



Land Monitoring

Copernicus Land Monitoring Service for Biodiversity

Biospace 25 – ESRIN, Frascati

Usue Donezar Hoyos, Andreas Brink

12 February 2025



Essential Biodiversity Variables

- variables to measure biodiversity change
- distill the complexity of biodiversity into a manageable list of priorities
- coordinated approach to observing biodiversity on a global scale from Earth Observation and In Situ measurements
- promoted by GEO BON

GEO BON, 2024



PROGRAMME OF THE
EUROPEAN UNION



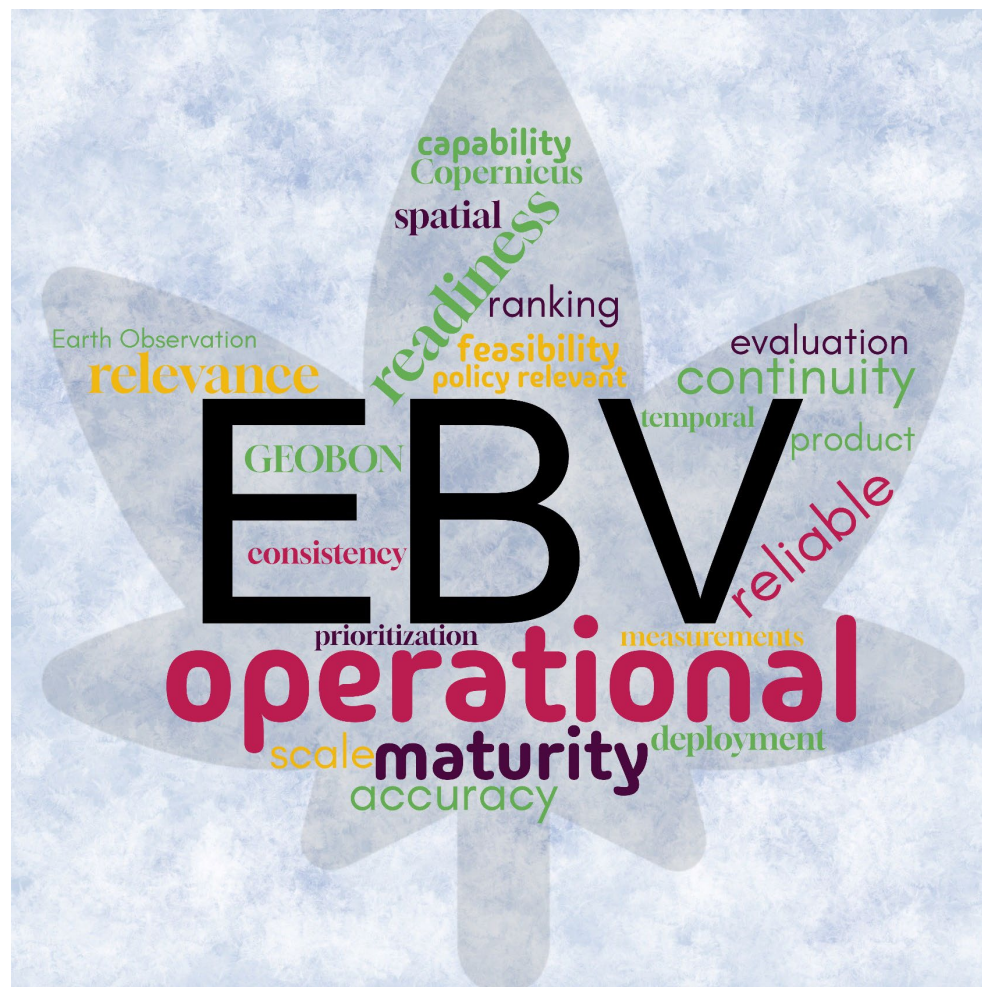
Implemented by



European
Environment
Agency



Needs and Requirements



Skidmore, A.K. et. al (2021). Priority list of biodiversity metrics to observe from space. *Nature Ecology & Evolution*, Vol. 5, July 2021, 896–906



PROGRAMME OF THE
EUROPEAN UNION



Implemented by



European
Environment
Agency



Earth Observation based EBV's

FIT4PURPOSE	Criteria	Description
	Relevance	Use and user fully identified
	Feasibility	Maturity of the science, technology and availability of remote sensing data, the ease of access and the completeness to such data
	Remote sensing status: Accuracy	Effectiveness of remote sensing data and techniques to achieve an accurate and precise value of the remote sensing-enabled biodiversity product
	Remote sensing status: Maturity	Operational implementation

Modified from: Skidmore, A.K. et. al (2021).

Ranking remote sensing biodiversity products

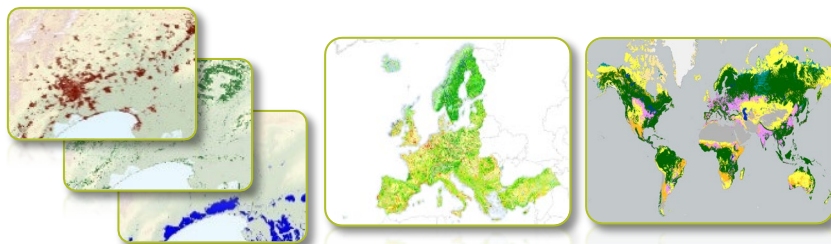
COPERNICUS LAND MONITORING SERVICE	RS biodiversity product	RS -enabled biodiversity variable	EBV class	Rank within EBV class	Rank across all EBV classes
	Fire disturbance	Ecosystem disturbance Habitat structure	Ecosystem function Ecosystem structure	1 1	1 1
	LAI	Ecosystem physiology Habitat structure Species physiology	Ecosystem function Ecosystem structure Species traits	3 3 1	5 5 21
	Land cover (vegetation type)	Habitat structure	Ecosystem structure	3	5
	Ice cover habitat	Habitat structure	Ecosystem structure	5	8
	Net primary productivity (NPP)	Ecosystem physiology Species physiology	Ecosystem function Species traits	5 2	11 28
	Gross primary productivity (GPP)	Ecosystem physiology Species physiology	Ecosystem function Species traits	5 2	11 28
	Fraction of absorbed photosynthetically active radiation (FAPAR)				
	Fraction of vegetation cover	Habitat structure	Ecosystem structure	7	11
	Peak, start, end of season	Ecosystem Phenology	Ecosystem function	8	22
Ecosystem soil moisture	Ecosystem physiology	Ecosystem function	14	28	



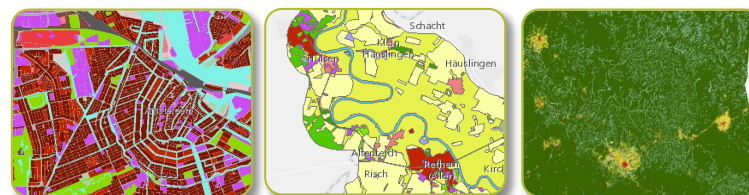
Copernicus Land Monitoring Service - products



**Land cover and
land use mapping**



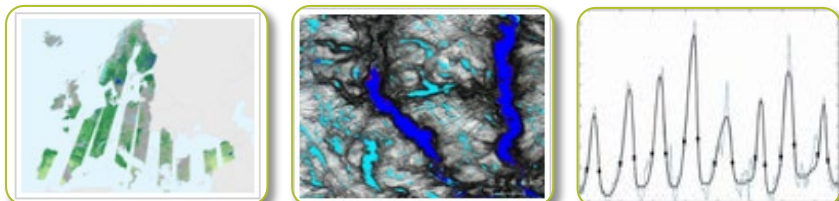
**Priority area
monitoring**



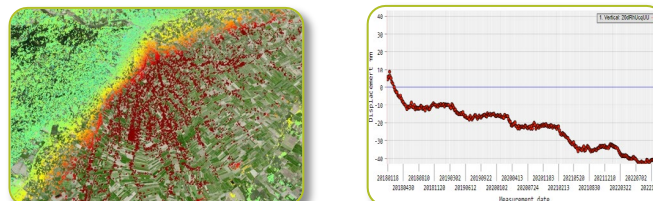
Satellite data



**Bio-geophysical
parameters**



**Ground motion
monitoring**



**Reference and
validation data**



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

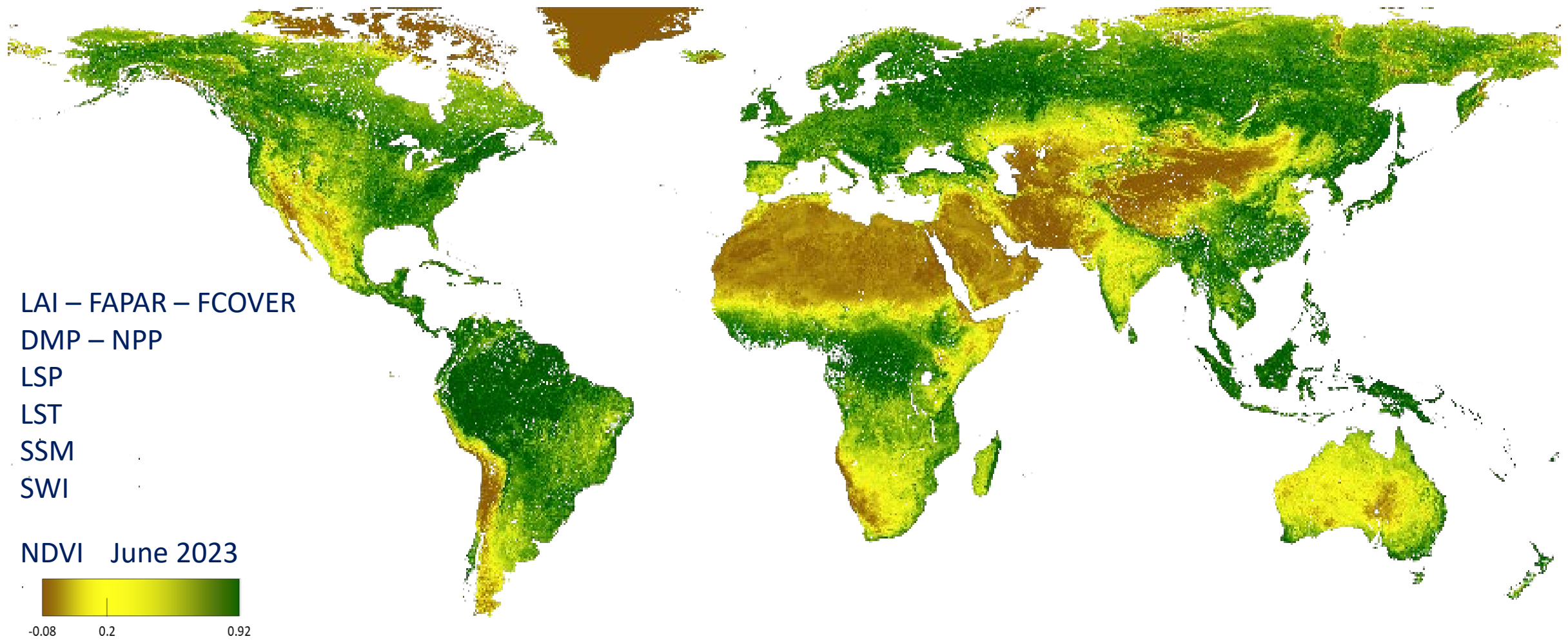
Implemented by



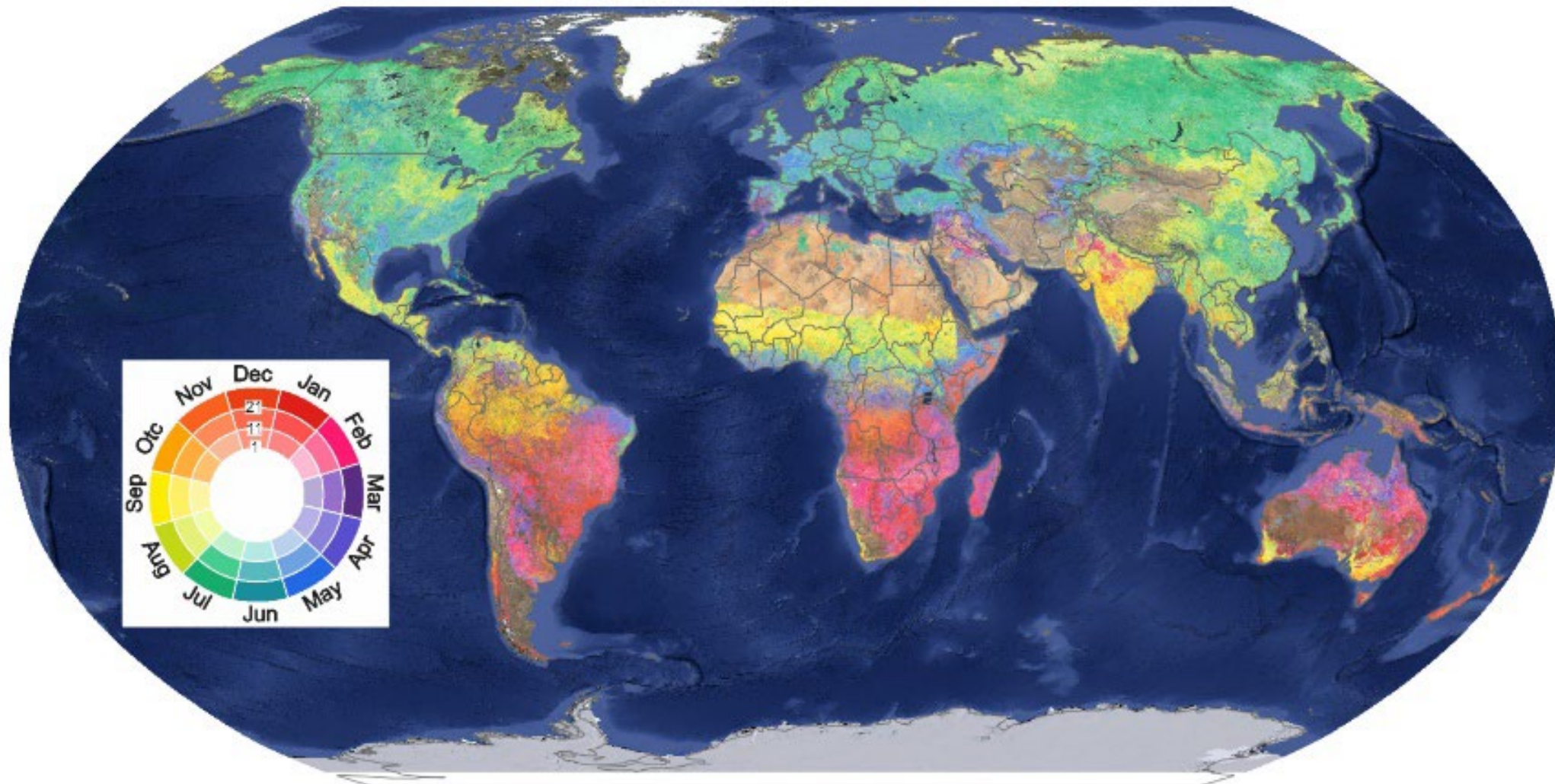
European
Environment
Agency



Global biophysical variables



Land Surface Phenology



Date of the peak of growing season - 2023



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by

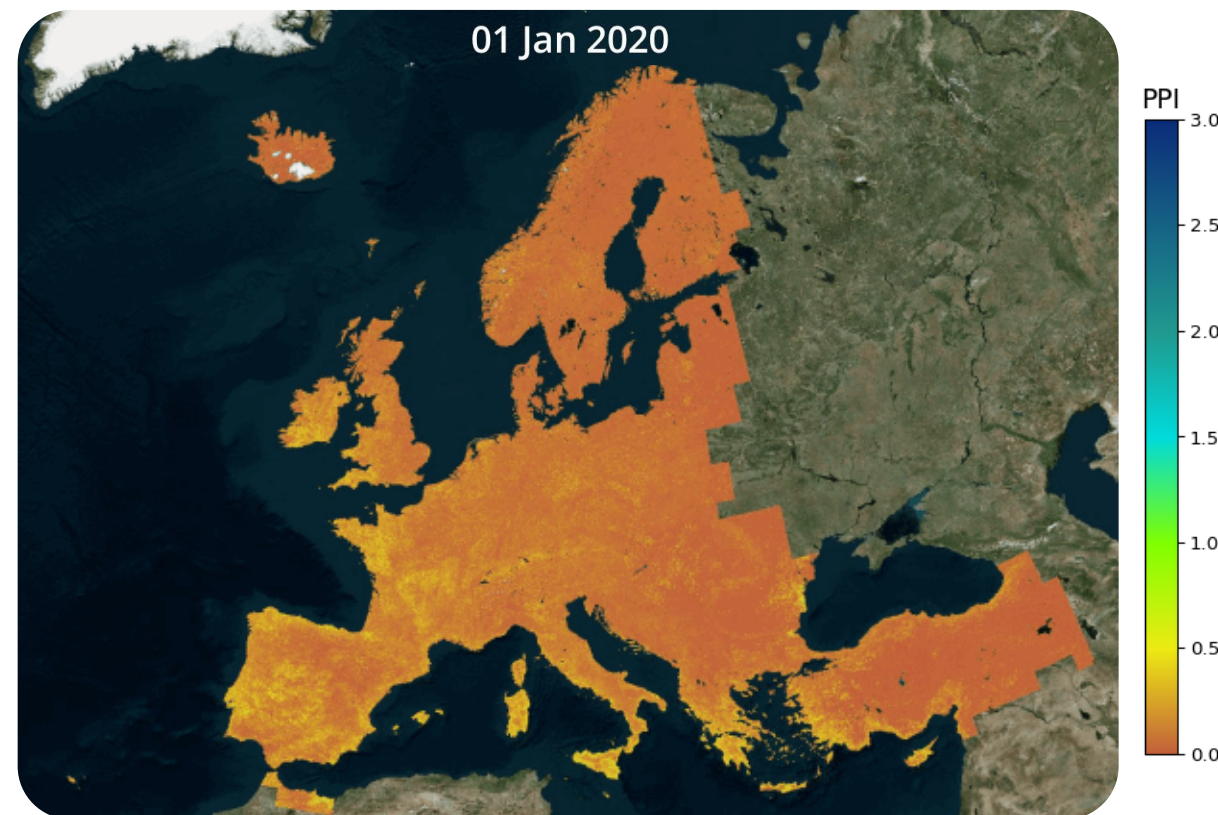


European
Environment
Agency



HR Vegetation Phenology & Productivity

- 10 meter annual processing of 13 metrics.
- **Near Real-Time:** vegetation indices & biophysical variables
- **Future prospects:**
 - Tree Cover Disturbances
 - Biomass Productivity (GPP/NPP)



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by



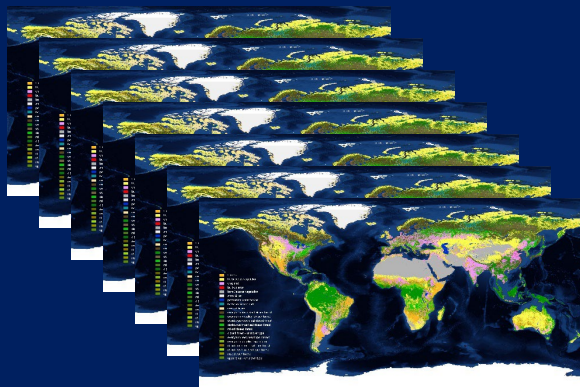
European
Environment
Agency



Global Land Cover

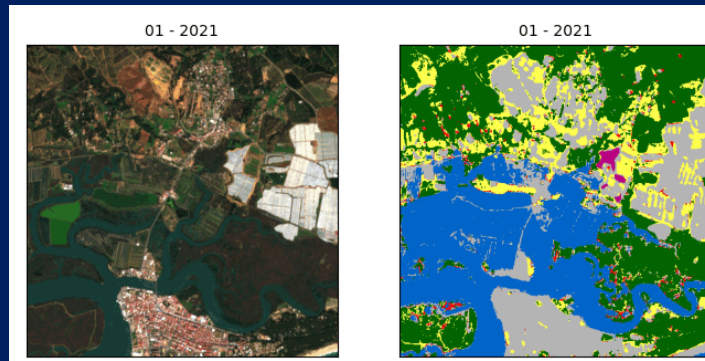
CONTINUE

- Continuation of 100m global LC
- Yearly updates (2020-2026)



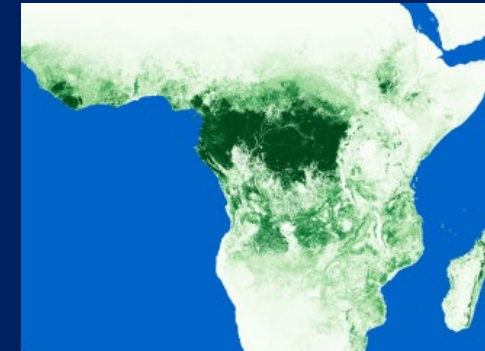
ENHANCE

- Spatial resolution: towards 10 m
- Temporal resolution: towards monthly and NRT
- Improved accuracy
- Consistent change mapping



EXTEND

- Sub-annual products
- Specific Tropical Forest Products (TCD, TCPC)



PROGRAMME OF THE
EUROPEAN UNION



Implemented by

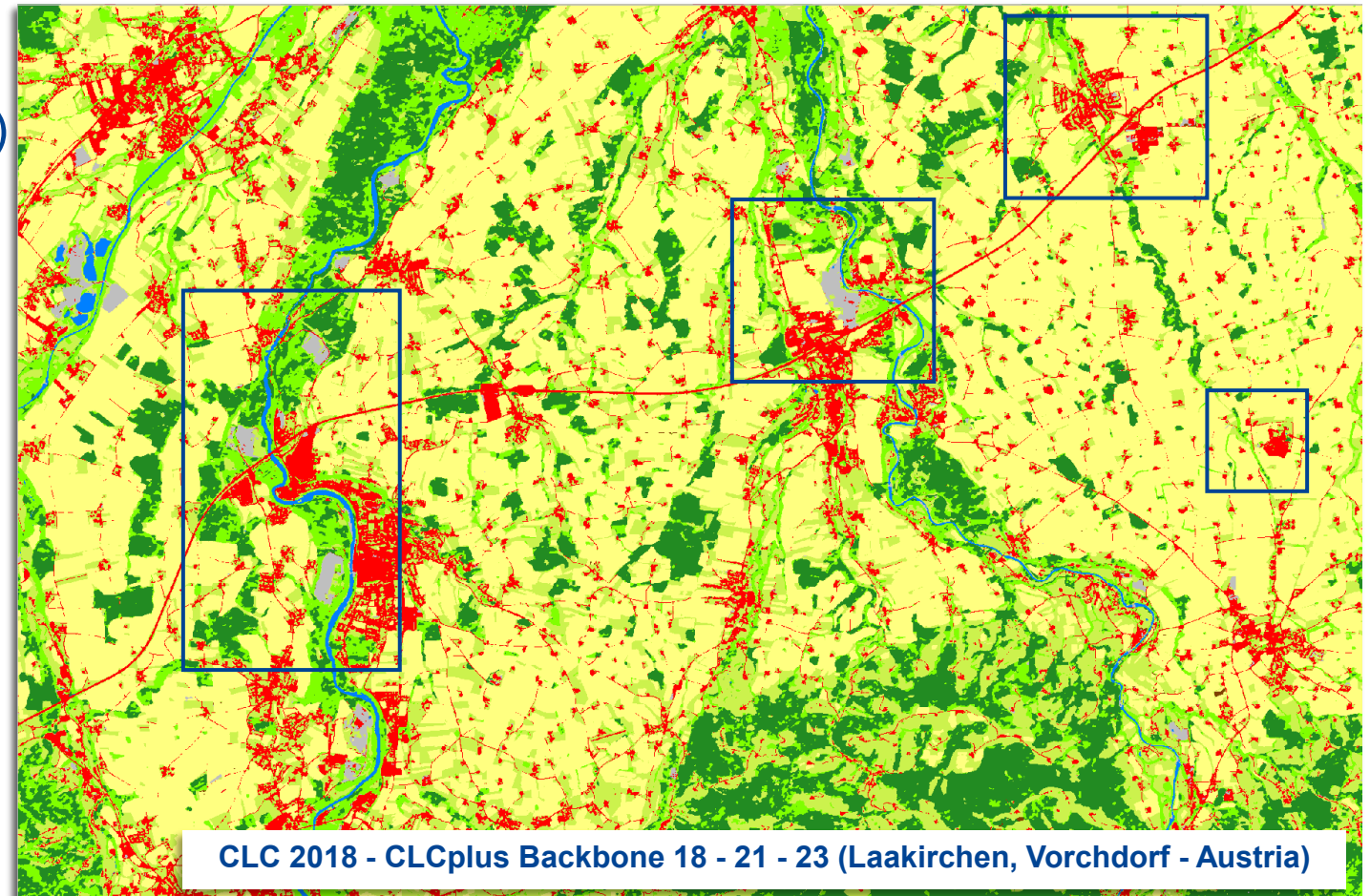
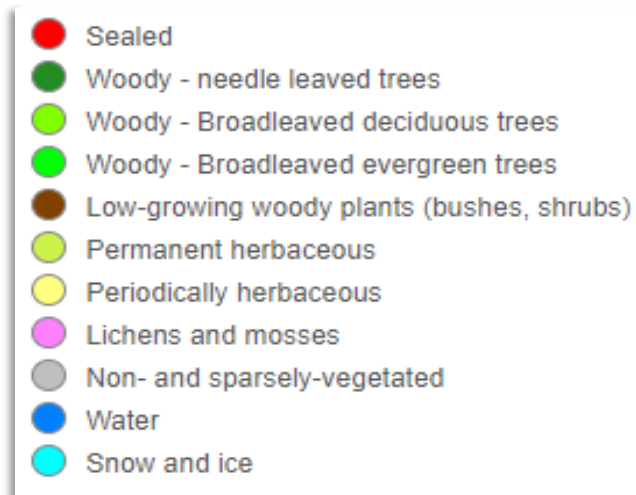


European
Environment
Agency



CLCplus Backbone

- High-resolution land cover status (10m)
- Timely availability (reference yr + 1yr)
- 11 basic land cover classes



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by



European
Environment
Agency



HRL – Tree Cover & Forests

- **Tree Cover Density (TCD)**
 - 0 – 100 % canopy density;
 - 10 meter resolution for EEA38/9;
 - Annual;
 - overall >90% accuracy with high spatial consistency.
- **Dominant Leaf Type (DLT)**
 - Coniferous / Broadleaved classification;
 - 10 meter resolution for EEA38/9;
 - Annual
- **Forest Type (FTY)**
 - Coniferous / Broadleaved classification;
 - FAO forest definition, filtering:
 - >10% TCD;
 - <0.5 ha MMU;
 - trees in agricultural and urban context (from CLC and HRL Imperviousness)
 - 10 meter resolution for EEA38/9;
 - 3 Year



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by



European
Environment
Agency



HRL Grassland

- **Grassland Status (GRA)**
 - Binary
 - Annual
- **Herbaceous (HER)**
 - Annual
 - Binary (Permanent & Temporary)
- **Ploughing Indicator (PLOUGH)**
 - Annual
 - 0 – 6+ years since identified last ploughing
- **Grassland Change (GRAC)**
 - 3-yearly
 - Classified (Gain/Loss)
- **Grassland Mowing (GRAM)**
 - Annual
 - **Events (GRAM-E)**
 - 0 – 4+ identified events
 - **Dates (GRAM-D)**
 - Four layers. One for each event
 - Day-of-Year



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

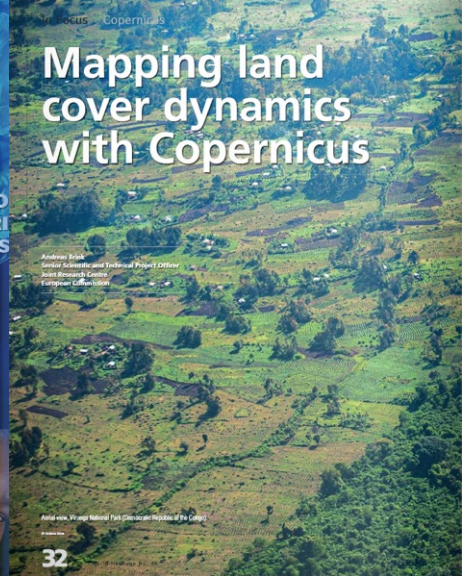
Implemented by



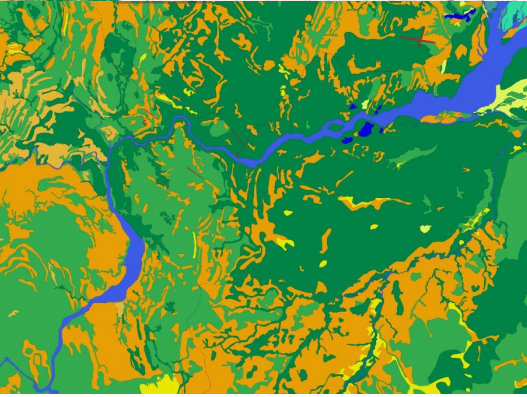
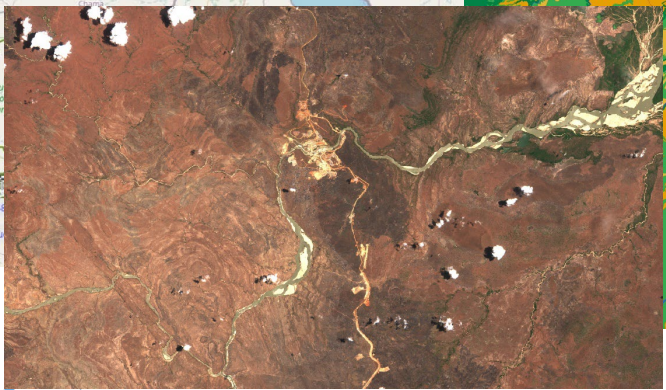
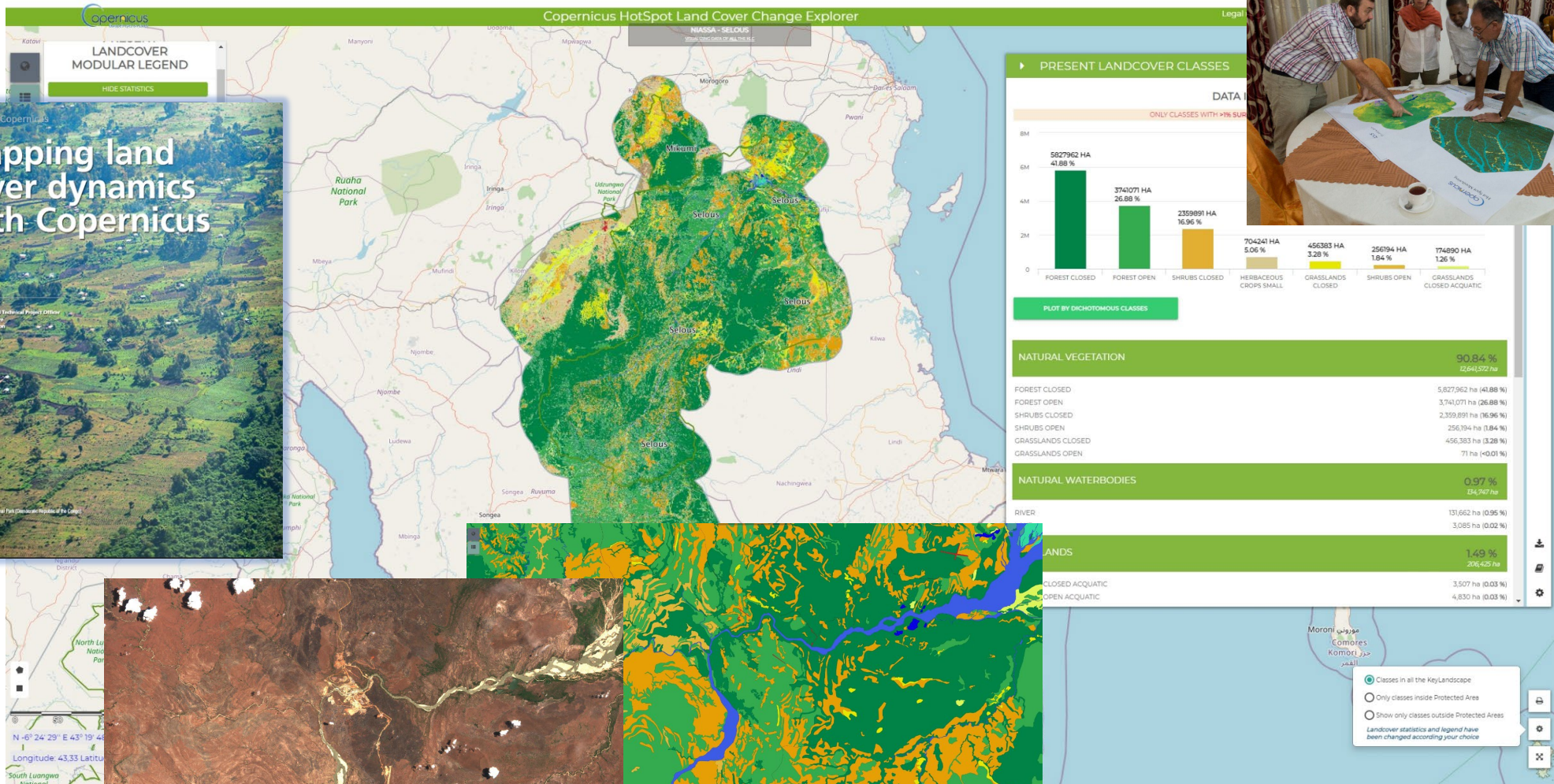
European
Environment
Agency



Hot Spot Monitoring - Biodiversity



NaturAfrica
The Green Deal approach for EU support to biodiversity conservation in Africa



Priority Area Monitoring

Urban Atlas

2006-12-18-21-24



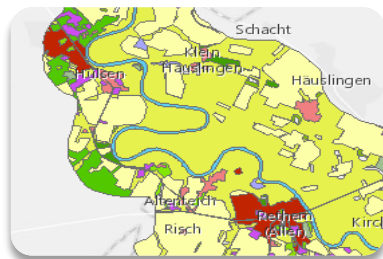
Protected Areas

2006-12-18-21-24



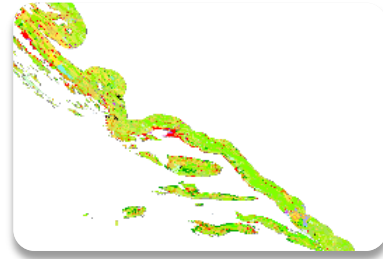
Riparian Zones

2012-18-21-24

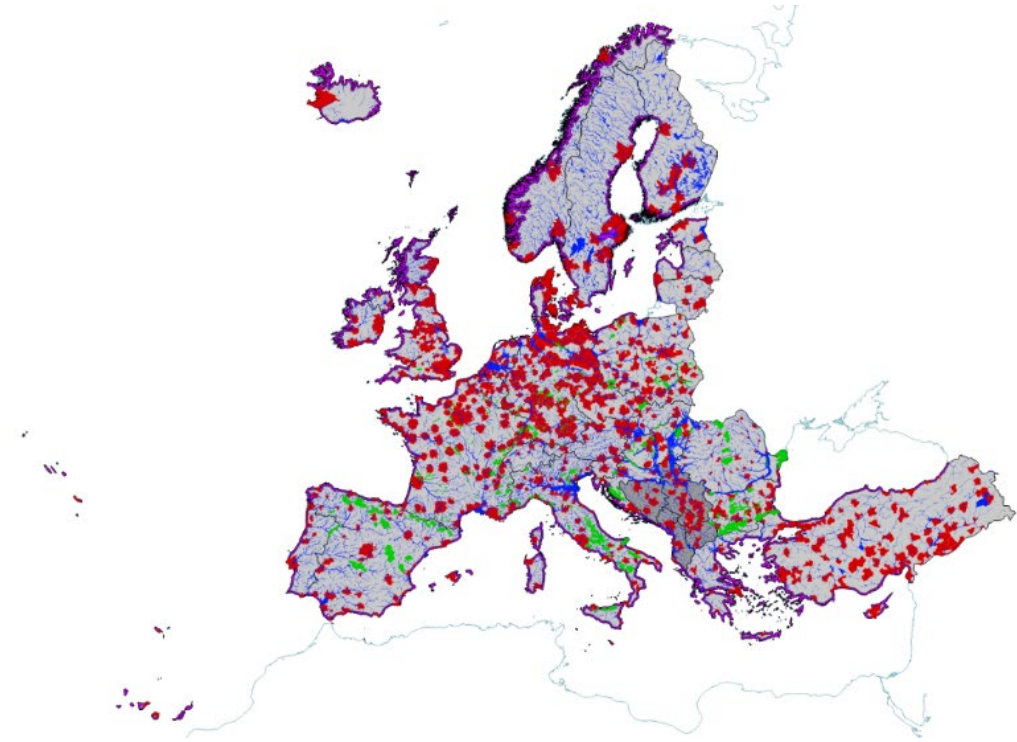


Coastal Zones

2012-18-21-24



- Vector based VHR LC/LU mapping of priority areas
- MMU 0.5 ha
- Tailored nomenclature
- Update on a 6/3 year cycle: status and change mapping



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by



European
Environment
Agency



Copernicus for CBD GBF Goals / Targets and SDG

FIT4PURPOSE
Relevance – Feasibility – Accuracy – Maturity

EBV class	Remote sensing biodiversity product	Aichi targets	SDG targets
Ecosystem Structure (an ecological structure that can be monitored at a global level)	Fire disturbance	7,9,10,12,14,15	15.2, 15.3
	LAI	5,7,9,10,12,14,15	15.2, 15.3, 15.5
	Land cover (vegetation type)	5,7,9,14,15	15.2, 15.3, 15.5
	Ice cover habitat	5,7,9,14,15	15.2, 15.3, 15.5
Species Traits (trait of an organism of known species that can be monitored at a local level)	Peak, start, end of season	5,7,9,12,14,15	15.4
	Gross primary productivity (GPP)	5,7,9,10,12,14,15	15.4
	Net primary productivity (NPP)	5,7,9,10,12,14,15	15.4
	LAI	5,7,9,10,12,14,15	15.4
Community Composition (composition of a community that can be monitored at a global level)	Peak, start, end of season	5,7,9,12,14,15	15.4
Ecosystem Function (an ecological function monitored over time at a global level)	Peak, start, end of season	5,7,9,12,14,15	15.4
	Gross primary productivity (GPP)	5,7,9,10,12,14,15	15.2
	Net primary productivity (NPP)	5,7,9,10,12,14,15	15.2
	LAI	5,7,9,10,12,14,15	15.2
	Evapotranspiration	5,7,10,12,14,15	15.2
	FAPAR	5,7,10,12,14,15	15.2
	Ecosystem soil moisture	5,7,10,12,14,15	15.2
	Fire disturbance	7,9,10,12,14,15	15.2, 15.3

Modified from: Skidmore, A.K. et. al (2021).



PROGRAMME OF THE
EUROPEAN UNION



Land Monitoring

Implemented by



European
Environment
Agency

