

## Towards a policy-relevant and coherent EU-wide biodiversity monitoring system: the EuropaBON project

Just over one year into the project, [EuropaBON](#) has made substantial progress on achieving some of its targets aimed at designing an EU-wide framework for monitoring biodiversity and ecosystem services. In this session, we want to report on EuropaBON's main achievements in the first year of its existence and the work that still lies ahead. We will also report on a related project in the Tropical Andes ([TAO](#)) and provide a hands-on session on the [GEO BON EBV Data Portal](#).

### **General introduction to the project**

*Henrique M. Pereira, Jessi Junker*

Putting biodiversity on a fast track of recovery; making sure that ecosystems deliver ecosystem services in the long-term; and restoring degraded ecosystems by 2050, represent the three major biodiversity goals of the EU's biodiversity strategy for 2030. While these goals may seem relatively straight-forward, the implementation of policies enabling biodiversity and ecosystem conservation in Europe is hampered by the limited availability of harmonized, long-term, spatially explicit and regularly updated biodiversity data at the EU-scale. To bridge this gap, EuropaBON (Europa Biodiversity Observation Network) will design an EU-wide monitoring framework for biodiversity and ecosystem services. Together with 15 partners from nine European Union countries and the UK, this 3-year project builds on stakeholder engagement and knowledge exchange during all stages of the design process: 1) identify user and policy needs for biodiversity monitoring; 2) capture and assess current workflows of monitoring efforts delivering biodiversity information in Europe to identify gaps, data and workflow bottlenecks; 3) identify essential biodiversity variables (EBVs) and ecosystem services variables (EESVs) to be monitored by the system to track and assess biodiversity change; and demonstrate the operationalization of EBVs and EESVs for policy through showcases in support of the various EU Directives. The EBV integrated datasets produced by each of EuropaBON's showcases will feed directly into the [GEO BON EBV Data portal](#), which is a platform for distributing and visualizing EBV/EESV datasets. Finally, we will conclude this session by presenting the Tropical Andes Observatory (TAO) project, which serves as a case in point for designing a user-driven biodiversity observation network following the GEO BON recipe and framing the process within the framework concept of the Essential Biodiversity Variables.

### **Presentation 1: User and policy needs assessment of biodiversity monitoring in Europe**

*Hannah Moersberger, Juliette Martin, Ian McCallum, Aletta Bonn*

EuropaBON aims to design an EU-wide monitoring framework for biodiversity and ecosystem services. This requires engaging stakeholders at all stages of the design process. To define the various user needs, we engaged stakeholders in four key steps: a stakeholder conference, a survey, an expert meeting and semi-structured interviews. The results of this assessment show a fragmented biodiversity data landscape that cannot easily answer all relevant policy

questions. With exceptions such as some bird species and some priority habitat types, monitoring schemes do not cover the full range of genetic, taxonomic and ecosystem diversity within the respective countries. The coverage of different species and ecosystems is biased, as many of the national monitoring activities are mainly influenced by the reporting obligations of the Birds and Habitats Directives. Countries across European regions face different biodiversity monitoring challenges. Roadblocks to monitoring by national agencies include lack of support to establish coordinated monitoring programs and insufficient technical capacity. A lack of detailed geo-referenced information is severely hampering assessments of biodiversity and ecosystem trends, as well as infrastructure planning. Although most countries responded that they use biodiversity monitoring data for some modelling, its full potential is currently not exploited due to lack of capacity and funding. The following solutions are proposed as potential avenues to address the challenges and to build a European Biodiversity Observation Network.

- Enhanced overall coordination, cooperation and synchronisation
- Enhanced data standardisation, coupled with increased data gathering and mobilisation, and dedicated data sharing mechanisms
- Increased modelling efforts and the use of new technologies
- Adequate substantial financial resources
- Capacity building to harness and develop a network of skills and knowledge.

## **Presentation 2: European biodiversity monitoring workflows**

*Alejandra Morán-Ordóñez, David Martí Pino, Lluís Brotons*

In this talk, we present the EuropaBON biodiversity database ([monitoring.europabon.org](http://monitoring.europabon.org)), a web-based platform explicitly describing current workflows of monitoring efforts delivering biodiversity information in Europe. The website serves the dual purpose of being a platform for data entry, as well as to allow the visualization and quick consultation of the collected data. This database is a key tool to understand how biodiversity data collected in monitoring schemes across Europe flows through different institutions and programs and gets processed to produce Essential Biodiversity Variables (EBVs), Ecosystem Services Variables (EESVs) and /or other European policy-relevant indicators. It serves as a basis to evaluate the current gaps and bottlenecks that biodiversity monitoring in Europe faces to deliver cost-effective EBV-based products that can effectively inform policy at the European scale.

For a given monitoring network, the database collects information about three distinctive elements: 1) the biodiversity data collected in monitoring programs (e.g. taxa, spatio-temporal resolution); 2) the “integration nodes”: platforms/projects/institutions processing the biodiversity data to generate EBVs, EESVs or any other indicators (e.g. funding available, type and spatial level of data processing) and 3) data flows.

Preliminary analyses of the database suggest that most integration of biodiversity data at the European level is carried out by non-governmental bodies and that there is a geographic and taxonomic bias in monitoring efforts across Europe, with data on plants and birds dominating over other taxonomic groups. Data from systematic monitoring programs are most commonly integrated to generate EBVs, ESSVs and indicators at the European level; however, only a small fraction of these data is currently open access.

### **Presentation 3: Essential Biodiversity Variables for EuropaBON**

*Henrique M. Pereira, Néstor Fernández, Miguel Fernandez, Jessi Junker, Jose W. Valdez*

Identifying which variables need to be monitored to track and assess biodiversity change is a key design question for EuropaBON. We are tackling this issue in two steps: (1) user driven selection and (2) expert driven selection. We started the user driven selection by compiling a list of candidate essential biodiversity and ecosystem service variables across a range of EU policies and also cross-sectorally. Next we conducted a survey to ask from the point of view of users and policymakers, how do they rank in importance the different variables and to identify what policy questions they hope to address with them. This has resulted in a set of 45 ranked variables, specifying the class of variables (e.g. species populations or ecosystem function), the name of the variables, the biological or taxonomic scope, the spatial and the temporal resolution. In the expert driven selection we are building on this list and relative importance ranks to produce a balance set of essential variables, that ensure cross-realm coverage (e.g. marine, freshwater and terrestrial), taxonomic coverage, policy questions, but also feasibility from a point of view of observation and modelling.

### **Presentation 4: Showcasing EuropaBON's contribution to environmental EU policies**

*Néstor Fernández*

Current European biodiversity policy reporting streams use highly heterogeneous data and methods for assessing biodiversity change. This represents a major limitation for assessing progress in the implementation of the European Nature directives. Furthermore, restoration planning and implementation required under the Biodiversity Strategy for 2030 and the European Restoration Law require spatially explicit information of biodiversity patterns and trends that are currently sparse. Enhanced data workflows and models, when adequately connected to regulatory monitoring and reporting streams, can leverage monitoring data on biodiversity and potential drivers to assess the status of selected terrestrial and aquatic habitats and species. Furthermore, the WFD regulatory monitoring can serve as the backbone for better integrated aquatic biodiversity monitoring in Europe. By integrating multiple data sources including remote sensing, coordinated monitoring programs, and citizen science, we propose ways in which data workflows under the European Nature Directives can be effectively implemented. Ensuring production and distribution of such datasets, including with the EBV Data Portal developed and hosted at iDiv, is key for supporting comprehensive and coherent monitoring within the EU Member States.

### **Presentation 5: Cataloging Essential Biodiversity Variables with the EBV Data Portal**

*Christian Langer, Henrique M. Pereira, Néstor Fernández*

Essential Biodiversity Variables (EBVs) are used to monitor the status and trends in biodiversity at multiple spatiotemporal scales. These provide an abstraction level between raw biodiversity observations and indicators, enabling better access to policy-relevant biodiversity information. Furthermore, the EBV vision aims to support detection of critical change, among other things, with easy to use tools and dashboards accessible to a variety of users and stakeholders.

We present the EBV Data Portal, a platform for distributing and visualizing EBV datasets. It contains a geographic cataloging system that supports a large number of spatiotemporal description features and enables their discoverability. To facilitate user interaction, it offers a web-based interface where users can (1) share and/or (2) find essential biodiversity spatiotemporal data through intuitive interaction with cataloging and visualization tools. Using the EBV Catalog module, the user can explore the characteristics of the data based on the definition of an EBV Minimum Information metadata standard. The Catalog also allows you to browse the description of the metadata as both the ACDD standard (JSON) and the EML standard (XML). This enables easy interoperability with other metadata catalogs. An example application is the calculation of EBV summary statistics for selected countries and areas. Using the EBV Data Portal, users can select EBVs and calculate basic biodiversity change metrics from spatiotemporal subsets and visualize conveniently complex, multidimensional biodiversity datasets. These visualization and analysis tools of the EBV Data Portal are a first step towards an EBV-based dashboard for biodiversity analyses.

### **Presentation 6: ebvcube: An R package for netCDF of Essential Biodiversity Variables**

*Luise Quoss, Néstor Fernández, Christian Langer, Jose W. Valdez, Henrique M. Pereira*

Multidimensional geospatial data is increasingly used in biodiversity research. This data can cover spatiotemporal estimates of biodiversity metrics using models and projection scenarios, and biodiversity products derived from remote sensing. However, the disparity of formats and criteria used to arrange the data severely limits their interoperability. The Essential Biodiversity Variables (EBV) datasets are defined as measurements providing essential information for analysing, tracking and reporting the state of biodiversity. A data and metadata standard has recently been developed to consistently organize and document the EBV cubes. The EBV data cubes are defined along the three dimensions of space, time and biological entities (e.g. species or types of ecosystems). These cubes are organized in hierarchical groups to allow for multiple biodiversity metrics and scenario projections per cube. However, tools that facilitate the production of these EBV cubes have been missing. In this talk, we present the ebvcube R package, a tool tailored to produce EBV cubes using a specification of the netCDF format and compliant metadata with the ACDD and CF conventions. The package functionality covers access to existing EBV netCDF datasets as well as the creation of new ones. The user can retrieve the metadata, which is distributed across the different netCDF components. Different visualization functions are available for fast data exploration, covering the temporal and spatial scope of the data. Specific functions have been implemented to access data subsets and to perform spatial resampling of the data in order to spatially align multiple EBV cubes. The creation of the EBV datasets can be accomplished in interaction with the EBV Portal and the R package. Finally, the created EBV datasets can be uploaded and shared through the EBV Portal. Together with the EBV Data Portal, ebvcube facilitates the exchange of interoperable scientific biodiversity data.

### **Presentation 7: TAO from data to decision in the Tropical Andes**

*Jose Valdez, Miguel Fernandez, & Henrique M. Pereira*

The Tropical Andes is a region that includes a great diversity of ecosystems, climates, and altitudinal gradients in South America. Covering approximately an area equal to France, Germany and Spain combined, the Tropical Andes is recognized as a global biodiversity hotspot due to its high levels of endemism, disproportionate number of species, and high rates of habitat loss. It is in this highly diverse area that the TAO Project team: from data to decisions, has been working for the last two years on the process. We are designing a user-driven biodiversity observation network following the GEO BON recipe and framing the process within the framework concept of the Essential Biodiversity Variables. At the core of this process a wide consultation with more than 400 experts and stakeholders at the regional level has prioritized six key topics that the system should address: 1) land-use planning and risk management, 2) development and infrastructure projects, 3) tourism and gastronomy, 4) international agreements and commitments, 5) use of natural resources by local communities, 6) education and capacity building. These findings provide the basis for building a system tailored to the needs of users in the region, ensuring the sustainability of this initial multi-country biodiversity observation effort in the region.