POLICY BRIEF

The Lag from Observation to Information

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The Context

Biodiversity is constantly changing. Birds migrate, insects emerge, plants flower and set seed, fish migrate, diseases spread, and species are introduced, expand or contract their ranges. Some of these changes are seasonal and familiar. Others are sudden, local, and harder to predict. Together they shape the condition of ecosystems and the benefits, and risks, they create for people.

These changes matter because biodiversity affects food production, water quality, human health, ecosystem resilience and the places people live and work. It can support livelihoods and wellbeing, but it can also create serious problems. Pests reduce crop yields, disease vectors affect public health, and invasive species can spread quickly through landscapes and waterways.

The difficulty is that biodiversity is far harder to monitor than many other parts of the environment. It is enormously diverse, unevenly observed, and constantly in motion across space and time. Many changes happen in places that are rarely surveyed, involve species that are difficult to identify, or only become visible once they are already well underway. Unlike weather, biodiversity cannot be measured through a single coordinated system of sensors and forecasts.

As a result, managing biodiversity often depends on information that is incomplete, delayed or unevenly distributed. At the very moment when rapid change makes timely knowledge more valuable, the systems for collecting, identifying, publishing and using biodiversity data often struggle to keep pace.

Evidence of a lag

Available biodiversity infrastructures already show that delay is measurable. A simple comparison between occurrence date and the number of observations in GBIF can reveal typical delays of months to years, varying among data types and providers. Such figures do not capture the full journey from observation to decision-ready information, but they do make visible an important bottleneck: the slow movement of records from local custody into shared infrastructures.

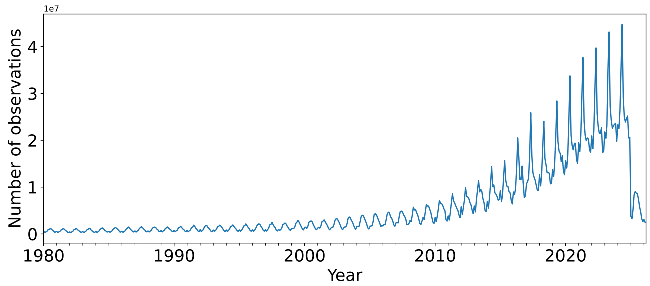
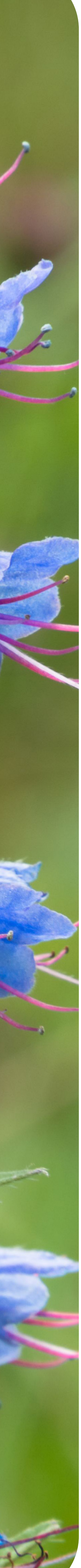


Fig. 1: The number of observations per month, showing seasonal variation, but also a dropoff in 2025 and 2026, even though we know that surveying has been conducted in this period (GBIF.org (14 April 2026) GBIF Occurrence Download **https://doi.org/10.15468/dl.yvacy9**).

Funded by the European Union



The Problem: A Persistent Lag

Despite enormous progress in digital infrastructures and open data policy, there remains a stubborn lag between the collection of biodiversity data and its arrival in a usable form. For a scientist it is frustrating; *for a policymaker it can be critical*. It means that many management decisions, environmental reports and conservation actions are based on a world that has changed since it was recorded.

The problem begins in the field. Much biodiversity recording still depends on volunteers and small local teams. Their contributions are invaluable but often uneven, data arrive in bursts, sometimes without full metadata or with identification that later needs correction. Even professional monitoring programmes face the same difficulty: limited staff, seasonal workloads and a reliance on outdated software or local storage systems that slow down the flow of data.

The identification of observations and specimens to species is a major bottleneck. Expertise is scarce, particularly for invertebrates, fungi and many plant groups. Observations and specimens can sit for years waiting for confirmation. Even where digital photographs are used, identification often relies on a small number of specialists who must balance accuracy with volume.

Once identified, data must be verified, standardised and cleaned. Each dataset brings its own conventions for names, dates and coordinates. Harmonising these takes time, and the work is often manual. Many projects operate within institutional silos, with incompatible databases or differing standards for quality control and publication.

Then there are the procedural and cultural delays. Data are sometimes held under embargo while publications are prepared, or until project reports are complete. This is somewhat understandable, careers and funding depend on recognition, but it means that the most current data are often the least accessible. Furthermore, some data infrastructures are designed more for archiving and citation than for operational use, so even when data are technically open, they are not easily discoverable or connected to decision-making tools.

The result is a chain of small delays that accumulate into a serious lag. By the time a dataset is cleaned, verified and made public, the ecosystems it describes may already have changed. Invasive species may have spread further, populations may have declined, and opportunities for intervention may have passed.

Implications

This lag weakens environmental governance at every level. It blunts early-warning systems for invasive species, ecosystem tipping points, pests and diseases. It delays assessments of habitat loss and undermines efforts to monitor progress towards biodiversity targets. It also makes it harder to link remote sensing data with in situ observations, because the two are often no longer temporally aligned by the time biodiversity records become available. In policy terms, it means decisions are often based on what was true some years ago rather than what is true now.

This problem sits within a wider "data-rich, information-poor" context. Biodiversity data are expanding rapidly in volume and diversity, yet the capacity to synthesise them into timely, decision-ready information has not kept pace. Fragmented infrastructures, limited resourcing and weak interoperability mean that even when data exist, they are often difficult to discover, harmonise and translate into operational products. The result is delayed situational awareness, reduced accountability and fewer opportunities for early, cost-effective intervention.

Emerging Technologies: Not the quick fix we imagined

A related issue concerns new observation techniques, such as camera traps; passive acoustic monitoring; and environmental DNA sampled from water, soil and air, combined with AI-assisted species identification. Because the data they collect are born digital, one might imagine their results could be available almost instantly. Yet the reality is otherwise. They suffer from the same old problems as traditional methods: incomplete taxon coverage of AI algorithms and DNA barcode reference libraries, the slow pace of identification for rare species, (partly) manual workflows, data embargoes and the long wait before information becomes usable.

These innovations, promising as they are, simply reveal that the lag is not only a technical issue but also cultural and institutional. Systems are designed for careful publication rather than rapid use, and the incentives reward accuracy and ownership more than timeliness and openness.

Policy Directions

To address this, the EU and its partners could focus on:

- **REDUCING INSTITUTIONAL BOTTLENECKS**: supporting data pipelines that move smoothly from field collection to open publication, with shared standards and automation where possible.
- **RE-THINKING INCENTIVES**: rewarding data publication and timely sharing as legitimate scientific outputs.
- **STRENGTHENING IDENTIFICATION CAPACITY**: investing in AI-assisted identification, reference collections and expert networks to accelerate taxonomic workflows.
- **ENCOURAGING NEAR-REAL-TIME DATA USE**: developing platforms that deliver provisional but usable data for decision-making, with clear metadata on taxonomic uncertainty.
- **EMBEDDING FEEDBACK LOOPS**: ensuring that once information is used, results and corrections flow back to improve data quality over time.

Conclusion

The lag from field to information is not a single technical problem but a systemic one, stretching from how data are gathered to how they are valued. As biodiversity change accelerates, the ability to see the present, not just the past, becomes essential for sound policy and effective management.

OneSTOP

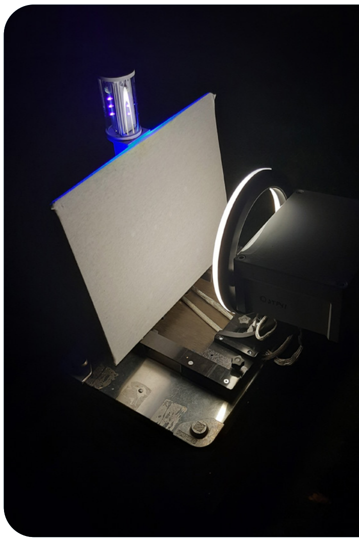
onestop-project.eu

OneSTOP: Faster data for faster action on invasive species

When it comes to invasive species, time matters. The earlier a new arrival is detected and shared, the greater the chance of containment or eradication. Delays of months can mean the difference between a manageable incursion and permanent establishment.

Yet data on emerging invasions often move slowly. Observation records may sit in local systems. Checklists and observations that document new presences are not always published promptly. Technical hurdles, formatting requirements and uncertainty about standards can delay their appearance in GBIF and other shared platforms. OneSTOP works to reduce these barriers. By streamlining the publication of both occurrence records and species checklists to GBIF, it helps ensure that information on new or spreading species becomes visible more quickly. Shared tools and clearer workflows make it easier for institutions and networks to publish data in standard formats without lengthy reprocessing.

Rapid action is widely recognised as the most effective and cost-efficient strategy for invasive species management. That action depends on rapid information flow. **By shortening the path from local detection to global visibility, OneSTOP contributes directly to earlier warning and more effective response**.



Biodiversity Meets Data

bmd-project.eu

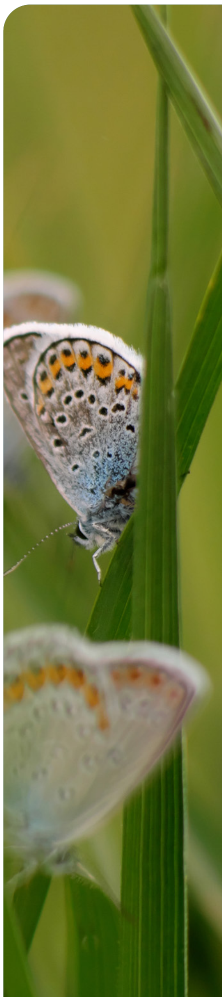
Biodiversity Meets Data – BMD: accelerating biodiversity monitoring for better conservation across Europe

The conservation of European habitats and species protected under the EU Nature Directives depends on timely evidence. Yet monitoring and reporting for Natura 2000 still often rely heavily on expert judgement, partly because biodiversity data are slow to collect, mobilise, analyse and turn into usable information. This makes it harder to detect change early, identify drivers and support data-driven management.

The Biodiversity Meets Data project aims to reduce this lag by improving the flow from biodiversity observation to policy-relevant information. It brings together high-throughput biodiversity monitoring, FAIR data mobilisation to GBIF, and analysis tools designed with users in mind. High-throughput monitoring includes camera traps, passive acoustic monitoring and environmental DNA, combined with AI-assisted species identification. Alongside this, BMD is co-developing a suite of Biodiversity Analysis Tools for terrestrial, freshwater and marine systems, working directly with stakeholder communities, especially managers of Natura 2000 sites.

Access to these tools, data streams, analysis workflows and training materials will be provided through the Biodiversity Explorer, a single entry point intended to make biodiversity monitoring and interpretation more accessible and more operational.

BMD's contribution is not only to collect more biodiversity data, but to help those data move more quickly into forms that can support reporting, site management and conservation action. **In that way, it helps shorten the distance between biodiversity change in the field and the information needed to respond to it.**



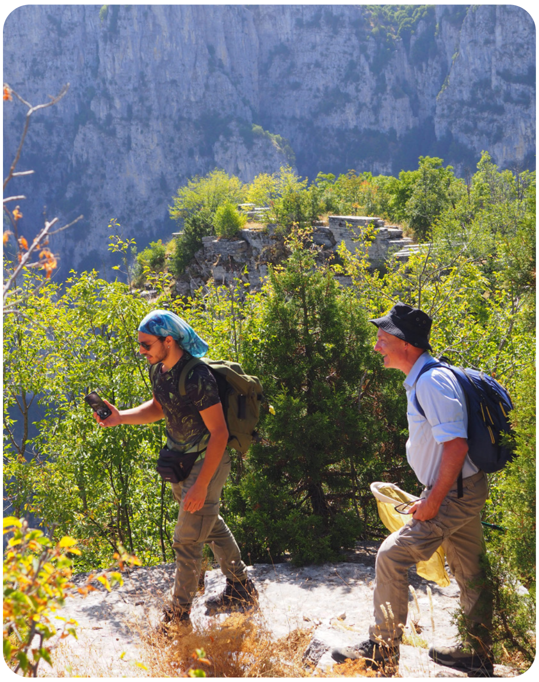
MAMBO mambo-project.eu

MAMBO: Faster biodiversity monitoring needs faster data pipelines

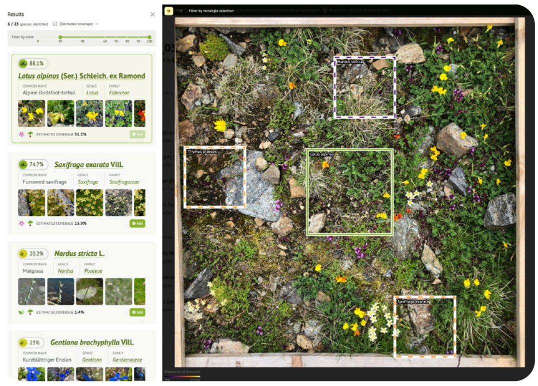
MAMBO highlights the transformative potential of new biodiversity observation technologies to make monitoring faster, broader and more responsive. LiDAR and remote sensing data, automated imaging, bioacoustics and AI-assisted identification can generate observations at unprecedented speed and scale. However, without shared reference libraries, standardised workflows and interoperable data systems, this digital abundance risks creating a new bottleneck.

MAMBO addresses this by developing and testing integrated monitoring approaches that allow for a more efficient transition from automated sampling and detection to validated and shareable biodiversity information. By combining innovative methods with conventional surveys, the project helps ensure that faster observation also means faster evidence for conservation and management.

Equally important, MAMBO highlights the need to make uncertainty visible rather than waiting for perfect data. Provisional identifications and early warning signs, if clearly documented, can still support timely decisions. Its policy message is clear: **investing in sensors alone is not enough. Equal attention is needed for taxonomic reference data, open standards, and data infrastructures that turn raw observations into actionable information for a wide range of stakeholders and purposes**.

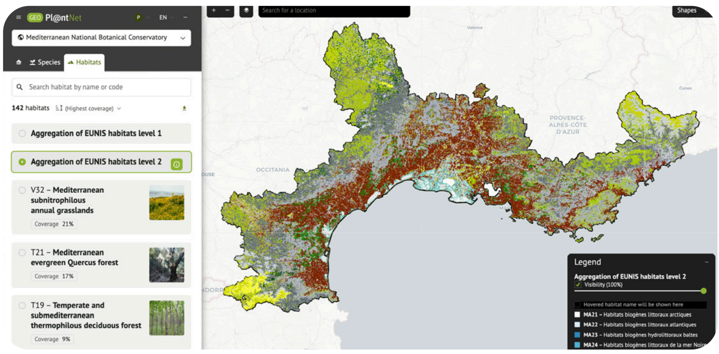


The sound recognition models for European animals make audio-based monitoring along transect possible



Plant Quadrat Image analysis tool detecting species

Pollinator camera in the field



GeoPl@ntNet platform

bio-shiny.ua.pt:3838/aurora

Aurora: Bringing biodiversity data to light – facilitating mobilisation

Biodiversity data are often stored in diverse tabular formats, even within the same research group, complicating standardisation and compliance with the requirements of public biodiversity repositories for data sharing. Researchers encounter challenges like taxonomic inconsistencies and georeferenced data in multiple formats, requiring manual resolution due to limited coding capabilities or through the use of a set of tools. This reliance on manual processing slows data preparation and hinders effective sharing on platforms such as GBIF. To address these issues, the AURORA project developed a public Shiny web application that simplifies the transformation of raw datasets into publication-ready Darwin Core Archives.

The AURORA application supports data ingestion, allowing users to convert both raw and tidy data structures. An interactive mapping interface enables alignment of user-defined fields with Darwin Core terms, combining manual selection with automated suggestions and validation of mandatory fields. It also automates key data cleaning steps, including date standardisation and geographic coordinate formatting. Taxonomic consistency is ensured through API integration with WoRMS and the GBIF Backbone Taxonomy, allowing users to select appropriate reference systems for marine or terrestrial datasets. The workflow includes a quality-control module that assesses completeness and flags missing fields. The final output is a standards-compliant Darwin Core Archive with structured metadata aligned with FAIR principles, substantially lowering the technical barriers to biodiversity data mobilisation and sharing.

By integrating these processes into a single, user-friendly environment, AURORA **reduces the time and effort required to move from data collection to publication, effectively shortening the lag between data generation and its availability for global reuse**.

GUARDEN

guarden.org

Guarden: Turning biodiversity data into decision-ready intelligence

GUARDEN is committed to ensuring that biodiversity information reaches decision-makers in forms they can actually use. Biodiversity change affects agriculture, forestry, water management, health and spatial planning, yet the data relevant to these sectors are often fragmented across institutions, scales and formats.

By connecting biodiversity observations with indicators, ecosystem-service information and decision-support tools, GUARDEN helps shorten the distance between monitoring and action. This is essential where rapid response matters, whether for emerging ecological risks, declining ecosystem functions or trade-offs between competing land and resource uses.

The project underlines that reducing lag is not only about collecting data faster. It is also about interoperability, co-design and building solutions that translate biodiversity evidence into operational choices across sectors and scales. In that sense, **GUARDEN contributes to a broader shift: from biodiversity data as an archive of the recent past to biodiversity intelligence that can guide present-day policy and management.**

BIODIVERSITY BUILDING BLOCKS FOR POLICY

b-cubed.eu

B-Cubed: Rapid, Repeatable Workflows for Policy

B-Cubed is building rapid, repeatable workflows that turn species occurrence data into policy-ready indicators. Instead of one-off analyses, it develops standardized biodiversity data cubes and automated open workflows that can be rerun whenever new data arrive.

This is especially useful where biodiversity change must be tracked consistently across space and time. By organising species occurrence records into harmonised spatial and temporal grids, and linking them with environmental and contextual data, B-Cubed supports indicators that are transparent, reproducible and easier to compare across countries and reporting cycles.

One important application is support for indicators relevant to the Kunming-Montreal Global Biodiversity Framework, including Target 6 on invasive alien species. These repeatable workflows can help estimate spread, occupancy and change through time from occurrence data, providing an evidence base for reporting, risk assessment and management. By aggregating occurrence records across space and time, harmonising them to common grids and integrating environmental data, B-Cubed can generate reproducible trends in the spread and occupancy of invasive species. These outputs directly inform national reporting and management under EU and global commitments.

Because the workflows are transparent, open and cloud-based, they reduce technical barriers and allow countries to update indicators regularly rather than sporadically.

B-Cubed's central message is that **policy needs more than access to data**. It needs operational workflows that can turn incoming data into updated evidence quickly, consistently and at scale. In this way, B-Cubed moves biodiversity monitoring beyond retrospective description towards **responsive, decision-relevant intelligence that keeps policy aligned with a rapidly changing world**.