European Commission

SCIENCE FOR POLICY BRIEF

KCEO Deep Dive

Earth Observation for Biodiversity

The Knowledge Centre on Earth Observation (KCEO) assessed the current and potential use of Earth Observation (EO) in support of EU policies related to biodiversity

HIGHLIGHTS

- → Examining biodiversity-related concerns through the lens of Earth observation (EO) has revealed **significant synergies** across different policy areas, e.g. in the assessment of wetlands. The identification of common needs and solutions can lead to **increased efficiency gains** and **improved coherence in EU policymaking** through consistent data and information.
- → This study underscores technical **gaps** in EO biodiversity data, including issues related to accessibility, geographic coverage, temporal inconsistencies, and thematic considerations. The analysis of the technical requirements for each specific use case yielded **key recommendations and actions** for future Improvements in the use of EO data in biodiversity policies.

INTRODUCTION

One of the most important global challenges we are currently facing is the loss of biodiversity, which has profound environmental, social, and economic implications. The EU Biodiversity Strategy (BDS) for 2030 includes comprehensive plans to safeguard and restore Earth's biodiversity, in full alignment with the Kunming-Montreal Global Biodiversity Framework (GBF).

Earth observation (EO) has a crucial role in supporting biodiversity-related policies. Copernicus Services play an increasingly important role in offering products and tools to monitor changes in ecosystems and biodiversity loss, thereby supporting the EU BDS, the Convention on Biological Diversity and reporting actions of the Sustainable Development Goals (SDGs).

The European Commission's Knowledge Centre on Earth Observation (KCEO) provides a coordination mechanism inside the European Commission (EC) to maximise the uptake of the Copernicus programme by EU policies, focusing on the translation of policy needs into concrete requirements for EO products and services.

The Deep Dive assessments launched by the KCEO analyse a defined policy area to verify how and to what extent existing EO products and services meet policy needs, to identify gaps, and to provide recommendations on the future evolution of Copernicus products and services to address these needs.

This brief summarises the findings of the Deep Dive assessment on Biodiversity[1] coordinated by the co-chairs of the KCEO - the Directorate-General for Defence Industry and Space (DEFIS) and the Joint Research Centre - in collaboration with the EC Directorate-Generals for Environment (ENV), Regional and Urban policy (REGIO), Climate Action (CLIMA), International Partnerships (INTPA), Maritime Affairs and Fisheries (MARE), Agriculture and Rural Development (AGRI), Research and Innovation (RTD) and the Statistical Office of the European Union (ESTAT).

A case-by-case assessment

The Deep Dive assessment addressed nine use cases, illustrated in the schematic on the centrefold with the main outcomes of these assessments.

Joint Research Centre

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

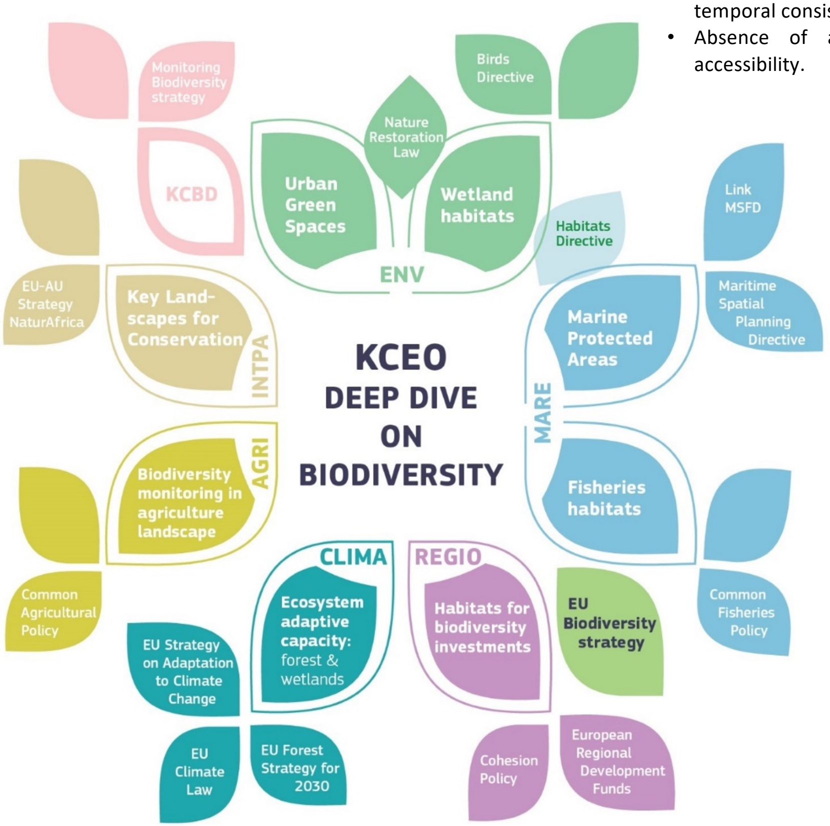
NEEDS: Multitemporal HR maps covering various types of urban green infrastructures.
STATUS: Urban Atlas and Small Woody Features, among others, partially fulfil the need.
GAPS:
- Inadequate temporal frequency, thematic granularity, and spatial coverage.
- Geometric inaccuracy.

MONITORING WETLAND HABITATS

NEEDS: HR maps 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 generalised, objective-, and measurable criteria.
- Insufficient geographic coverage, thematic granularity, spatial and temporal consistency, and lack of a long-term record.
- Absence of a user-friendly platform to facilitate products' accessibility.

BIODIVERSITY MONITORING IN KEY AFRICAN LANDSCAPES FOR CONSERVATION AND DEVELOPMENT (KLCDs)

NEEDS: Detailed indicators, encompassing performance monitoring and accountability measures to support the conservation of ecosystems and the expansion of the protected areas network, while fostering livelihoods and human development.
STATUS: EO products integrated in the AKP provide a baseline for monitoring across the selected KLCDs. A user-friendly tool will be developed in the context of NaturAfrica and the Regional Centres of Excellence Programme.
GAPS: Insufficiency in integrating ancillary data, including socio-economic information derived from UNESCO and EU Delegations.



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 centralised 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.
- 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.

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 EO 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 about disturbances, assess the impact of climate change 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.
- Insufficient delineation of forest types.
- Insufficient integration of ground and satellite data.
- Limited access to and use of training and reference data for accuracy assessment of Copernicus products.

GENERAL RECOMMENDATIONS

- **Enhance data records** to provide consistent high-resolution long-term indicators with more regular updates. This ensures continuity, facilitates trend analysis, and addresses the seasonality and evolution of change (e.g. wetlands degradation, habitat conditions) while aligning with specific policy requirements and the need for monitoring with respect to historic baselines.

- **Refine land cover maps** that are currently deemed insufficient for various biodiversity applications, by improving the thematic granularity of categories.

- **Consistently apply reference ecosystem typologies** in line with the Habitat Directive to further improve aggregated land cover classes. This will help assess and map the health and conditions of habitats and ecosystems.

- **Enhance quality and validation processes** of EO products to guarantee their accuracy and reliability. Incentivise access to in-situ observations for validation purposes and for the sharing of data needed to assess product accuracy.

- **Develop spatially referenced in-situ datasets** for validation, particularly in wetland and marine ecosystems, where biodiversity monitoring is more complex.

- **Integrate and harmonise relevant datasets and products** to establish a comprehensive mapping and monitoring system, incorporating diverse spatial and temporal resolutions, geographical coverage, and thematic granularity. The aim is to effectively track the status of and changes in various habitats (wetlands, green spaces in urban areas and agriculture, marine, forests) and monitor biodiversity holistically.

- **Make EO data and information accessible and easy to use by non-experts.** Develop user-friendly dashboards or web-based information systems to address last-mile policy applications, facilitating downstream data integration and application for reporting and decision-making purposes.

ACTIONS

To enhance the utilisation of Earth Observation data in biodiversity policies, the following key actions are proposed:

- **Leverage Copernicus services, to bridge significant information gaps and ensure the availability of high-quality data** with adequate geographic and thematic granularity, temporal resolution and quality assurance measures. For example, the new Copernicus Land Monitoring Service (CLMS) will contribute to a more dynamic characterisation of land surfaces on both sub-annual and annual bases, supporting biodiversity applications.

- **The Commission should proactively advance the state-of-the-art through coordinated research and innovation activities**, with a focus on developing methods and models to generate relevant indicators and analysing and monitoring ecosystem conditions. The feasibility of proposed monitoring systems should be assessed.

- **The Copernicus programme should reinforce data accessibility and discoverability** by developing dedicated user-friendly dashboards or web-based information systems. Priority should be given to implementing 'last mile applications' necessary for processing EO products and calculating policy-relevant indicators that can inform EU policies and track progress effectively.

- **The implementation of the Copernicus Thematic Hub on Biodiversity**, to be executed by the EEA, should leverage the strengths across Copernicus Services to facilitate the uptake of EO in support of Biodiversity policies.

- **The Commission and relevant Knowledge Centres (KCBD, KCEO) should facilitate cooperation among stakeholders**, including research entities, service providers within Copernicus, citizen science initiatives, international networks, Member States and EU policy bodies. This collaborative effort should extend to the sharing of data, including national inventories, which will significantly bolster research and conservation policies. The success of implementing the identified recommendations relies on effective Europe-wide cooperation, promoting synergies for comprehensive biodiversity policies.

REFERENCES

(1) Camia, A., Gliottone, I., Dowell, M., Gilmore, R., Coll, M., Skidmore, A., Chirici, G., Caimi, C., Brink, A., Robuchon, M. and Ferrario, I., Earth Observation in support of EU policies for biodiversity - A deep-dive assessment of the Knowledge Centre on Earth Observation, EUR 31484 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-02459-1, doi:10.2760/185588, JRC132908

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