



BIODIVERSITY
BUILDING
BLOCKS FOR
POLICY

MS32 List of indicators and data sets to be used in the case study III - Regional indicators in Europe.

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Author(s): **Jasmijn Hillaert, Lissa Breugelmans, Ward Langerlaert,
Tim Adriaens, Toon Vandaele, Damiano Oldoni & Quentin Groom**



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Summary

WP6 of B3 will focus on testing biodiversity indicators and modelling approaches developed during the project on several use cases. This milestone presents a list of indicators that will be used in casestudy III - Regional indicators in Europe. The objective is to evaluate their performance and suitability for monitoring biodiversity trends in Flanders, using real-world data on native and invasive species.

The implemented indicators can be subdivided into:

- General biodiversity indicators (based on [b3gbi](#), for instance, cumulative species richness, relative species richness, etc.);
- Phylogenetic indicators (based on [pdindicator](#));
- Invasive Alien Species indicators (based on [implindicator](#)) but extended with additional indicators necessary for reporting (e.g. rate of establishment, proportion of non-native species, comparison of species occupancy between periods, TrIAS indicators);
- Additional indicators that are used for IAS reporting might be added to the list, based on stakeholder needs.

Extra attention will be given to a comparison between Natura 2000 versus non-Natura 2000 habitats when applying these indicators, calculation and interpretation of indicator uncertainty, and taking into account survey effort.

The main expected outcomes:

- The selected indicators will be made available through a public dashboard that can serve as inspiration for other dashboards (e.g., the alien species portal, the Flemish biodiversity portal, and the Belgium GBIF node);
- We will foster close contact with other dashboard maintainers to ensure interoperability, for instance, by providing all code in an R package.
- The outcomes of this work will support policy assessments at regional, national, and European levels.

List of abbreviations

B-Cubed	Biodiversity Building Blocks for policy
EASIN	European Alien Species Information Network
EU	European Union
IAS	Invasive Alien Species
ISEIA	Invasive Species Environmental Impact Assessment
GBIF	Global Biodiversity Information Facility
GBF	Global Biodiversity Framework
GRIIS	Global Register of Introduced and Invasive Species
PD	Phylogenetic Diversity
TrIAS	Tracking Invasive Alien Species
WP6	Work package 6





1. Introduction

Work Package 6 (WP6) – Use Cases aims to validate the relevance, usability, and impact of B3 developments through a series of representative case studies. Each use case contributes to assessing:

- a) the capacity of B3 indicators to capture key aspects of biodiversity relevant to the specific context;
- b) the ability of B3 workflows to deliver tailored outputs aligned with the spatial, temporal, and thematic requirements of stakeholders;
- c) effective strategies for communicating outputs in a policy-relevant and user-friendly manner.

This milestone presents the initial list of datasets and indicators identified for case study III of WP6: “Regional indicators in Europe”. The objective of this casestudy is to evaluate the performance and suitability of the developed indicators and workflows for monitoring biodiversity trends in Flanders, using real-world data on native and invasive species.

2. Data sets

All data will be downloaded from GBIF as species occurrence cubes (Blisset *et al.*, 2025). GBIF (Global Biodiversity Information Facility, <https://www.gbif.org/>) is an international network for centralizing global biodiversity data. Data on the GBIF platform is openly available.

2.1 Spatial scope

All data are regionally limited to Flanders, a region in Europe with abundant species occurrence records. The grid size of the generated occurrence cubes will be 1x1km and 10x10km.

2.2. Taxonomic scope

The general and phylogenetic indicators tested in this case study will be calculated for native Angiosperms in Flanders, because of the expertise of Meise Botanic Garden and the availability of a comprehensive Angiosperm phylogeny with branch lengths for Western European plants (Janssens *et al.*, 2020). The IAS indicators will be limited to Invasive Alien Species of Union concern (Regulation 1143/2024). If computationally feasible, the taxonomic scope of IAS indicators will be broadened to include invasive species listed in the GRIIS checklist (Desmet *et al.*, 2025) for Belgium.

2.3. Temporal scope

Temporally, native Angiosperm data will be limited to records after 1900. IAS data will be limited to records after 2000. Occurrences will be grouped on a year level.



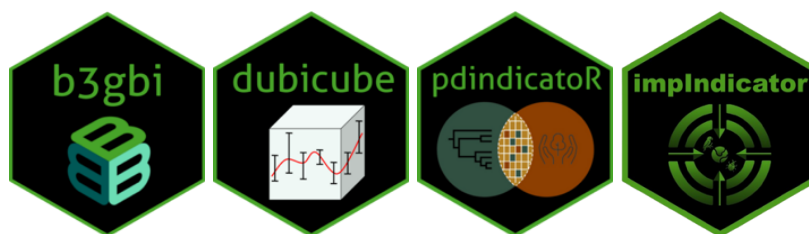


3. Indicators to be used

The implemented indicators can be subdivided into:

- General biodiversity indicators (based on [b3gbi](#));
- Phylogenetic indicators (based on [pdindicatoR](#));
- Invasive Alien Species indicators (based on [implIndicator](#)) but extended with additional indicators necessary for reporting (e.g. rate of establishment, proportion of non-native species, comparison of species occupancy between periods, TriAS indicators);
- Additional indicators that are used for IAS reporting might be added to the list, based on stakeholder needs.

For all indicators applied, special attention will be given to accounting for variation in survey effort, which can significantly influence the reliability and comparability of biodiversity assessments. Differences in sampling intensity, geographic coverage, and temporal frequency are always present and mitigating these biases to avoid obscuring true ecological patterns is important. Methodological corrections will be applied to ensure that indicator values reflect genuine changes in biodiversity rather than artefacts of data collection practices. In parallel, the uncertainty associated with each indicator will be explicitly quantified and visualised. Presenting these alongside the indicator values in a transparent and interpretable manner. By embedding uncertainty into the reporting framework, stakeholders will gain a clearer understanding of the robustness and limitations of the results, enabling more informed decision-making in biodiversity policy and management. Robustness and uncertainty metrics of the `dubicube` (Langerhaert *et al.*, 2025) package are foreseen to be applied on each indicator in this case study.





3.1. General indicators

All indicators which are calculated in the R package `b3gbi` (Dove *et al.*, 2025) will be tested on the dataset of observations in Flanders on GBIF. Initially, taxa will be limited to Angiosperms and observations after 1900.

List of available indicators in `b3gbi`:

1. Observed Species Richness
2. Total Occurrences
3. Pielou's Evenness
4. Williams' Evenness
5. Cumulative Species Richness
6. Density of Occurrences
7. Abundance-Based Rarity
8. Area-Based Rarity
9. Mean Year of Occurrence
10. Taxonomic Distinctness
11. Species Richness (Estimated by Coverage-Based Rarefaction)
12. Hill-Shannon Diversity (Estimated by Coverage-Based Rarefaction)
13. Hill-Simpson Diversity (Estimated by Coverage-Based Rarefaction)
14. Species Occurrences
15. Species Range
16. Occupancy Turnover

3.2. Phylogenetic indicators

Based on the R-package `pdindicator` (Breugelmans *et al.*, 2024), distribution maps of phylogenetic diversity will be generated based on an Angiosperm phylogeny and a GBIF occurrence datacube for the native Angiosperms in Flanders. A phylogenetic diversity indicator will also be calculated which estimates the amount of phylogenetic diversity that is currently safeguarded within the Natura 2000 areas in Flanders. If time allows, the national red list status of species will be used to calculate a 'PD loss indicator' for Flanders, which represents the amount of phylogenetic diversity lost when threatened species would appear from the area.





3.3. IAS indicators

The following indicators will be included concerning IAS:

3.3.1. Rate of establishment indicator

As agreed upon within Target 6 of the monitoring framework of the Kunming - Montreal Global Biodiversity Framework, the introduction of invasive alien species should be reduced by 50 percent by 2030 and their impact minimized. The headline indicator for this target is “The rate of invasive alien species establishment”.

3.3.2. The proportion of non-native plant species in the global plant composition for Flanders

This indicator will be included as it is currently [already applied](#) for Flanders (INBO, 2025). Whereas the original indicator is defined for Flanders, the option to calculate this indicator per km² grid cell (Natura 2000 versus non Natura 2000) will be considered.

3.3.3. Compare species occupancy between time period

As part of [EASIN](#), this indicator is calculated for each species on the Union list. Occupancy is compared per species between two time periods (baseline state versus current state). Here, the two time periods will be flexible, depending on user choice.

3.3.4. TrIAS indicators

These indicators (see list below) were developed within the [TrIAS](#) project.

List of available TrIAS indicators

- Checklist-based indicators
 - Number of new introductions of alien species per year
 - Cumulative number of introductions of alien species
 - Pathways associated with introductions of alien species
- Occurrence-based indicators
 - Detect appearing and reappearing species per year
 - Assessing emerging status of alien species
 - Ranking species per emerging status
 - Define taxonomic distribution of emerging species





- Species observations and occupancy in Belgian protected areas
- Status of alien species in Belgian protected areas

[ISEIA](#) (Invasive Species Environmental Impact Assessment) assessments are a methodology developed to assess the environmental impact and invasion stage and identify those of most concern for preventive and mitigation actions. If sufficient ISEIA assessments are available, indicators within the B3 R package `impIndicator` (Yahaya *et al.*, 2025) will be implemented for Flanders. The `impIndicator` package can be used to estimate the pressure of alien species in protected areas of the Natura 2000 network (create impact maps, compare impact between alien species, visualise total impact over time).

Within the horizontal IAS working group at INBO, there will be a thematic meeting in September 2025 on indicators to align the selected indicators in the list above with practical needs. In December 2025 or January 2026, the LivingLab community for [OneStop](#) in Belgium will be contacted to review the first version of the dashboard where these indicators will be visualised.

4. Policy question(s)

Several general indicators are applied in policy reporting. For instance, species richness and occupancy turnover [are reported](#) to the CBD (Convention on Biological Diversity). Moreover, species range is one of the five criteria on which [red list assessments](#) are based.

The Kunming - Montreal Global Biodiversity Framework (GBF) recognizes the need to preserve the full range of evolutionary traits across the tree of life to safeguard the 'option value' of biodiversity for humanity. It therefore includes a phylogenetic diversity indicator as a complementary measure under Goal A (halting extinction by 2050) and Goal B (ensuring sustainable use of biodiversity and maintaining nature's contributions to people).

As highlighted above, the rate of establishment indicator is a headline indicator of Target 6 of the GBF. The proportion of non-native plant species in the global plant composition for Flanders is currently already being applied by INBO as an indicator for reporting. The comparison of species occupancy between two time periods is an important indicator for the member states to report to EU as part of EASIN. Among the TrIAS indicators, the cumulative number of introductions of alien species is considered a complementary indicator under the Global Biodiversity Framework (GBF). More specifically, it refers to the number of invasive alien species included on national lists, as recorded in the Global Register of Introduced and Invasive Species (GRIIS). Assessing emerging status of alien species is a component indicator of the rate of invasive alien species spread and rate of invasive species impact.

By focusing most indicators on comparing Natura 2000 and non-Natura 2000 areas, we provide new insights to support Natura 2000 management.





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