BIODIVERSITY BUILDING BLOCKS FOR POLICY

D1.9: Updated Plan for Exploitation, Dissemination and Communication (PEDCOM)

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Key takeaway messages

- **Structured DEC Approach:** B3 implements a comprehensive Dissemination, Exploitation, and Communication (DEC) strategy, designed in two stages to maximise the project's impact.
- **Key Exploitable Results (KERs):** Chapter 2 provides a detailed overview of B3's main results, including delivery timelines, accessibility platforms, and exploitation opportunities.
- **Successful Cultivation stage (M1-M21)**: Chapter 3 highlights the successful completion of outreach KPIs in the first stage, focusing on raising awareness, building a stakeholder community, and effectively sharing initial project results.
- **Upcoming Growth Stage (M22-M42+)**: Chapter 4 details the plans for the second stage, emphasising sustained dissemination, advanced exploitation of mature outcomes, and long-term accessibility of results post-project.

Executive summary

To maximise the impact of its outcomes, B3 detailed its communication, dissemination, and exploitation strategies in *D1.2 Plan for Exploitation, Dissemination and Communication (PEDCOM)*, submitted in M6. It included an implementation plan for key activities to be carried out up to M21 of the project, along with Key Performance Indicators (KPIs) to assess their effectiveness. The current deliverable, D1.9, serves as an update to the PEDCOM, reflecting progress made in the implementation plan. Based on this progress, D1.9 outlines the planned activities for the project's second outreach stage (M22-M42+). The updated PEDCOM also provides additional details for the project's Key Exploitable Results (KERs) and the most suitable means for their exploitation, based on feedback collected from the consortium.

Non-technical summary

To ensure that the results of EU-funded projects have the greatest possible value, it's important to share these outcomes with the groups who can benefit from them. To achieve this, projects develop a communication plan at the outset, outlining activities to spread awareness and engage with key stakeholders. Because projects evolve over time, this plan needs to be updated to reflect progress and changes. In this context, B3 initially outlined its outreach strategy in D1.2 and is updating it midway through the project in the current D1.9. This update reviews how outreach activities have progressed so far and sets goals for the second stage of the project. Additionally, D1.9 provides further details on the project's most significant results that have the greatest potential to impact stakeholders and outlines how they can be used for further research, commercial, societal, or political purposes.

List of abbreviations

EU	European Union
DEC	Dissemination, Exploitation, and Communication
GPL	GNU General Public License
IBDC	Integrated Biodiversity Data Cube
IFDC	Invasion Fitness Data Cube

IP	Intellectual Property
KER	Key Exploitable Result
KPI	Key Performance Indicator
PEDCOM	Plan for Exploitation, Dissemination, and Communication
WP	Work Package

1. Introduction

To maximise the short-, medium-, and long-term impact of B3's results, a carefully crafted Dissemination, Exploitation, and Communication (DEC) strategy was outlined in *D1.2 Plan for Exploitation, Dissemination and Communication (PEDCOM)*, submitted in M6. This plan defined B3's stakeholder groups, mapped the project's expected results, established the tools and channels for sharing them, and provided a timeline for promoting the project (communication), sharing its results with potential users (dissemination), and facilitating their practical utilisation (exploitation).

The timeline was divided into two stages based on the project's development and included a planned PEDCOM update at M22. Accordingly, in D1.2, KPIs were provided only for the first stage, covering M1-M21. This approach allows WP1 to evaluate the effectiveness of DEC activities and adjust Key Performance Indicators (KPIs) for the next stage of the project.

Following this plan, the current update delivered in M22 reviews the progress of the initial DEC plan and proposes a refreshed version for the M22-M42+ stage. It also provides further details on the project's Key Exploitable Results (KERs) and outlines tailored exploitation strategies to maximise their impact.

2. Key Exploitable Results

B3 is actively developing 16 Key Exploitable Results (KERs), designed to support regional, national and global biodiversity research, monitoring, and policy-making. Their public release timelines span from February 2024 to November 2025. All project outputs will be openly accessible, ensuring availability to a wide range of users who can benefit from them. The majority of the results will be accessible on widely established, community-endorsed platforms such as GitHub, GBIF, and the EBV Data Portal, while other key outputs will be hosted on platforms such as GeoPl@ntNet, tailored to meet the needs of specific user communities. The results will be released under open licences, underscoring the project's dedication to easy access and adaptability.

This commitment to openness is further reinforced by extensive dissemination and exploitation efforts. These efforts include collaborating with existing infrastructures and communities to facilitate tool adoption, as well as creating comprehensive documentation, tutorials, and training materials designed to reduce technical barriers and encourage widespread use. In addition to addressing the immediate goals of the project, B3's results are positioned for continued exploitation beyond its scope, with several outputs already integrated into other European projects, such as GUARDEN and BMD. The identified availability dates, potential users, and suitable exploitation pathways outlined below will inform the outreach implementation plan and its Key Performance Indicators (KPIs) detailed in Chapter 3.

The current document provides an overview of the Key Exploitable Results of the projects, detailing the plans for their public release and further development, including user training, and integration with established platforms. More in-depth details on the long-term sustainability plans of B3's outputs will be provided in *D1.8 Sustainability Report*. This report will outline a detailed plan for maintaining B3's infrastructure, software, workflows, and data, ensuring that

these contributions continue to support biodiversity research and conservation efforts into the future.

2.1. KER1. A cloud computing environment for biodiversity and environmental data

- **Lead result owners**: GBIF (partially)
- **Description**: Robust and adaptable computing environment for biodiversity data analysis that enables stakeholders to run ambitious models of biodiversity at high resolution and frequency.
- **Main novelty**: More powerful and flexible computing environment for analysis of biodiversity data.
- **Scale**: Global
- **Potential outcomes & impact**: Ability to run more ambitious models, metrics and indicators of biodiversity at high resolution and frequency.
- **Accessible by**: GBIF SQL service online through API – October 2024. UI will be available in March 2025.
- **Accessible via**: GBIF
- **Intellectual Property (IP)**: MIT Licence
- **Users**: Scientific community; Industry and practitioners
- **User exploitation beyond B3**: Cloud environments are defined as Infrastructure as Code (IaC), so other parties can execute the environment themselves. Some workflows are also made available through the GBIF platform.
- **Barriers to exploitation and mitigation measures**: Running IaC scripts is complicated. Adequate documentation will be provided for other users to exploit them.
- **Further development by partners beyond B3**: This result has already been used in another EU-funded project, GUARDEN, and it will be used in the new project BMD.
- **Potential communication activities to support exploitation**: Informative materials, Tutorials, Presentations

2.2. KER2. Software and workflows for the creation of data cubes

- **Lead result owners**: GBIF
- **Description**: Software and workflows facilitating the faster aggregation of biodiversity data from heterogeneous sources.
- **Main novelty**: Automation of data aggregation
- **Scale**: Global
- **Potential outcomes & impact**: 1) Faster aggregation of biodiversity data from heterogeneous sources. 2) Lower technical threshold to use data derived from a large dataset (billions of records reduced to Excel sheet sizes). 3) Reduced costs for data users (bandwidth).
- **Accessible by**: 29/02/2024
- **Accessible via**: GitHub
- **IP**: MIT Licence
- **Users**: Policy and governance, Scientific community
- **User exploitation beyond B3**: Stakeholders using species occurrence records can use these in their analyses, biodiversity reporting and indicator development.

- **Barriers to exploitation and mitigation measures**: The software is written in Java and designed for large-scale data processing. This is a fairly high technical threshold. Support and training can be given to potential software developers.
- **Further development by partners beyond B3**: GBIF will train and support users and the GBIF network, and engage with indicator developers to further tailor these data products as part of core GBIF services (funded through the GBIF work programme).
- **Potential communication activities to support exploitation**: Informative materials, Tutorials, Workshops

2.3. KER3. Regular production of biodiversity data cubes

2.3.1. Data cubes

- **Lead result owners**: GBIF
- **Description**: Data cubes providing standardised and reproducible information on biodiversity data.
- **Main novelty**: Standardisation, reproducibility and provenance
- **Scale**: Global
- **Potential outcomes & impact**: FAIR Principles compliant data aggregations
- **Accessible by**: 28/02/2025
- **Accessible via**: GBIF
- **IP**: Open service
- **Users**: Policy and governance, Organisations, Scientific community, Data collectors, Industry and practitioners, General public
- **User exploitation beyond B3**: Stakeholders using species occurrence records can use these in their analyses, biodiversity reporting and indicator development.
- **Barriers to exploitation and mitigation measures**: Today, there are numerous data standards associated with GIS systems, making it challenging to select the most suitable format to support. Active engagement and monitoring of this area are essential to ensure that data products are as accessible and usable as possible.
- **Further development by partners beyond B3**: GBIF will train and support users and the GBIF network, and engage with indicator developers to further tailor these data products as part of core GBIF services (funded through the GBIF work programme).
- **Potential communication activities to support exploitation**: Informative materials, Presentations

2.3.2. Data mobilisation workflows

- **Lead result owners**: MLU
- **Description**: Data mobilisation workflows of species occurrence cubes in GBIF to the EBV Data Portal. Metrics for the EU Birds Directive and Invasive Alien Species of Union Concern.
- **Main novelty**: Implementation of a geographical metadata format and a hierarchical data structure for essential biodiversity variables.
- **Scale**: Regional
- **Potential outcomes & impact**: FAIR Principles for data findability and accessibility
- **Accessible by**: 22/08/2024

- **Accessible via**: EBV Data Portal Birds Directive, EBV Data Portal Invasive Alien Species of Union Concern, Zenodo, GitHub
- **IP**: CC BY 4.0
- **Users**: Policy and governance, Organisations, Scientific community, Industry and practitioners
- **User exploitation beyond B3**: The documented workflow for data mobilisation can guide future users of species occurrence cubes who are willing to openly share the gridded geographic results.
- **Barriers to exploitation and mitigation measures**: Data is growing rapidly in GBIF and technology is constantly improving. These challenges require documentation to be updated at the end of the project if necessary.
- **Further development by partners beyond B3**: This result can used by the EBV Data Portal users and GEO BON community.
- **Potential communication activities to support exploitation**: Online workshops, materials

2.4. KER4. Automated biodiversity modelling workflows and software

2.4.1. Virtual Suitability Cube

- **Lead result owners**: UNIBO
- **Description**: The structure of the data cube is demonstrated using virtual species, which are artificially generated with known suitability maps based on climate data. To facilitate the observation of suitability for multiple species over time and space, a framework that uses Data Cubes (multidimensional arrays that organise data in a structured way) was developed. The stars R package provides an infrastructure for managing data cubes – multi-dimensional arrays that enable the organisation and analysis of large datasets across multiple dimensions, such as time, space, and various environmental variables. The stars object includes three dimensions: time, space (represented as grid cells), and species, with suitability as the main attribute. Stars objects can be sliced, aggregated along one of the dimensions, and analysed, making them ideal for studying species suitability. The main steps involve combining climate data to calculate the suitability of two different species over time and in the same area, followed by merging these species into a single stars object.
- **Main novelty**: First workflow related to cubes coupled with virtual species.
- **Scale**: Applicable at any scale: from local to global
- **Potential outcomes & impact**: Development of species suitability maps allowing researchers to detect how favourable an environment is for a species to survive, reproduce, and grow in a specific area and time. It takes into account factors like climate, landscape, and resource availability.
- **Accessible by**: 30/10/2024
- **Accessible via**: GitHub
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Scientific community, Data collectors, General public
- **User exploitation beyond B3**: The attained results can be used by users to re-create cubes based on any species and test the code.

- **Barriers to exploitation and mitigation measures**: Capability to make use of code is needed. Basic knowledge is sufficient.
- **Further development by partners beyond B3**: The code will be tested with real species and different habitat types.
- **Potential communication activities to support exploitation**: Reports, Presentations, Workshops, Tutorials, Coding clubs, Hackathons

2.4.2. Automated Data Pipeline for Biodiversity Monitoring

- **Lead result owners**: SUN
- **Description**: A streamlined, automated pipeline for species occurrence and environmental data integration, reducing manual processing time and improving consistency in data handling.
- **Main novelty**: The pipeline offers an innovative solution for harmonising diverse biodiversity datasets with environmental variables, addressing the gap in scalable, efficient data preprocessing tools.
- **Scale**: User-defined
- **Potential outcomes & impact**: Enhanced data quality and accessibility, facilitating more robust biodiversity assessments and accelerating ecological research.
- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Policy and governance, Organisations, Scientific community
- **User exploitation beyond B3**: Biodiversity researchers, conservation managers, and policymakers can use the pipeline for rapid, reliable data processing, aiding in more informed decision-making.
- **Barriers to exploitation and mitigation measures**: Potential technical barriers in data harmonisation due to varying formats. Mitigation: Provide comprehensive documentation and user support, along with training materials to assist new users.
- **Further development by partners beyond B3**: The pipeline will be expanded for integration with cloud-based data platforms (e.g., Google Earth Engine), allowing broader access and use in global biodiversity assessments.
- **Potential communication activities to support exploitation**: Workshops, webinars, and training materials will be developed to promote adoption. Social media and research networks will be utilised for outreach.

2.4.3. Multi-Site Generalised Dissimilarity Modelling (MS-GDM) Framework

- **Lead result owners**: SUN
- **Description**: An advanced statistical framework that integrates zeta diversity metrics, enabling a multi-site analysis of compositional turnover and biodiversity patterns.
- **Main novelty**: Extends traditional GDM by incorporating higher-order diversity measures (zeta diversity), capturing complex spatial and temporal patterns across landscapes.
- **Scale**: User-defined
- **Potential outcomes & impact**: Provides deeper insights into biodiversity dynamics, aiding in the identification of priority conservation areas and contributing to landscape-level biodiversity planning.

- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Organisations, Scientific community
- **User exploitation beyond B3**: Ecologists, biogeographers, and conservation planners can use the framework to assess spatial patterns of biodiversity and predict the impact of environmental changes.
- **Barriers to exploitation and mitigation measures**: Users may require advanced statistical expertise to implement the model. Mitigation: Offer user-friendly software packages and tutorials to facilitate uptake by non-specialists.
- **Further development by partners beyond B3**: Further development will include an open-source R package with comprehensive documentation, facilitating integration into broader ecological analysis workflows.
- **Potential communication activities to support exploitation**: Presentations at international conferences (e.g., Ecological Society of America), publication in high-impact journals, and collaboration with conservation organisations to showcase use cases.

2.4.4. Bioregional Classification Tool

- **Lead result owners**: SUN
- **Description**: A tool for delineating bioregions based on ecological similarity using advanced multiscale modelling techniques.
- **Main novelty**: Combines spatial mapping and predictive modelling to provide a robust, data-driven approach for bioregional classification.
- **Scale**: User-defined
- **Potential outcomes & impact**: Improved regional conservation strategies, identification of ecologically unique areas, and enhanced landscape-scale biodiversity monitoring.
- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Organisations, Scientific community
- **User exploitation beyond B3**: Conservation agencies, land-use planners, and environmental NGOs can employ the tool for strategic planning and habitat management.
- **Barriers to exploitation and mitigation measures**: High computational requirements could limit access for resource-constrained users. Mitigation: Develop a cloud-based, scalable version with options for simplified analysis.
- **Further development by partners beyond B3**: The tool will be adapted for use in different ecosystems and integrated into larger biodiversity assessment frameworks.
- **Potential communication activities to support exploitation**: Dissemination through online platforms, training courses, and a dedicated project website providing access to software, documentation, and case studies.

2.4.5. Automated Invasion Fitness Modelling Workflow

- **Lead result owners**: SUN
- **Description**: A workflow that automates the calculation and visualisation of invasion fitness using species occurrence data, IAS lists, and species traits. It computes trait centrality, visualises trait dispersion, estimates interaction strength, and assesses community invasibility. Outputs include interaction strength matrices and detailed insights into community dynamics under invasion scenarios.
- **Main novelty**: Integrates diverse data sources and automates complex ecological modelling tasks, providing a standardised and efficient framework for assessing biological invasions and network stability.
- **Scale**: User-defined
- **Potential outcomes & impact**: Enhances our ability to predict invasive species impacts and supports conservation planning by identifying traits linked to invasibility, aiding in the formulation of targeted management strategies.
- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Organisations, Scientific community
- **User exploitation beyond B3**: Ecologists and conservation managers can use the workflow to evaluate invasion risks, develop management plans, and integrate them into broader invasive species monitoring programs.
- **Barriers to exploitation and mitigation measures**: Potential difficulty in accessing comprehensive species trait data. Mitigation: Provide links to open-access trait databases and user guides for trait data integration.
- **Further development by partners beyond B3**: The workflow will be further developed into an R package with a user-friendly interface and integrated with existing ecological modelling software.
- **Potential communication activities to support exploitation**: Dissemination through publications, online workshops, video tutorials, and GitHub repository updates.

2.5. KER 5. Aggregated data cube and modelled cube data

2.5.1. The gcube R package

- **Lead result owners**: INBO
- **Description**: The goal of gcube is to provide a simulation framework for biodiversity data cubes using the R programming language. This can start by simulating multiple species distributed in a landscape over a temporal scope. In a second phase, the simulation of a variety of observation processes and efforts can generate actual occurrence datasets. Based on their (simulated) spatial uncertainty, occurrences can then be designated to a grid to form a data cube.
- **Main novelty**: First package to make simulations on cubes. Simulations are crucial since they allow researchers to model and understand the complexity of ecological systems by varying parameters such as spatial and/or temporal clustering, species prevalence, etc.
- **Scale**: Applicable at any scale: local to global
- **Potential outcomes & impact**: Possibility to map multiple cubes with multiple species.
- **Accessible by**: 30/09/2024

- **Accessible via**: GitHub
- **IP**: Copyright (c) 2024 Research Institute for Nature and Forest (INBO) - MIT Licence
- **Users**: Data scientists working directly in policy support, Scientific community, Data collectors, General public
- **User exploitation beyond B3**: The package could be used to model any kind of species-related cube.
- **Barriers to exploitation and mitigation measures**: Capability to make use of code is needed. Basic knowledge is sufficient.
- **Further development by partners beyond B3**: The package will be continuously updated.
- **Potential communication activities to support exploitation**: Reports, Presentations, Workshops, Tutorials, Coding clubs, and Hackathons

2.5.2. Integrated Biodiversity Data Cube (IBDC) for Spatiotemporal Analysis

- **Lead result owners**: SUN
- **Description**: The Integrated Biodiversity Data Cube (IBDC) aggregates diverse biodiversity and environmental data into a unified data structure, enabling sophisticated spatiotemporal analysis. It includes both raw and modelled data layers, facilitating efficient exploration of species turnover, diversity metrics, and species-environment interactions across landscapes.
- **Main novelty**: The IBDC offers a novel, multi-dimensional approach by merging heterogeneous data sources into a single, accessible data cube. It integrates outputs from advanced models (e.g., GDM, MS-GDM), allowing for direct querying of model predictions alongside raw observational data. This enhances analytical capabilities and reduces the time needed for data preparation.
- **Scale**: User-defined
- **Potential outcomes & impact**: The IBDC enhances biodiversity monitoring capabilities by providing a standardised and interoperable framework for large-scale ecological assessments. It enables the identification of ecological patterns and trends, supports predictive modelling, and informs conservation planning. This innovation can lead to a better understanding of biodiversity dynamics under changing environmental conditions.
- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Organisations, Scientific community
- **User exploitation beyond B3**: The IBDC can be used by biodiversity researchers, conservation practitioners, and data scientists providing policy support for rapid assessments of species diversity and compositional turnover. It is particularly useful for integrating into biodiversity monitoring programs, environmental impact assessments, and landscape-level conservation planning. The data cube's standardised format supports seamless data sharing and collaborative research efforts.
- **Barriers to exploitation and mitigation measures**: Barrier: High computational requirements may pose challenges for some users. Mitigation: Provide cloud-based access (e.g., via Google Earth Engine and AWS) and develop API endpoints for

simplified data retrieval. Offer tailored subsets of the data cube for specific regions or projects, reducing the computational load. Comprehensive user documentation and training resources will also be provided.

- **Further development by partners beyond B3**: The IBDC will be expanded with additional data layers (e.g., remote sensing indices, and climate projections) and integrated with broader ecological data platforms. Future development will focus on enhancing the cube's scalability and usability, including outputs specific to topical ecological applications.
- **Potential communication activities to support exploitation**: Planned activities include publication of research findings, presentations at major biodiversity and conservation conferences (e.g., GEO BON, IUCN World Conservation Congress), and online workshops demonstrating the IBDC's capabilities. The project will maintain a GitHub repository, publish video tutorials, and host webinars to facilitate broader adoption and user engagement.

2.5.3. Invasion Fitness Data Cube (IFDC)

- **Lead result owners**: SUN
- **Description**: The IFDC aggregates multi-source data on species occurrences, invasive species lists, and species traits into a structured data cube. It includes raw and modelled data layers, facilitating spatiotemporal analysis of invasion fitness, community invasibility, and trait dispersion patterns.
- **Main novelty**: Combines raw observational data with advanced model predictions in a multi-dimensional data cube format, enabling comprehensive analysis of invasion dynamics across multiple scales.
- **Scale**: User-defined
- **Potential outcomes & impact**: Provides a robust framework for evaluating invasion risks and community stability, informing policy decisions and conservation strategies. Enhances predictive modelling of ecological invasions and supports large-scale biodiversity monitoring.
- **Accessible by**: 30/11/2025
- **Accessible via**: GitHub (temporary link)
- **IP**: MIT Licence
- **Users**: Data scientists working directly in policy support, Organisations, Scientific community
- **User exploitation beyond B3**: Researchers, conservation agencies, and policymakers can use the IFDC for rapid assessments of invasion fitness and to guide invasive species management efforts.
- **Barriers to exploitation and mitigation measures**: High computational demands for accessing the full data cube. Mitigation: Offer cloud-based access options and create regional data subsets to reduce computational load.
- **Further development by partners beyond B3**: Expansion to include additional trait-environment relationships, with data products accessible for biodiversity and ecological analysis tools.
- **Potential communication activities to support exploitation**: Planned activities include presentations at international conferences, publications, and online tutorials. The project website and GitHub will host resources and updates for user engagement.

2.6. KER6. Regular production of biodiversity indicators

2.6.1. Indicators supporting alert systems

- **Lead result owners**: INRIA
- **Description**: High-resolution indicators enhancing the current evidence base for improved policy and better alert systems.
- **Main novelty**: Very high resolution (50m) and up-to-date (bi-yearly), standardised indicators responsive to the addition of new data.
- **Scale**: Europe, national and regional
- **Potential outcomes & impact**: A better evidence base for policy, better alert systems, and more rapid action.
- **Accessible by**: 30/09/2025
- **Accessible via**: GeoPl@ntNet web app, GeoPl@ntNet API (Web Map Services, JSON)
- **IP**: Freeware
- **Users**: Policy and governance, Organisations, Scientific community, Data collectors, Industry and practitioners, General public
- **User exploitation beyond B3**: GeoPl@ntNet application will be an open web accessible to anyone.
- **Barriers to exploitation and mitigation measures**: Maps related to protected species can be sensitive and may not be accessible at a very high resolution to the general public. The mitigation measure will be to ensure those indicators are generalised according to GBIF's current best practices for generalising sensitive species occurrence data.
- **Further development by partners beyond B3**: GeoPl@ntNet will be maintained as part of the Pl@ntNet participatory research platform. Pl@ntNet is piloted by a consortium of four French research organisations hosted by Inria as part of its InriaSOFT program. The business model involves four main sources of revenues: (i) consortium member fees, (ii) general public donations, (iii) response calls for projects (research and education), and (iv) direct sales of services (e.g. massive use of the API).
- **Potential communication activities to support exploitation**: Presentations, Tutorials, Social networks (Pl@ntNet accounts), and Media (news, press, etc.).

2.6.2. The R package b3gbi

- **Lead result owners**: JLU
- **Description**: The R package b3gbi contains R scripts to calculate various biodiversity indicators based on GBIF occurrence cubes. It also includes scripts to prepare data cubes for the indicator calculation and to visualise indicator values over time and space.
- **Main novelty**: User-friendly way to calculate biodiversity indicators from occurrence cubes.
- **Scale**: The scale is user-defined ranging from local to global scale.
- **Potential outcomes & impact**: Reproducible, transparent and easy way for indicator calculation.
- **Accessible by**: 30/04/2024
- **Accessible via**: GitHub
- **IP**: MIT License.

- **Users**: Policy and governance, Scientific community, Data collectors, General public
- **User exploitation beyond B3**: Everybody can use the package to calculate biodiversity indicators for themselves including policymakers, managers, and other stakeholders.
- **Barriers to exploitation and mitigation measures**: Applying the package requires some basic R knowledge, which can be gained through various available online tutorials. To understand the package, documentation is provided for each function. Depending on the size and resolution of the occurrence cube, calculation can be computer-intensive. We will provide a cloud-based solution to access high computer power.
- **Further development by partners beyond B3**: Partners are constantly working on the package to improve its functionality and interoperability during the lifespan of the project.
- **Potential communication activities to support exploitation**: The package will be part of a package bundle developed in the project, which will be advertised in various ways including the GBIF website.

2.7. KER7. Case studies

B3's case studies will bring together a community of biodiversity informaticians to contribute to the development and refinement of the project's tools at regional, national, and global levels. However, since work on these case studies is set to begin in M23 of the project, and the current document is being submitted in M22, it is not possible to provide such specific details and outcomes as featured in the other KERs in this Chapter. Detailed information about each case study will be made available in their corresponding deliverables – *D6.1 Biodiversity change* (M42), *D6.2 Biological invasions in southern Africa* (M41), *D6.3 Biological invasions in Flanders* (M40) and *D6.4 Stakeholder driven use-case* (M41).

2.8. KER8. Training manuals and documentation

- **Lead result owners**: Each training material associated with a specific B3 result is owned by the partner institution that created it.
- **Description**: Guideline documents to build capacity in biodiversity informatics and cloud computing.
- **Main novelty**: Rapid adoption and implementation of new tools by 3rd parties.
- **Scale**: Global
- **Potential outcomes & impact**: Building capacity in biodiversity informatics and cloud computing.
- **Accessible by**: Training materials are periodically being released.
- **Accessible via**: B3 website; B3 training website; B3 Zenodo; B3 GitHub
- **IP**: N/A
- **Users**: Policy and governance, Organisations, Scientific community
- **User exploitation beyond B3**: Can be used for research projects and to develop standards.
- **Barriers to exploitation and mitigation measures**: No barriers are foreseen as the materials will be freely available to all users.
- **Further development by partners beyond B3**: The materials could be used to feed into standards and best practices and in future research activities.
- **Potential communication activities to support exploitation**: Tutorials, Workshops, Explanatory videos, and Informative materials.

2.9. KER9. Alignment of EU and international policy instruments with models and indicators

2.9.1. Insights for enhanced indicator use in policy

- **Lead result owners**: MLU, JLU
- **Description**: Insights aiming to enhance the use of biodiversity indicators in biodiversity policy decisions.
- **Main novelty**: An improved match between policy and the indicators used to inform it.
- **Scale**: Global, National and Regional
- **Potential outcomes & impact**: Greater use of biodiversity indicators in biodiversity policy decisions.
- **Accessible by**: 01/06/2024
- **Accessible via**: B3 website, Open access repository
- **IP**: N/A
- **Users**: Policy and governance, Organisations
- **User exploitation beyond B3**: Results are used internally to align project developments and outcomes with stakeholder needs and expectations.
- **Barriers to exploitation and mitigation measures**: Results will be published by project partners but are not intended for external direct use.
- **Further development by partners beyond B3**: N/A
- **Potential communication activities to support exploitation**: Workshops, policy briefs, posters, events, and scientific publications.

2.9.2. List of species relevant to European Biodiversity Policy and their corresponding taxonomy retrieved from the GBIF (WORMS) Backbone match tool

- **Lead result owners**: MLU
- **Description**: Lists of species from EU Directives in tabular format and including taxonomic equivalence in GBIF for data queries.
- **Main novelty**: Efficient access to species lists for optimised queries and analysis.
- **Scale**: Regional
- **Potential outcomes & impact**: A better informatic access to species list relevant to EU Policies.
- **Accessible by**: 31/05/2024
- **Accessible via**: GitHub (temporary link)
- **IP**: N/A
- **Users**: Policy and governance, Organisations, Scientific community
- **User exploitation beyond B3**: These lists are relevant to all country members and scientists supporting the Nature Directives.
- **Barriers to exploitation and mitigation measures**: Taxonomic changes accepted by the EEA will present a challenge for an up-to-date list. Therefore the lists need to be updated after the new names are accepted.
- **Further development by partners beyond B3**: The TETTRIs project is already using this list to understand capacity-building requirements for taxonomic services in Europe.

Potentially, this list can provide policy-relevant input to a variety of workflows providing information on these species or works related to them.

- **Potential communication activities to support exploitation**: Workshops

3. Progress for M1-M21

The initial PEDCOM divided B3's outreach activities into two main stages. The first stage, titled Cultivation, covered the first 21 months of the project and focused on raising awareness and building B3's community from the ground up. This involved attracting and engaging new users, establishing a strong presence, and setting the foundation for future growth. As the stage progressed, the focus expanded to include the dissemination of the project's initial results as they became available.

Following the outline from D1.2, Table 1 provides an overview of the progress made on each KPI related to B3's dissemination, communication, and exploitation activities during the Cultivation stage. This table gives a high-level summary of the activities, helping B3's communication partner, PENSOFT, identify areas needing improvement, as well as successful activities that should continue into the next project phase. Detailed information on each specific dissemination and communication activity conducted by B3 partners can be found in the Continuous reporting module on the Funding and Tenders Portal, under the following four dedicated tabs: Publications, Dissemination Activities, Communication Activities, and Datasets.

Table 1: Progress of B3's communication, dissemination and exploitation tools with KPIs for the first project stage (M1-M21)

Tool	Output KPIs Target	Output KPIs Progress M1-M21	Outreach KPIs Target	Outreach KPIs Progress M1-M21
Promotional materials	Introductory presentation (IP): 1 Two-pager (2P): 1 Poster (P): 1 Roll-up banner (RB): 3	*Available here* Introductory presentation (IP): 1 Two-pager (2P): 1 Poster (P): 1 Roll-up banner (RB): 4 Sticker (S): 1 Online meeting backgrounds: 4	Downloads: 150/per item (IP, 2P) Use at events: 10 (IP), 2 (P, RB) Distributed: 150 (2P)	Downloads: 167 (IP), 157 (2P) Use at events: 8 (IP), 2 (P, RB), 6 (2P) Distributed: 300 (2P), 400 (S)

Tool	Output KPIs Target	Output KPIs Progress M1-M21	Outreach KPIs Target	Outreach KPIs Progress M1-M21
B3's website	News items: 21 Updates of results pages: 6 Uploaded documents: 15	News items: 82 Updates of results pages[1]: 9 Uploaded B3-produced documents[2]: 29	Number of visits: 4000 Number of returning visitors: 15% Average session duration: 120s Country distribution: >40 countries from Europe and beyond	Number of visits: 11853 Number of returning visitors: 38% Average session duration: 173s Country distribution: 42 countries from Europe and beyond
Partners' existing communication structures	Number of channels: ≈5	Number of channels: 6	*It is not suitable to establish an outreach KPI since the effectiveness of partner-driven outreach efforts is often dependent on qualitative factors, such as relationship-building, awareness raising and uptake of project results, which are challenging to quantify with measurable metrics.	
Informative materials	Number of materials: 2	Number of materials: 2[3]	Downloads: 150/per item Distributed: 150	Views: 485/video Distributed: 1 poster used at GEOBON
Videos	Number of videos: 9	Number of videos: 11	Views/video: 100/item	Views/video: 106/item
Newsletters	Number of newsletters: 3	Number of newsletters: 5	Number of new subscribers: 100 Open rate: >35% Link-click rate: >20% Unsubscribe rate: <5%	Number of new subscribers: 103 Open rate: 61% Link-click rate: 19% Unsubscribe rate: 0%
Press releases	Number of press releases: 3	Number of press releases: 4	Views/press release: 1000	Views/press release: 2196

[1] https://b-cubed.eu/data-and-evidence, https://b-cubed.eu/cloud-computing, https://b-cubed.eu/policy, https://b-cubed.eu/capacity-building, https://b-cubed.eu/b-cubed-hackathon

[2] https://b-cubed.eu/library?type=4&Filter%5Bsort%5D=title+asc&search=, https://b-cubed.eu/library?type=3&Filter%5Bsort%5D=year+desc&search=

[3] https://b-cubed.eu/storage/app/uploads/public/655/46f/975/65546f975df21139586960.pdf#file_name=B-Cubed%20Stakeholder%20Engagement%20Poster.pdf; https://www.youtube.com/watch?v=ynEDwiemHrw

Tool	Output KPIs Target	Output KPIs Progress M1-M21	Outreach KPIs Target	Outreach KPIs Progress M1-M21
Social media, X & LinkedIn (L)	Number of posts: 84 (X, L) Number of reposts: 84 (X, L)	Number of posts: 148 (X), 132 (L) Number of reposts: 154 (X), 163 (L)	Number of new followers: 300 (X), 150 (L) Number of interactions per post: 13 (X), 5 (L) Number of impressions per post: 300 (X), 100 (L) Traffic to B3's website: 200 users (X), 100 (L)	Number of new followers: 522 (X), 307 (L) Number of interactions per post: 7 (X), 4 (L) Number of impressions per post: 550 (X), 139 (L) Traffic to B3's website: 470 users (X), 188 (L)
Scientific publications	New publications: 5	New publications: 18	* B3 would like to not focus on the impact factors of target journals, but rather on qualitative evaluation based on each paper's statistics such as citations. These, however, are accumulative and require more than one project stage to be accurately determined.	
Presentations at events	Number of attended events: 10	Number of attended events: 36	Number of attendees: > 300	Number of attendees: > 4000
Open access collection	Number of available documents: 5	Number of available documents: 14	Number of views: 200	Number of views: 204
Policy briefs	Number of policy briefs: 1 Published on: >2 platforms	Number of policy briefs: 1 Published on: 1 platform	Downloads/Opens: 150/item Distributed to: ≈5 relevant networks	Downloads/Opens: 157/item Distributed to: 7 relevant networks
B3 workshops	Number of workshops: 2	Number of workshops[4]: 2	Number of participants: ≈30	Number of participants: >60

[4] https://b-cubed.eu/news/b-cubeds-online-workshop-explores-impact-indicators-biological-invasions; https://www.gbif.org/event/gvRWGsyeY9jx5Yrs9bTvi/how-to-package-your-functions-from-standalone-to-r-packages-b-cubed-workshop

Tool	Output KPIs Target	Output KPIs Progress M1-M21	Outreach KPIs Target	Outreach KPIs Progress M1-M21
Training (materials & events)	Number of webinars: 1 Number of videos: 1 Number of supporting materials: 1	Number of webinars (training lectures)[5]: 5 Number of videos: 1 Number of supporting materials[6]: 2 Internal workshops: 4 Hackathon: 1 Live demonstration at COP16: 1	Webinar attendees: ≈15 Downloads/item: 50 Views/video: 50	Webinar attendees: ≈30 Views/video: 155 Hackathon participants: 86

As shown in Table 1, B3 has successfully met its KPIs for all DEC activities, contributing to the overall objectives of this communication stage: raising awareness, building B3's community, engaging with stakeholders, and disseminating results.

The communication activities effectively raised awareness of the project by producing and distributing various promotional materials. B3 leveraged partner networks—including GEO BON, GBIF, IPBES, CBD, and the CEOS Ecosystem Extent Task Team—to introduce the project to wider audiences. Videos, press releases, newsletters, as well as numerous news items and social media posts were shared to further amplify visibility. The project also reached key media outlets, such as EurekAlert, AlphaGalileo, Plattelands TV and WITNews.

B3 successfully built a community around the project. It collaborated with other EU projects, including its sister projects AD4GD, USAGE, FAIRiCUBE, as well as BioAgora, COOP4CBD, EarthMonitorOrg, EuropaBON, BioDT and GUARDEN, fostering valuable partnerships. Moreover, it established a stable online community, as evidenced by the significant growth in social media following, which exceeded expectations and consistently engaged with B3's content, driving traffic to the website.

This community has been engaged through various B3-hosted events, including online lectures and workshops, live demonstrations at events, and notably the B3 Hackathon, which drew 86 participants. Lastly, B3 disseminated its results through a wide range of publications including a policy brief, participation in conferences, the creation of an open-access collection in the RIO journal, and communities in Zenodo and GitHub.

4. Implementation plan for M22-M42+

As the project enters its second outreach stage (M22-M42+), known as the Growth stage, B3's dissemination, exploitation, and communication activities will shift focus. During this stage, the

[5] https://b-cubed.eu/news/mini-school-lecture-series-biodiversity-data-cubes-empowers-researchers; https://b-cubed.eu/news/workshop-r-package-development-empowering-researchers-open-source-tools
[6] https://biomath-lab.github.io/b-cubed/about/; https://docs.b-cubed.eu/dev-guide/

emphasis will be on sustaining dissemination efforts and supporting the exploitation of more mature project outcomes. Additionally, plans will be developed to ensure that stakeholders can access B3's results after the project concludes.

To align with these new objectives, a fresh set of KPIs for B3's DEC activities has been defined in Table 2. The KPIs for the two stages are not intended to be divided equally; instead, they are tailored to reflect the specific goals and priorities of each period. In some cases, KPIs have been adjusted to better fit the objectives of the Growth stage. For example, instead of focusing on the geographical spread of website visits, KPIs will now measure user actions, providing a more accurate indicator of engagement with the project's results. Similarly, rather than prioritising the number of news items with project updates on the website, the focus will shift to increasing the number of updates on the results pages, ensuring the effective dissemination of B3's outcomes.

Table 2: Overview of B3's communication, dissemination and exploitation tools with KPIs for the second project stage (M22-M42+)*
**Abbreviations for stakeholder groups: Policy and governance (P), Organisations (O), Scientific community (S), Data collectors (D), Industry and practitioners (IP), General public (GP)*

Type of DEC activity	Tool	Stakeholder group	Output KPIs	Outreach KPIs
C	Promotional materials	All	*Awareness-raising promotional materials were created in the previous stage and the focus is now shifting to results-focused materials (e.g., policy briefs).*	
C & D	B3's website	All	News items: 44 Updates of results pages: 15 Uploaded documents: 30	Number of visits: 14000 Number of returning visitors: 40% Average session duration: 180s Actions/visit ≥2.5
C & D	Partners' existing communication structures	All	*During the project's initial stage, relationships were already established with the communication channels and networks of the partners. During this stage, they will be utilised to distribute B3 results.*	
C & D	Informative materials	D, IP, O, P, S	Number of materials: 4	Downloads/Distributed: 150/per item
C & D	Videos	All	Number of videos: 3	Views/video: 150/item

Type of DEC activity	Tool	Stakeholder group	Output KPIs	Outreach KPIs
C & D	Newsletters	All	Number of newsletters: 4	Number of new subscribers: 50 Open rate: 60% Link-click rate: 20% Unsubscribe rate: <2%
C & D	Press releases	All	Number of press releases: 3	Views/press release: 2000
C & D	Social media, X, LinkedIn (L) and BlueSky (B)* **B3 will gradually shift its focus from X to BlueSky, driven by growing concerns over X's policies. This is why certain KPIs for X are being adjusted downward.*	All	Number of posts: 170 (X, L, B) Number of reposts: 170 (L, B)	Number of new followers: 100 (X), 150 (L, B) Number of interactions per post: 5 (X, B), 7 (L) Traffic to B3's website: 300 users (X), 150 (L), 100 (B)
D	Scientific publications	S	New publications: 20	* B3 would like to not focus on the impact factors of target journals, but rather on qualitative evaluation based on each paper's statistics such as citations. These, however, are accumulative and require more than one project stage to be accurately determined.
D	Presentations at events	S	Number of attended events: 30	Number of attendees: > 4000
D	Open access collection	S	Number of available documents: 30	Number of views: 200

Type of DEC activity	Tool	Stakeholder group	Output KPIs	Outreach KPIs
D & E	Policy briefs	P, O	Number of policy briefs: 2 Published on: 2 platforms	Downloads/Opens: 150/item Distributed to: ≈5 relevant networks
D & E	B3 workshops	D, S, P, O	Number of workshops: 4	Number of participants: ≈50
D & E	Training (materials & events)	S	*The training strategy for the project is compiled in Milestone 1 and supporting materials are continuously updated on B3's tutorial website*	
D & E	EU Platforms	P, O, S	≥3 results on the Horizon Results Platform ≥1 CORDIS news item Use of Horizon Result Booster event and policy brief service with AD4GD, USAGE and FAIRiCUBE	

In addition to the KPIs outlined in Table 2, B3 will ensure the exploitation and long-term impact of its results by offering a catalogue of data (detailed in D1.3), workflows, and services through GBIF and the EBV Data Portal. By making B3's outputs accessible on these platforms, the project guarantees that its results will remain available beyond its lifespan, as both platforms are committed to long-term data provision and infrastructure sustainability.

5. Outlook

As B3 transitions into the Growth stage, the focus will intensify on the dissemination and exploitation of its results. The project will prioritise user engagement through its four case studies, continue to develop training materials for its results, implement tailored exploitation strategies detailed in Chapter 2, and plan sustainability measures in Task 1.8. Additionally, B3 will leverage dissemination services provided by the European Commission, including publishing results on the Horizon Results Platform and utilising the Horizon Results Booster in collaboration with its sister projects. Progress on these planned activities will be provided in the project's periodic reports, as well as in the Continuous reporting module on the Funding and Tenders Portal, under the following four dedicated tabs: Publications, Dissemination Activities, Communication Activities, and Datasets.