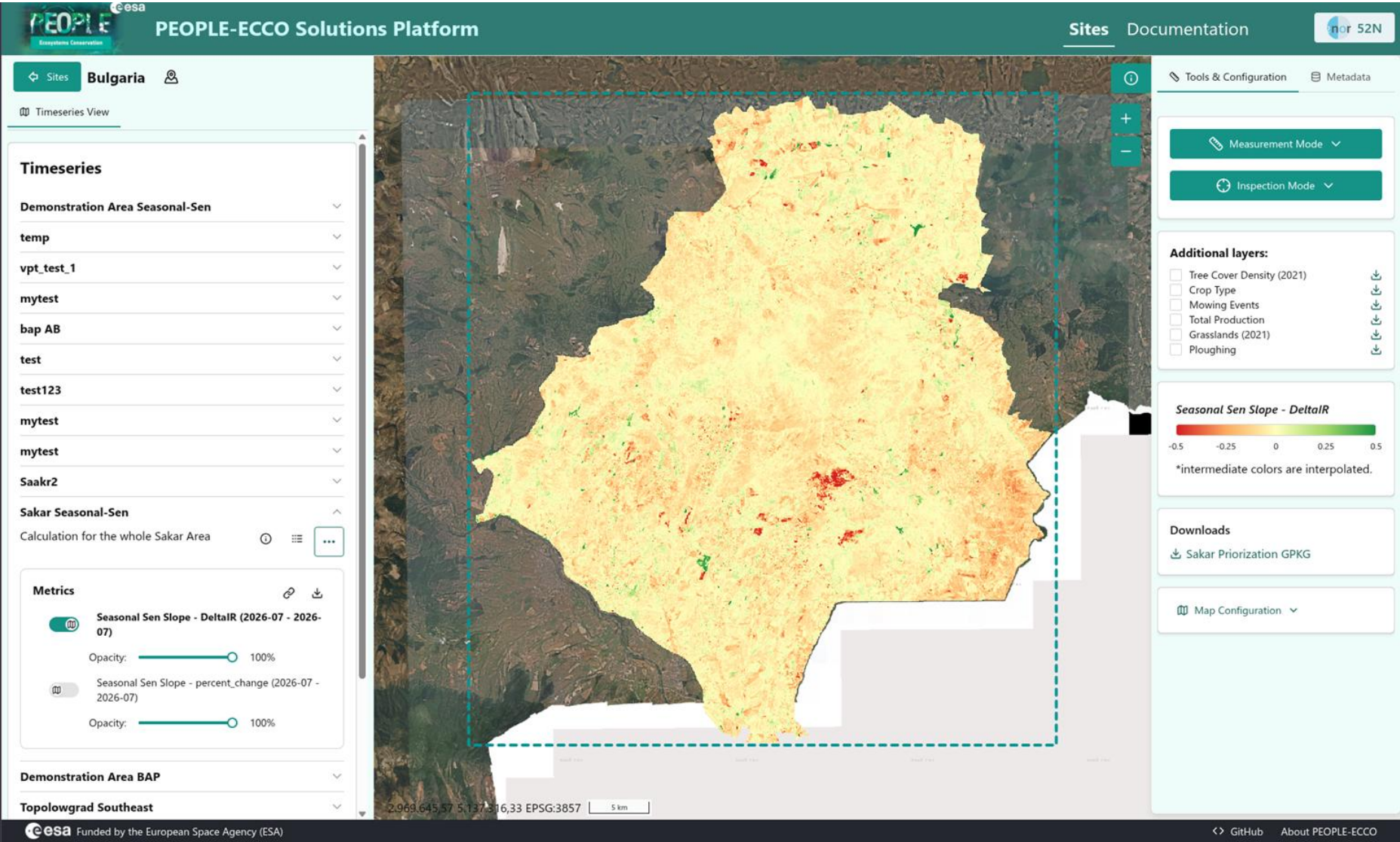
About PEOPLE-ECCO

49

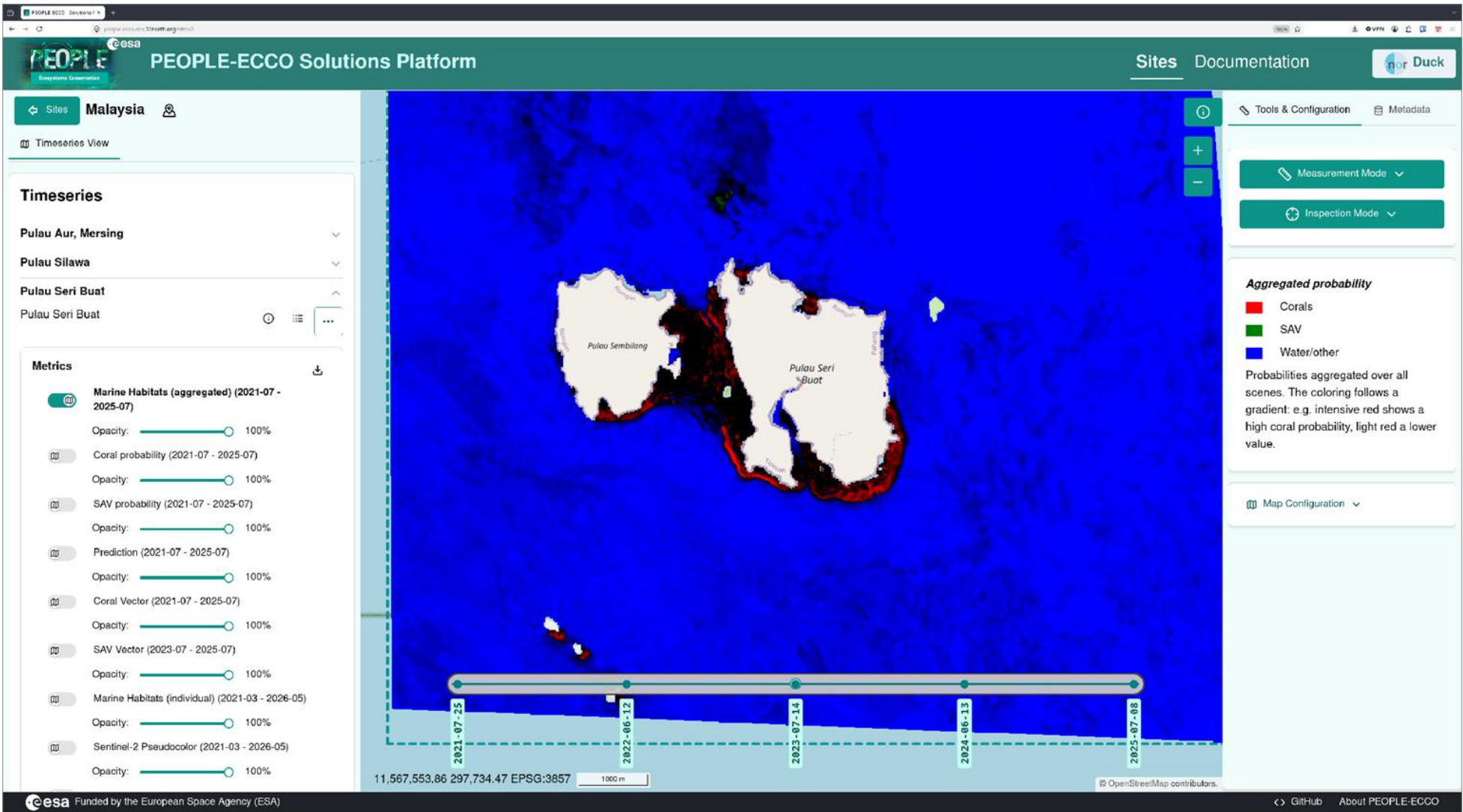


→ THE EUROPEAN SPACE AGENCY

PEOPLE-ECCO Platform – Web Interface



PEOPLE-ECCO Platform – Web Interface



52

The **PEOPLE-ECCO Interoperability Framework** leverages open standards and platforms to ensure seamless workflow execution, reproducibility, and integration across the EO ecosystem.

PLATFORM

ESA APEx Integration

Federated Access: Aligns with ESA APEx standards for seamless integration into broader European EO infrastructure.

Service Discovery: Enables sharing and registration of EO application processing services across platforms.

Key Objective: Ensures compatibility with ESA ecosystem toolings and long-term sustainability.

WORKFLOW STANDARD

Common Workflow Language

Portable Specification: Use CWL to explicitly define data processing pipelines and parameter requirements.

Vendor-Neutral: Avoids platform lock-in, enabling execution across diverse cloud environments.

Reproducibility: Guarantees strict provenance tracking and repeatable execution of algorithms.

INTEROPERABILITY

EO Application Package

Containerized Execution: Encapsulates software, dependencies, and metadata into standardized units.

OGC Best Practices: Aligns with OGC standards for Earth Observation Application Packages.

Cloud Deployment: Facilitates direct deployment to cloud processing backends and openEO nodes.

Quick live demonstration:

PEOPLE-ECCO Platform (visual exploration)

PEOPLE-ECCO Solution execution (via CWL → APEX compatibility)

- Onboarding to ESA Application Propagation Environments (**APEx**)
 - Technical compatibility: Earth Observation Application Package
 - Docker containers, CWL, Inputs / Outputs, STAC
 - Project results on the Geospatial Explorer and the ESA Stakeholder Engagement Facility
 - Local CWL/EOAP execution already possible
 - Details available in the **User Handbook**: <https://people-ecco.github.io/integration/integration-interopability/>
- Dissemination
 - Platform source code is available as Open Source (<https://github.com/PEOPLE-ECCO/>)
 - Solutions
 - Platform backend and UI
 - Documentation on how to **deploy the platform in your own premises** is being developed

- <https://people-ecco.eu/> - Project website: publications, events, project results
- <https://people-ecco.github.io/> - PEOPLE-ECCO User Handbook: living documentation on the developed Solutions, the Platform and how to apply them in your environment
- <https://algorithm-catalogue.apex.esa.int/> - ESA APEx Algorithm Catalogue: Solutions will eventually be available here
- <https://sef.apex.esa.int/en> - ESA Stakeholder Engagement Facility: Project results (data for pilot regions) will eventually be available here
- Willemen, L., Bijker, W., Dean, A., Munk, M., Rieke, M., Christensen, M., Huber, S., Kavlin, M., Konkol, M., Pontius, M., Speckamp, J., Stroeven, C., Tang, V., Tsui, O., & van Doninck, J. (2025). Enhancing ecosystems conservation through earth observation solutions, capacity development and co-design. Abstract from BIOSPACE 2025, Frascati, Italy. https://biospace25.esa.int/iframe-agenda/files/ID198_Willemen.pdf

Thank you for your attention!



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Hatfield



Q&A



Flora Kopelou
European Data Portal,
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Stay up-to-date on our 2026 activities!

The logo for Data.europa academy is located in the bottom left corner. It consists of the words "data", "europa", and "academy" stacked vertically in a white, lowercase, sans-serif font. The text is set against a dark blue circular background. To the right of this circle is a larger, lighter purple circular shape, and further to the right is a small white circle.

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Meet us during EU Regions Week 2026!

Open data to empower communities and strengthen social inclusion

Newcomers in municipalities often face difficulties in finding trustworthy information about essential services to make informed decisions and adapt to their new environment. Data experts from the European Data Portal have identified examples of data-driven tools that address this issue. Put yourself in the shoes of a newcomer and navigate your first few weeks and months in your new home, using the Integreat platform. Or, as a local authority, see how you could use open data to develop efficient and cost-effective solutions that help newcomers thrive in their new setting. The platform promotes cooperation among municipalities and stakeholders for the improvement of integration services.

Register



Digital and ICT | EU/ European | Governance and Public administration | Migration | Social inclusion and Equality



Wed 14/10/2026 at 08:00 to Wed 14/10/2026 at 18:30 CET



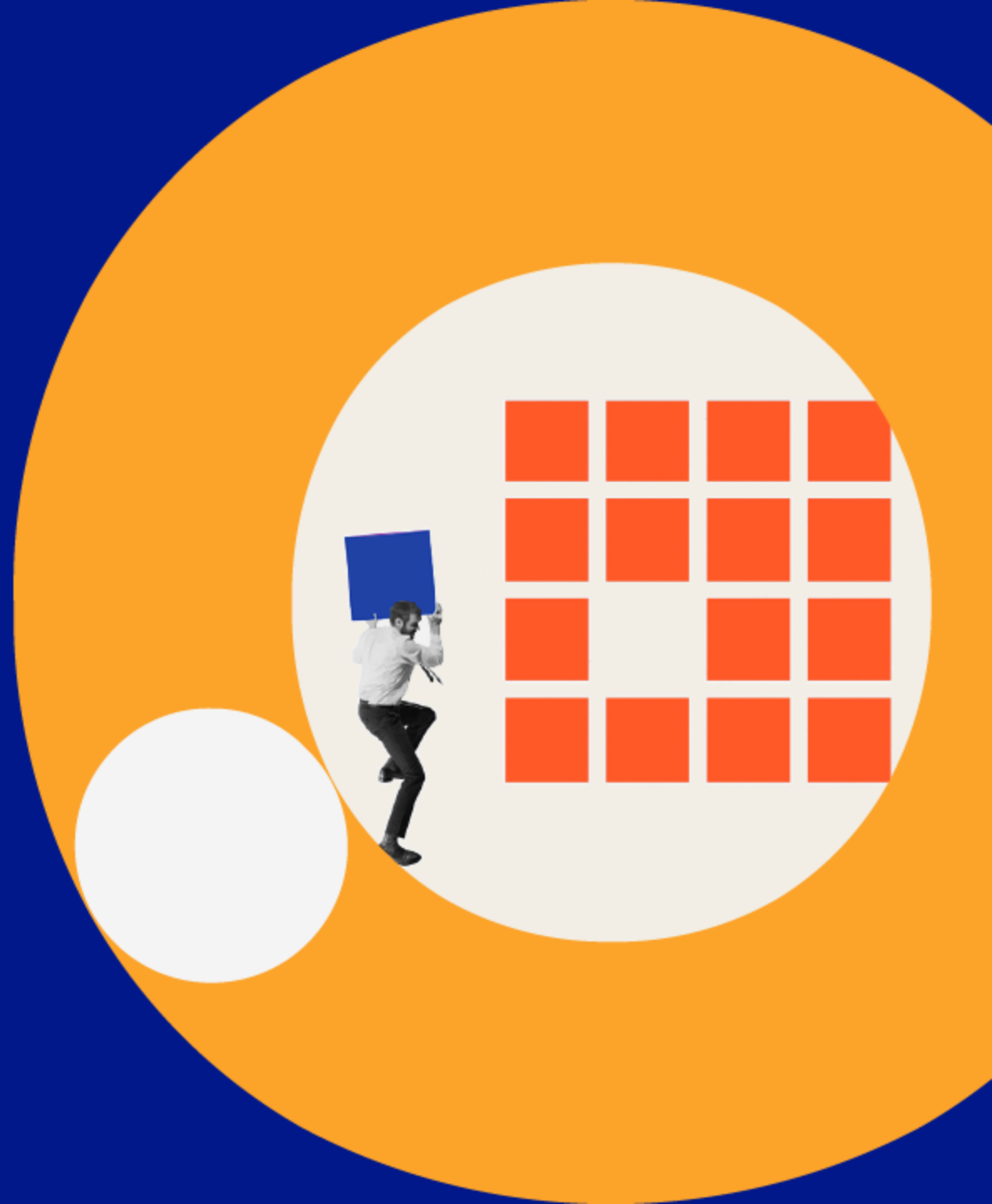
Code: 14Stand263947



Square Brussels , Exhibition area, Grand Hall 2, Mont des Arts, Brussels, Belgium



Your opinion is important to us



Thank you!

