PROGRAMME OF
THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

#EUSpace
#Copernicus

Copernicus for Biodiversity Workshop

BIOSPACE, February 2025

Copernicus for Biodiversity Workshop Agenda

- 15.00 Introduction, Michel Massart, European Commission, Directorate General JRC

- 15.05 Copernicus, EO Space Flagship Program, Michel Massart, EC DG JRC

- 15.15 EO Nature protection: an EU policy perspective, Bruno Combal, EC DG ENV

- 15.30 Copernicus Services and Copernicus In Situ component

  State of play of the Copernicus services, the products and their interest for biodiversity monitoring.

  Andreas Brink, DG JRC for Copernicus Land Service, Tina Silovic, MOI for Copernicus Marine Service, Laurence Rouil, ECMWF for Copernicus Atmosphere Service, Samual Almond, ECMWF for Copernicus Climate Change Service, Jose Rubio, EEA for Copernicus In Situ component.

- 16.30 Coffee Break

- 17.00 Panel discussion

  Relevance of the Copernicus service products for biodiversity monitoring, the potential evolution of the products towards new challenges and the strengthening of user uptake.

  Jillian Campbell (UN-CBD), Alice Hughes (GEOBON), Pavel Milenov (EEA), Enrique Montes (NOOA), Steven Ramage (CEOS-GEOBON), Andrea Taramelli (ISPRA), Victor Martinez Vicente (PML)

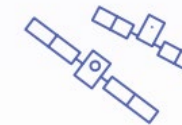- 18.30 End

PROGRAMME OF
THE EUROPEAN UNION

copernicus
Europe's eyes on Earth

The EU Space Programme

EU SPACE PROGRAMME OVERVIEW

COPERNICUS
Earth Observation (EO) and monitoring based on satellite and non-space data

Nr.1 world provider of space data and information

GALILEO
Global satellite navigation and positioning system (GNSS)

10% of the EU GDP enabled by satellite navigation

EGNOS
Reliable navigation signals for safety of life use

Operational in 360+ airports & helipads in 23 countries

SSA
Space situational awareness monitoring and protecting space assets

Providing surveillance and tracking services to 210+ satellites

GOVSATCOM
Secure satellite communications for EU security actors

Delivering rapid support over crisis areas

AN INVESTMENT IN A **FUTURE READY EUROPE**

Competitive edge
Completing current satellite constellations, developing and launching the next-generation of satellites

Research **innovation**
Ambitious research and innovation programme benefiting from Horizon Europe

Fighting Climate Change
Monitoring biodiversity, environmental compliance and CO2 emissions (Paris Agreement)

EU as a **global actor**
Supporting disaster relief, humanitarian assistance and security operations

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

Copernicus History

1998 Baveno Manifesto

1999 "Global Monitoring for Environment and Security"

2004 EC-ESA agreement On space component "the Sentinels"

2005 GMES EU's main Contribution to GEOSS

2011 GMES Initial Operations Phase begins

2012 GMES renamed to Copernicus, Start of CLMS, CEMS

2013 EU Regulation: full, free and open data policy.

2014 launch of Sentinel-1A Copernicus Regulation adopted

2015 launch of Sentinel-2A, Start of CMEMS and CAMS

2016 launch of Sentinel-3A and S-1B Start of CSS

2017 launch of Sentinel-2B, Launch of S-5P, global air quality monitoring

2018 launch of Sentinel-3B and S-1B Start of C3S

2020 launch of Sentinel-6, topography of the global ocean.

2021 EU Space Programme Regulation

2023 Launch CDSE

2024 Celebration Copernicus 25 years Launch of Sentinel 2-C and S-1C
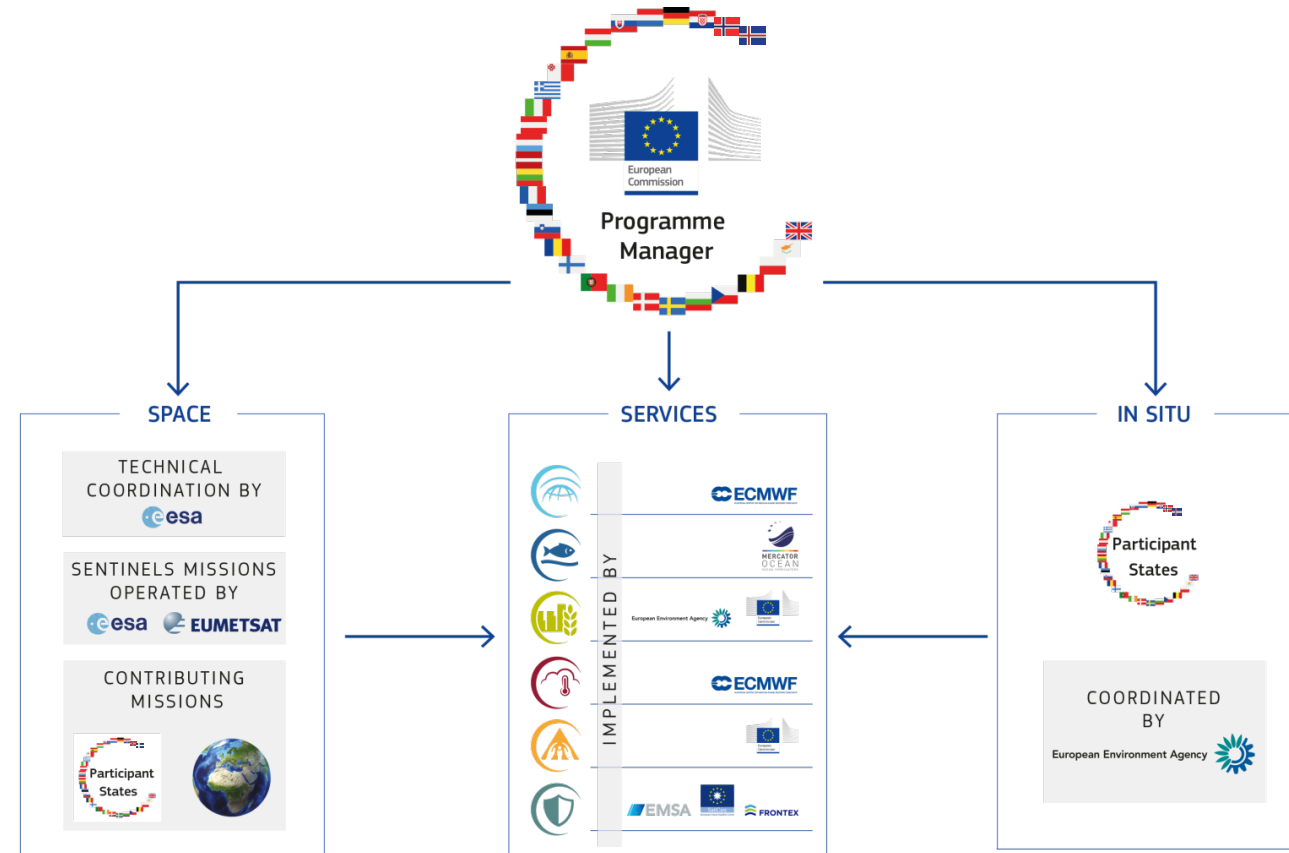
Copernicus Evolution MFF 2028-2032

| GMES | GMES IO | Copernicus 1.0 | Copernicus 2.0 | Copernicus 3.0 |

Copernicus
Europe's eyes on Earth

Copernicus Overview

- Copernicus is the European Union programme aimed at developing European information **services** based on satellite Earth Observation and in situ data

- Copernicus is coordinated and **managed** by the **European Commission**

- Copernicus is **implemented in partnership** with the Member States, ESA, EUMETSAT, ECMWF, EEA, EC JRC, Mercator, EMSA, SatCen, Frontex

- Copernicus **Multiannual Financial Framework** 2021-2027 > 5 billion €

- Tool for **economic growth**
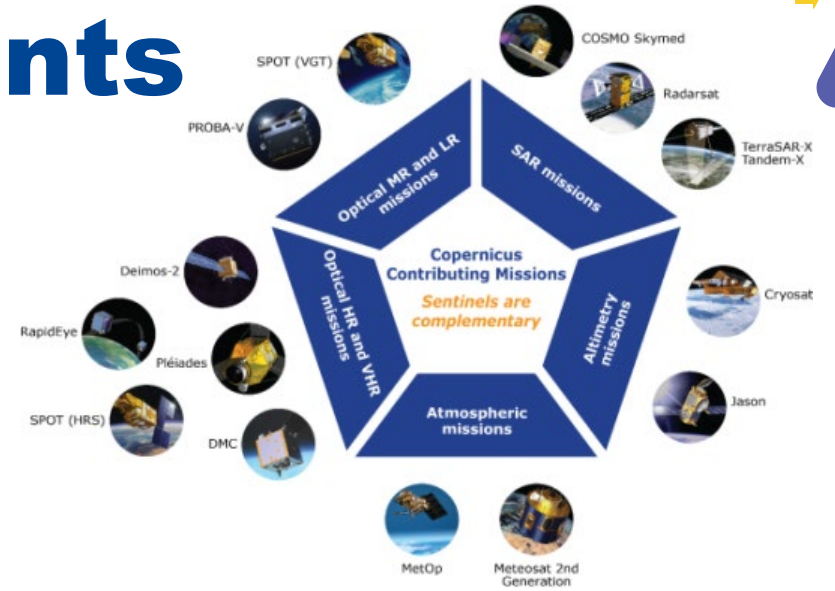
- **Operational, Sustainable, Free and Open**

Programme Manager

SPACE	SERVICES	IN SITU
TECHNICAL COORDINATION BY esa	IMPLEMENTED BY ECMWF, MERCATOR OCEAN, European Environment Agency, ECMWF, EMSA, FRONTEX	Participant States
SENTINELS MISSIONS OPERATED BY esa EUMETSAT		COORDINATED BY European Environment Agency
CONTRIBUTING MISSIONS, Participant States		

Copernicus Components

Sentinels

FULL, FREE AND OPEN

Six Copernicus Services
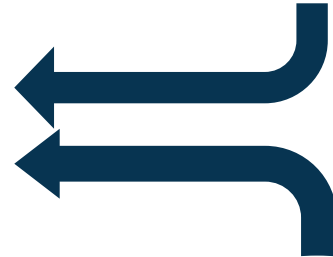

Atmosphere

Marine

Land

Climate Change

Security

Emergency

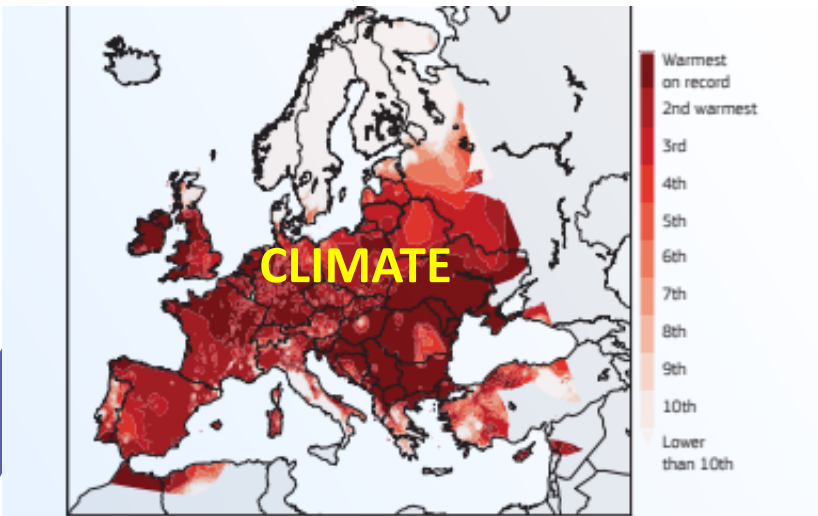Value-added   Services

Contributing missions

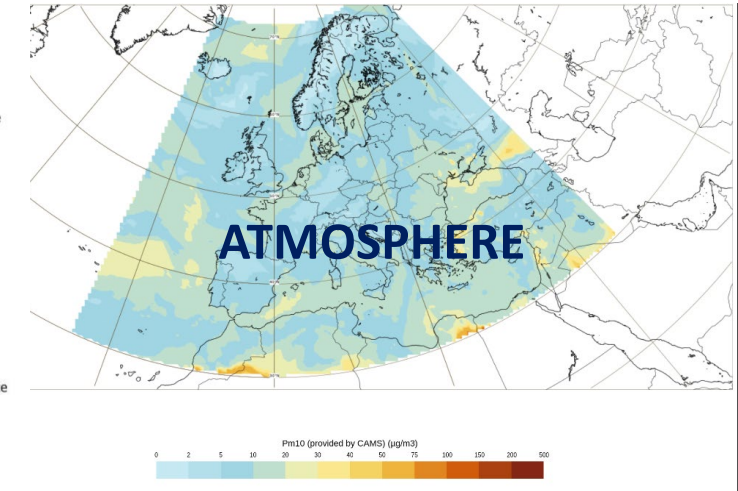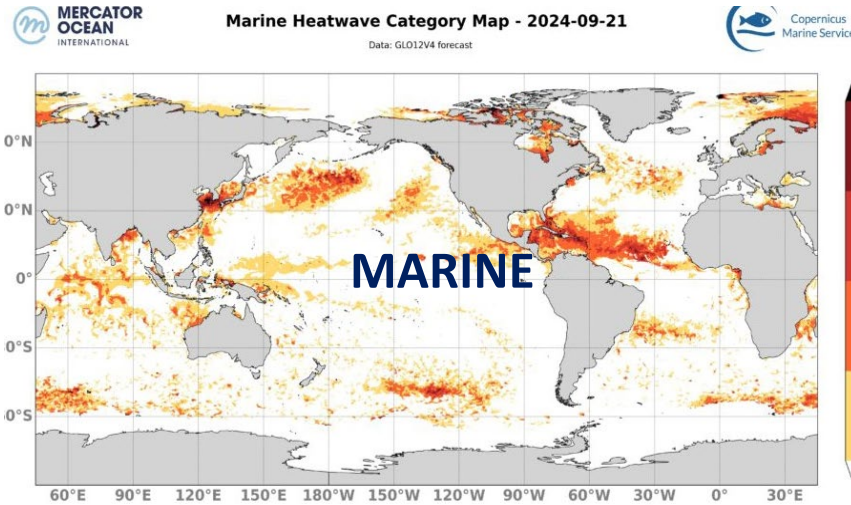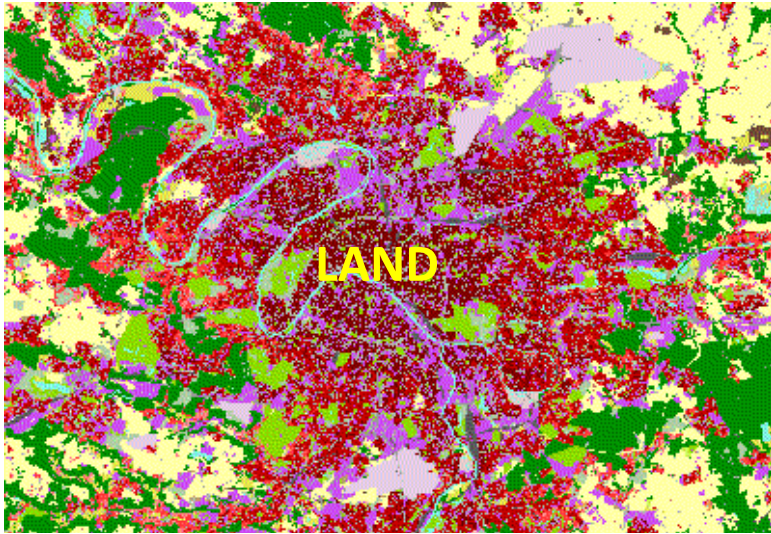In situ data

Building on existing expertise

Copernicus Land Service : 65+ industry partners / 350+ experts

The Copernicus Services

LAND

MARINE

Marine Heatwave Category Map - 2024-09-21
Data: GLO12V4 forecast

ATMOSPHERE

CLIMATE

EMERGENCY

SECURITY

PROGRAMME OF
THE EUROPEAN UNION
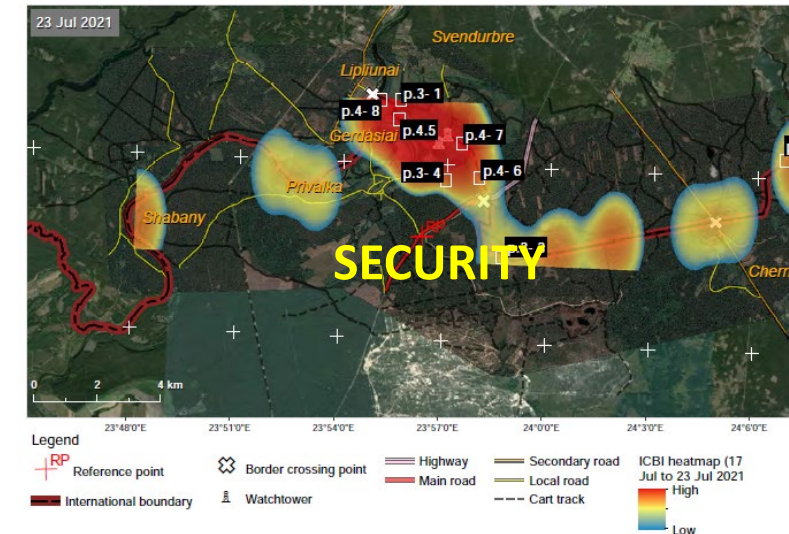
Copernicus
Europe's eyes on Earth

The Copernicus Sentinels

Sentinel Mission and Status

SENTINEL-1:
4-40m resolution, 6 days revisit at equator

SENTINEL-2:
10-60m resolution, 5 days revisit time

SENTINEL-3:
300-1200m resolution, <2 days revisit

SENTINEL-4:
8km resolution, 60 min revisit time

SENTINEL-5p:
7-68km resolution, 1 day revisit

SENTINEL-5:
7.5-50km resolution, 1 day revisit

SENTINEL-6:
10 day revisit time

Key Features

Polar-orbiting, all-weather, day-and-night radar imaging

Polar-orbiting, multispectral optical, high-res imaging

Optical and altimeter mission monitoring sea and land parameters

Payload for atmosphere chemistry monitoring on MTG-S

Mission to reduce data gaps between Envisat, and S-5

Payload for atmosphere chemistry monitoring on MetOp 2ndGen

Radar altimeter to measure sea-surface height globally

Europe's eyes on Earth

Sentinel Satellite Deployment

Indicative Copernicus Constellation Deployment Schedule
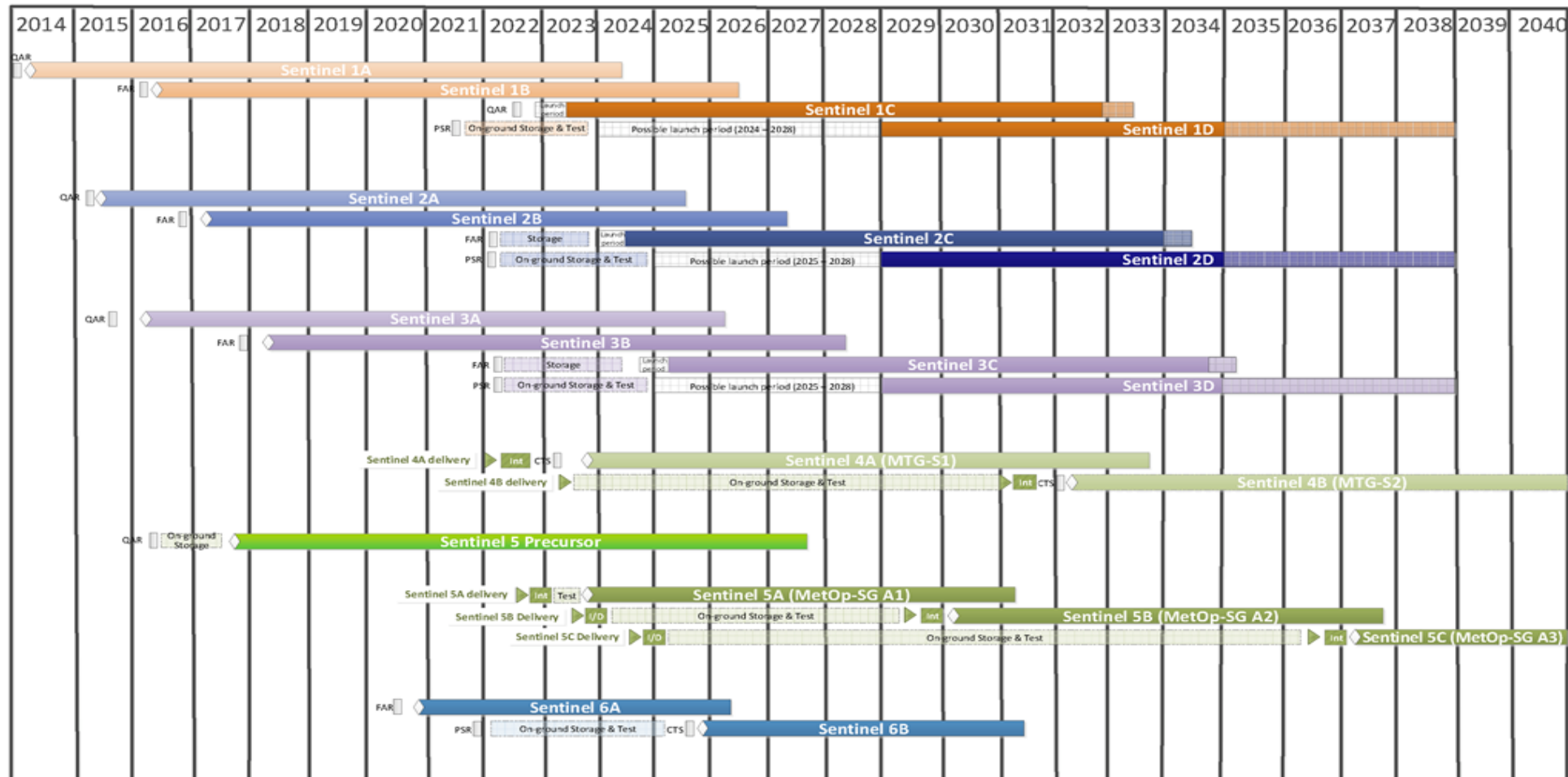
Copernicus Expansion Missions
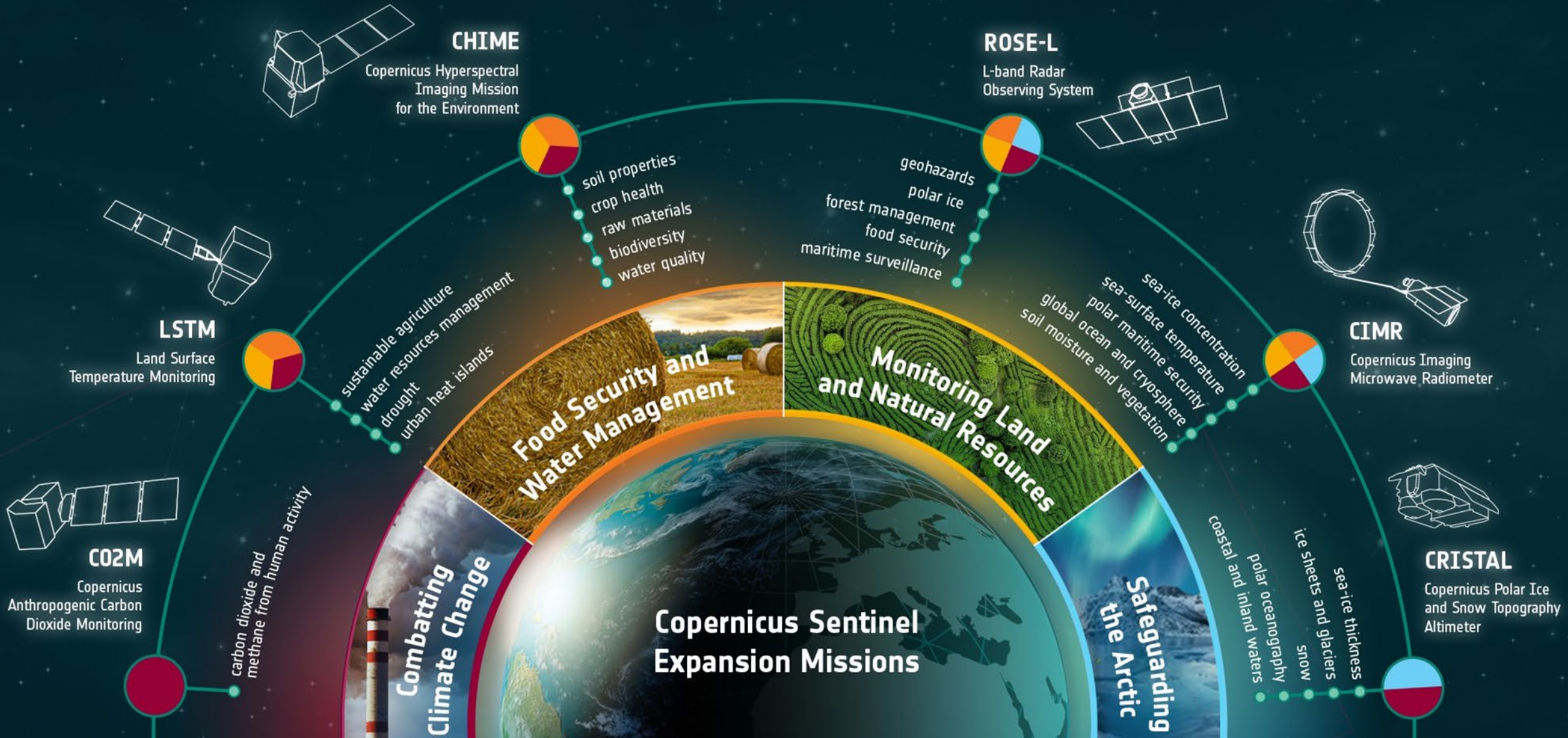
Copernicus Contributing Missions

- Emerging Companies
(EU and Copernicus participating states)

- Established Companies
(EU and Copernicus participating states)

- Non-EU Companies (Copernicus cooperating states)

PROGRAMME OF
THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth
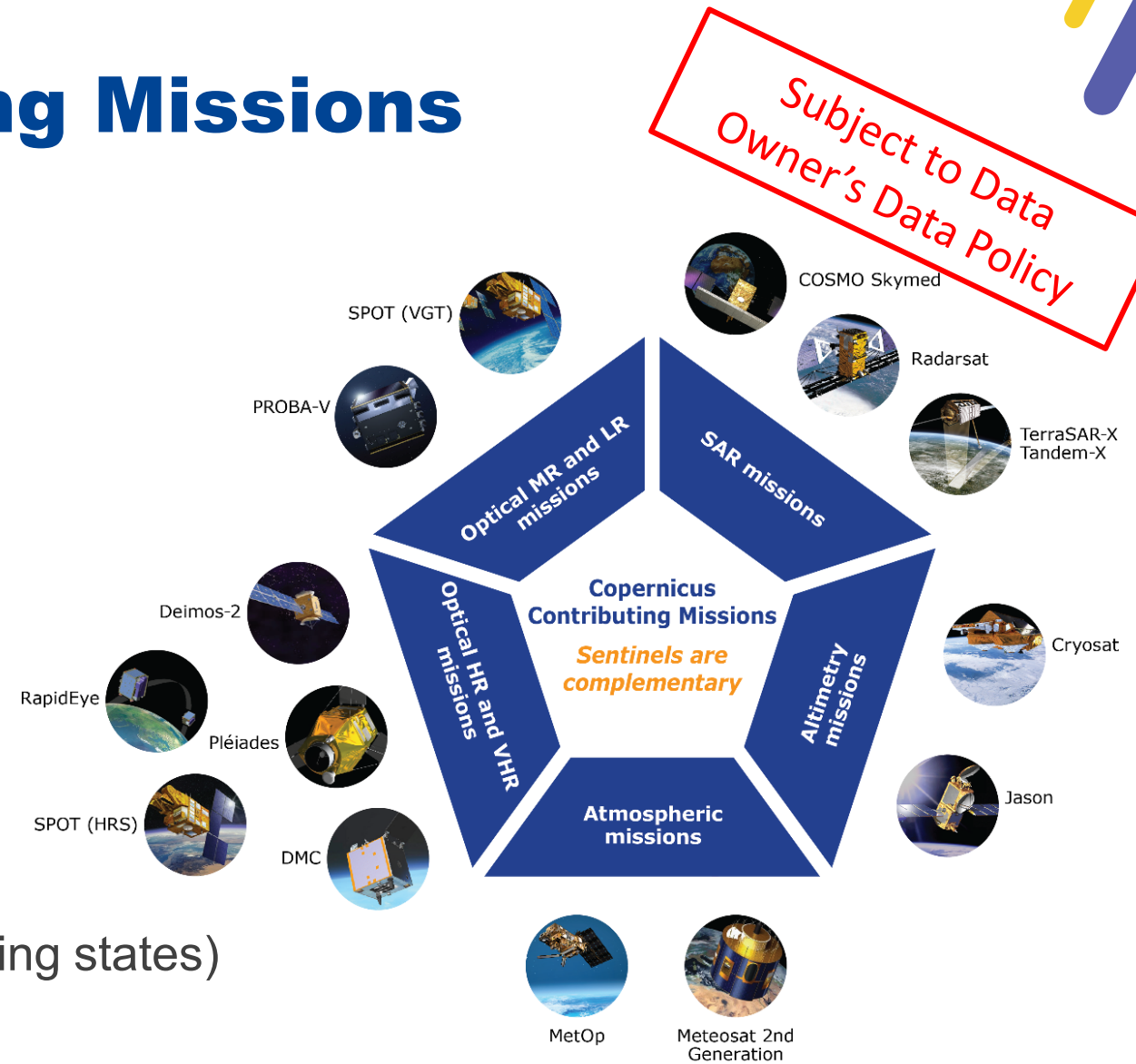
How to access the Copernicus data and products

Thematic Hubs

https://dataspace.copernicus.eu
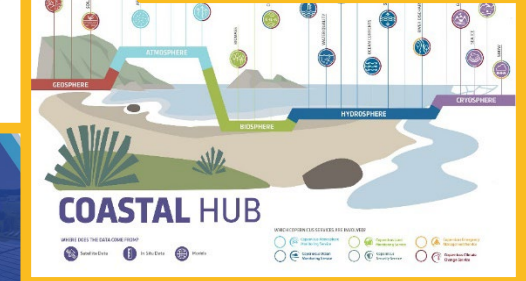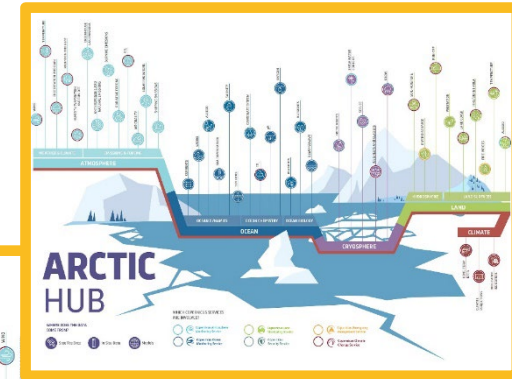
Copernicus Data Space Ecosystem (CDSE) Portal

https://www.wekeo.eu

WEkEO Portal

Land Monitoring

Marine Monitoring

Emergency Management

Atmosphere Monitoring

Climate Change

Security

ARCTIC HUB

COASTAL HUB

ENERGY HUB

A gateway to Copernicus for energy policy makers, public administrations, and industry

HEALTH HUB

Copernicus Health Hub: the link between Earth Observation, Environmental Information and Health

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

14

Knowledge Centre on Earth Observation

Pillar 1: Policy Needs, Uptake & Coherence

Pillar 2: Mainstreaming R&I

KCEO

Focused entry point
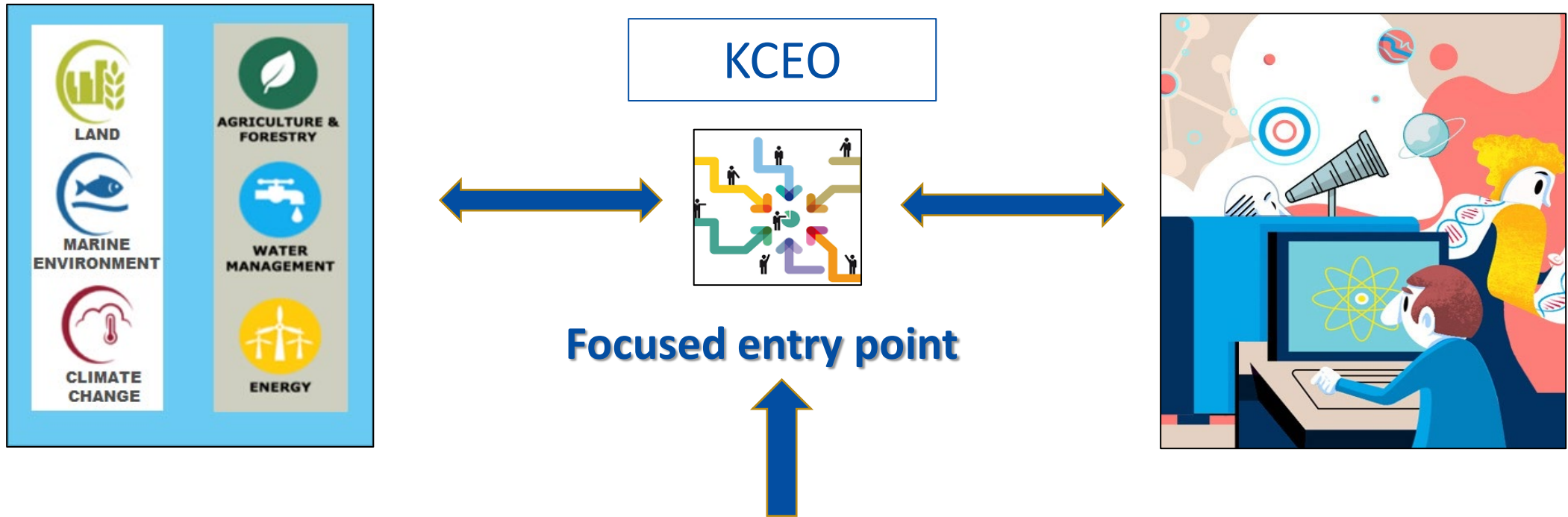
Inclusiveness & Transparency: Dialogue with external partners; international organisation; society

PROGRAMME OF
THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

European Green Deal Legislation including Copernicus by policy area over time

Policy Areas

- European Green Deal
- Increasing the EU Climate Ambition for 2030 and 2050
- Building and Renovating in an Energy and Resource Efficient Way
- Mobilising Industry for a Clean and Circular Economy
- Accelerating the Shift to Sustainable and Smart Mobility
- From Farm to Fork: Designing a Fair, Healthy and Environmentally-Friendly Food System
- Preserving and Restoring Ecosystems and Biodiversity
- A Zero-Pollution Ambition for a Toxic-free Environment
- Sustainable Development Goals
- EU Missions
- Cohesion
- International Partnership, Cooperation, Research, Innovation & Development, Telecommunications
- Marine, Water & Fisheries

PROGRAMME OF
THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

Thematic Deep Dive Methodology Summary of steps

1. Policy needs assessment

2. Earth Observation Value Chain

3. Translation of needs into quantitative requirements

4. Assessment of fitness for purpose with regards to existing products, services, infrastructure, capacities

5. Gap analysis and recommendations for evolution

Deep Dive on Biodiversity

MONITORING OF THE EU BIODIVERSITY STRATEGY (BDS) TARGETS

NEEDS: High-resolution (HR) and long-term indicators on a yearly basis to effectively monitor progress towards the targets outlined.
STATUS: Two online tools for tracking and reporting the progress of the BDS implementation: Actions tracker and Dashboard.
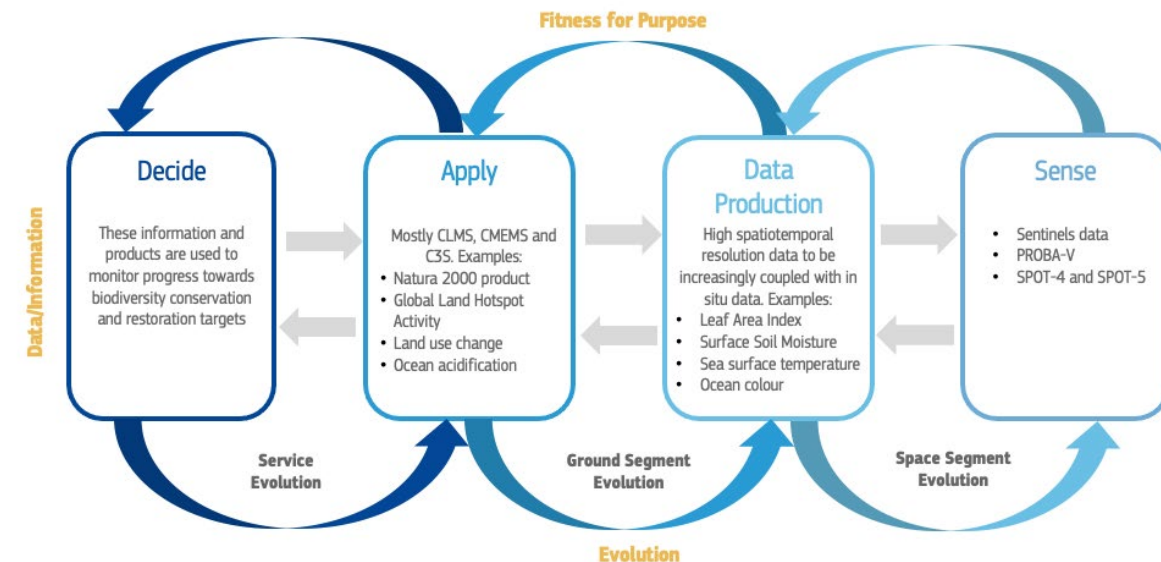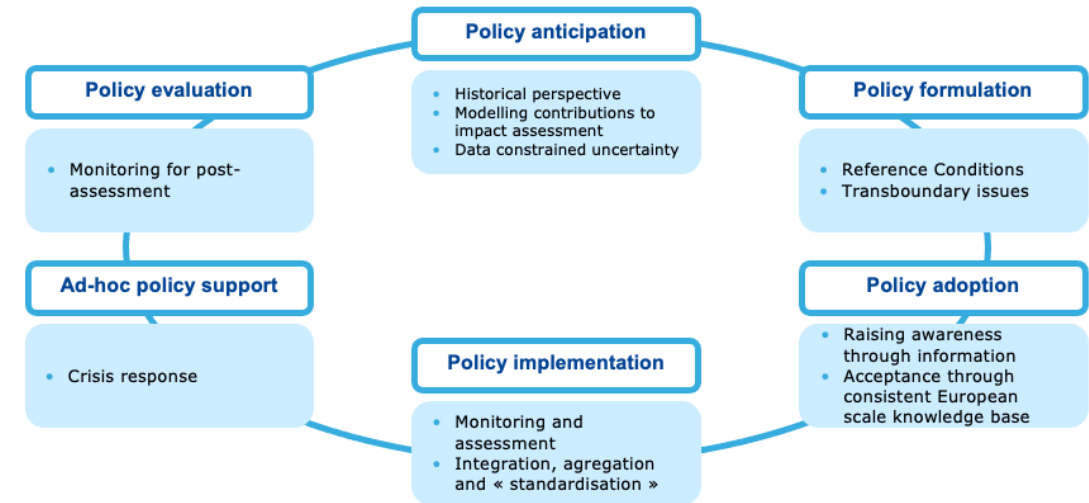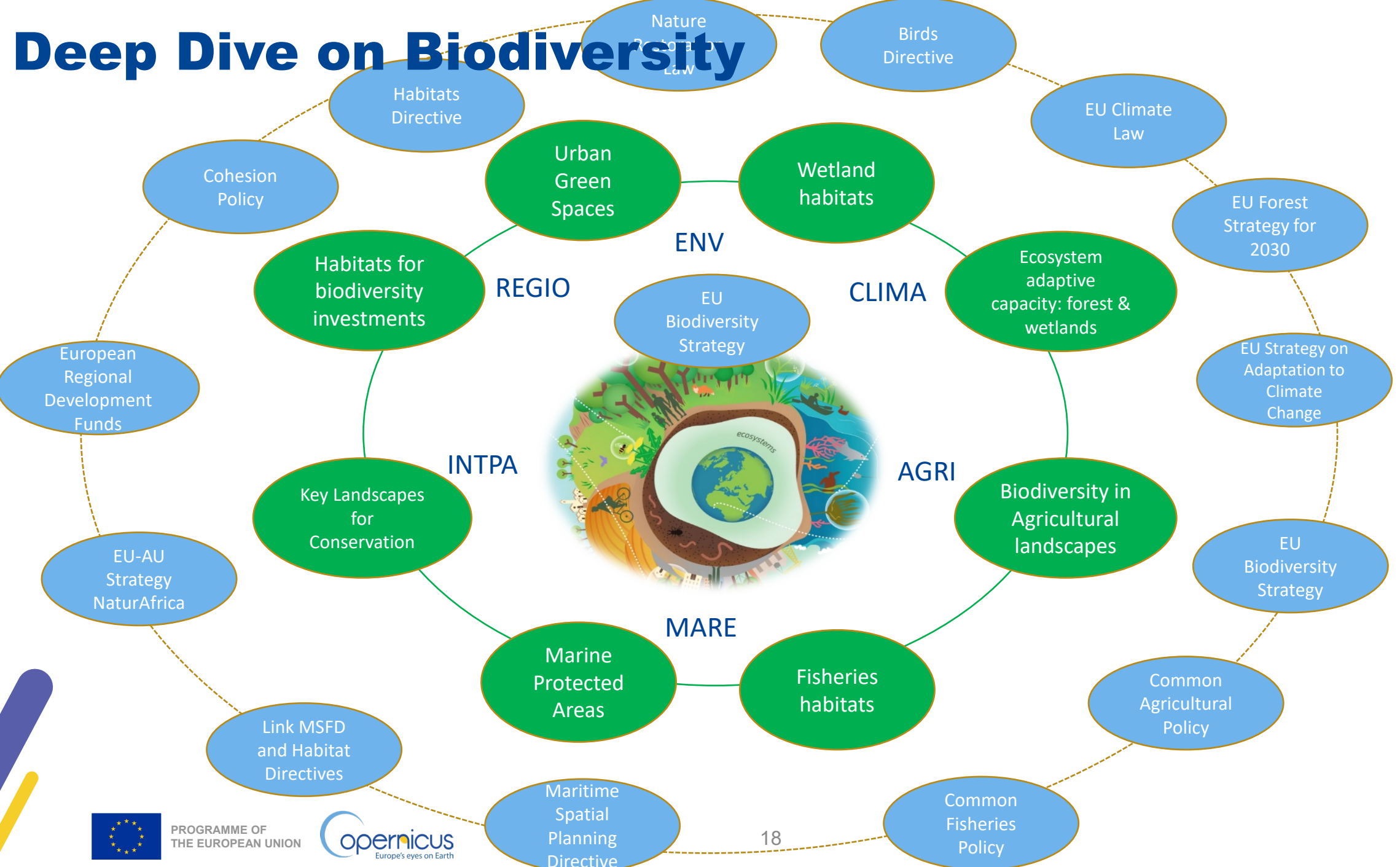**GAPS:**
- Lack of yearly HR maps to track changes.
- Absence of suitable ground-based biodiversity data for training and validation.

MONITORING OF URBAN GREEN SPACES

NEEDS: Multitemporal HR maps covering various types of urban green infrastructures.
STATUS: Urban Atlas and Small Woody Features (SWF), among others, partially fulfill the need.
GAPS:
- Inadequacy of temporal frequency, thematic granularity, and spatial coverage.
- Geometric inaccuracy.

MONITORING WETLAND HABITATS

NEEDS: HR maps of delineating wetland habitats and long-term indicators for assessing overall conditions and changes.
STATUS: Land cover map on riparian zones, a dataset on long-term dynamics of surface water, and in-situ soil moisture observations.
GAPS:
- Lack of common definition for wetlands, based on generalized, objective, and measurable criteria.
- Insufficiency in geographic coverage, thematic granularity, spatial and temporal consistency, and a lack of a long-term record.
- Absence of a user-friendly platform to facilitate products accessibility.

BIODIVERSITY MONITORING IN KEY AFRICAN LANDSCAPES FOR CONSERVATION (KLCs)

NEEDS: Detailed indicators, encompassing performance monitoring and accountability measures to support ecosystems conservation while supporting livelihoods and human development.
STATUS: EO products integrated in the AKP provide a baseline for monitoring across the selected KLCs.
GAPS:
- Insufficiency in integrating ancillary data, including socio-economic information derived from UNESCO and EU Delegations.
- Absence of a user-friendly platform to facilitate products accessibility, analysis and reporting.

MONITORING ESSENTIAL FISH HABITATS AND VULNERABLE MARINE ECOSYSTEMS, & MARINE BIODIVERSITY

NEEDS: HR maps for assessing marine protected areas (MPAs), characterising fisheries resources and identifying vulnerable ecosystems.
STATUS: EMODnet and the Copernicus Marine Service partially address the needs.
GAPS:
- Lack of centralized and easy access to satellite and in-situ national data.
- Absence of informative indicators on species richness and abundance hotspots, overlaps between hotspots and MPAs, and areas impacted by cumulative impacts.
- Insufficient spatial and temporal resolutions.

BIODIVERSITY MONITORING IN AGRICULTURE LANDSCAPE

NEEDS: Indicators for biodiversity monitoring and evaluation to meet the 10% target for High Diversity Landscape Features.
STATUS: SWF and LUCAS Landscape Features module partially address the needs.
GAPS:
- Lack of integration between SWF and LUCAS module.
- Absence of independent and traceable quality assessment of SWF with respect to policy requirements.
- Inadequate frequency and latency of available products.

Central diagram

KCEO DEEP DIVE ON BIODIVERSITY

- Monitoring Biodiversity Strategy
- Birds Directive
- Nature Restoration Law
- KCBD
- Urban Green Spaces
- Wetland habitats
- Habitats Directive
- **ENV**
- EU-AU Strategy Republic Africa
- Key Land-scapes for Conservation
- **INTPA**
- Link MSFD
- Marine Protected Areas
- Maritime Spatial Planning Directive
- **MARE**
- **AGRI**
- Common Agricultural Policy
- Biodiversity monitoring in agriculture landscape
- Fisheries habitats
- Common Fisheries Policy
- **CLIMA**
- **REGIO**
- EU Strategy on Adaptation to Climate Change
- Ecosystems adaptive capacity: forest & wetlands
- Habitats for biodiversity investments
- EU Biodiversity strategy
- EU Climate Law
- EU Forest Strategy for 2030
- Cohesion Policy
- European Regional Development Funds

MONITORING ECOSYSTEMS HEALTH TO SUPPORT BIODIVERSITY INVESTMENTS

NEEDS: Monitoring system to guide and assess EU investments in biodiversity and ecosystems.
STATUS: Available EO products partially address the needs.
GAPS:
- Insufficient generation of targeted indicators, such as phenology or productivity indices.
- Lack of operationality.
- Inconsistencies and gaps in the time series.
- Coarse thematic granularity of land cover maps, limiting a comprehensive understanding of ecosystems.

MONITORING SHIFTS IN GEOGRAPHIC RANGES, DISTRIBUTION AND CONDITIONS OF SPECIES POPULATION AS A FUNCTION OF CHANGING CLIMATE

NEEDS: Assessment of the impacts of Climate Change on ecosystems' functions and structures, on species abundance and distribution.
STATUS: Climatic data products are suitable for bioclimatic models.
GAPS:
- Low spatial resolution of available products.
- Lack of operationality in combining bioclimatic modelling technologies with bioclimatic products (under development by C3S).
- Insufficiency in parametrising biological processes to be included in models.
- Inaccuracy and lack of performance assessment of bioclimatic models.

ASSESSMENT AND MONITORING OF EU FOREST HEALTH

NEEDS: A forest monitoring system to alert on disturbances, assess the impact of climate changes on biodiversity, and predict disturbance risks.
STATUS: Copernicus CLC+ Backbone and High Resolution Layer Forest, among others, partially address the needs.
GAPS:
- Lack of HR yearly maps on forest status and changes.
- Insufficiency in delineating forest types.
- Deficiency in integrating ground and satellite data.
- Limited access to and use of training and reference data for accuracy assessment of Copernicus products.

PR
THI

#	RS - Biodiversity Product (*)	EU Biodiversity Strategy Targets																Copernicus Product
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Biological effect of fire disturbance	x	x	x	x													Burnt Area
2	Biological effect of irregular inundation	x	x	x	x													Soil Water Index
3	Leaf Area Index		x		x													Leaf Area Index
4	Land Cover	x	x	x	x			x	x	x	x							Land Cover
5	Ice Cover habitat	x	x	x	x													RLIE S1+S2
6	Above ground biomass		x		x													NA
7	Foliar NPK Content						x							x				NA
8	Net primary productivity							x	x									Net primary productivity
9	Gross primary productvity							x	x									Gross primary productvity
10	FAPAR		x		x													FAPAR
11	Fraction of vegetation cover							x	x									Fraction of vegetation cover
12	Plant area index profile		x		x													NA
13	Urban habitat														x			1. Urban Atlas, 2. GHS BUILT, 3. GHS SMOD
14	Vegetation canopy height	x	x	x	x													NA
15	Habitat structure				x													NA
16	Ecosystem Fragmentation	x			x													Corine Land Cover
17	Ecosystem structural variance	x			x													Corine Land Cover
18	Land surface phenology peak							x	x									Vegetation phenology and productivity suite HR VPP
19	Land surface phenology green-up							x	x									Vegetation phenology and productivity suite HR VPP
20	Land surface phenology senescence							x	x									Vegetation phenology and productivity suite HR VPP
21	Carbon cycle		x		x													NA
22	Chlorophyll content and flux	x		x														Chlorophyll content and flux

(*) RS products prioritized as EO biodiversity metrics in Skidmore et al. (Nature ecol & evol, 2021)

General recommendations on EO support to EU biodiversity policy
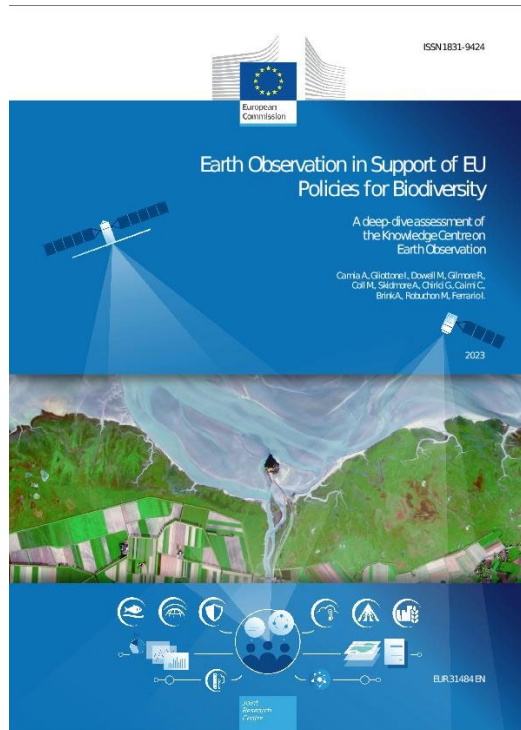
- Sustained assistance to cover the "**last mile**" for an efficient uptake: products need to be tailored

- Efficiency potentially gained addressing **cross-policy needs**

- **Spatial resolution and thematic detail** more important than high time frequency

- **Time series** length, consistency and regular updates to improve e.g., for benchmarking and observing evolutions over time

- **Improving thematic details** of EO products; standard land cover classes not sufficient for many biodiversity applications. Need of a harmonised ecosystem typology classification (other communities are going in this direction).

- Integration of **in situ data** and models is key but far from operational

- **Availability of in situ** data is still a challenge

- **Access to EO products** and services for decision makers to improve

https://publications.jrc.ec.europa.eu/repository/handle/JRC132908

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

THANK YOU

#EUSpace
#Copernicus

Michel Massart

European Commission

JRC D6