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EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards

EBV Data Team



iDiv



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EBV Data Portal Workshop
Session 1 / 07.10.2024 / On-line

Workshop

EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards

Session 1:

Overview of the EBVCube Concept and EBV Data Portal

Date and time: 07-Oct. 2024 from 11:00 to 12:00 am

Session 2:

Hands-on training on the `ebvcube` R package

Date and time: 14-Oct. 2024 from 11:00 to 12:00 am

Agenda

1. Overview of the EBV Cube Concept and EBV Data Portal (20 min + 10 min questions) by Henrique.
2. Poll to investigate technical needs and skills for the second session (5 min).
3. Recap slide on 'EBV Cube Format' (5 min) by Lina.
4. Navigating the EBV Data Portal (data sets, DOIs) and metadata creation on the Portal (10 min) by Lina.
5. Data visualisation in Panoply (5 min) by Emmanuel.



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Team



Henrique



Néstor



Lina



Christian



Emmanuel



Luise



Miguel

Session 1: Overview of the EBV Cube Concept and EBV Data Portal

By

Henrique Pereira
Lina Estupinan-Suarez
Emmanuel Oceguera

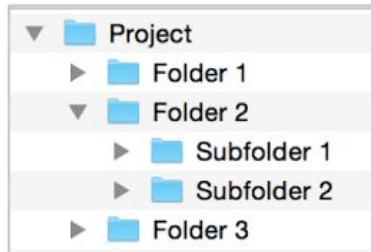
The problem

Many spatial biodiversity datasets from modelling analysis and other approaches (e.g. expert) maps exist only has inaccessible figures in papers and reports

When the datasets have been published, they are made available in a variety of formats, from ASCII to GeoTiff, often organized by ad-hoc organization in folders to convey the hierarchical nature of the data.

Existing repositories such as DRYAD and ZENODO do not enforce any standard data structure and act mostly as dumps for the data.

This contrasts with remote sensing, environmental and climate modelling community that have been sharing their datasets using NetCDF and Climate Forecast convention for many years.



DRYAD



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Biodiversity Building Blocks for policy

Challenges in leveraging biodiversity data for informed policy making



Hard to find the data



Data is not easily accessible



Data formats are not interoperable



Sources are not persistent



PANGAEA.

Data Publisher for Earth & Environmental Science



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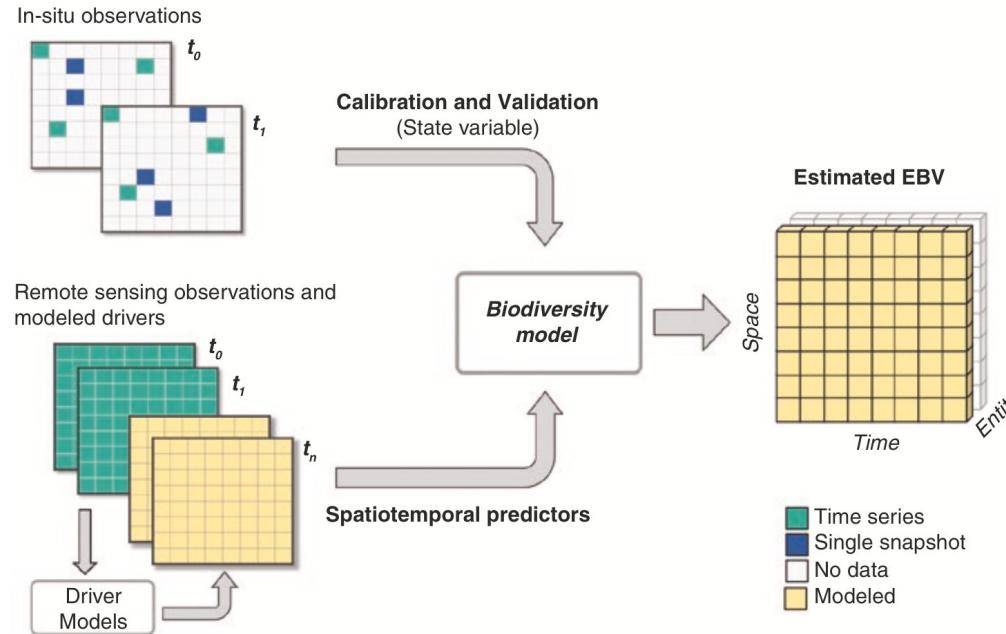
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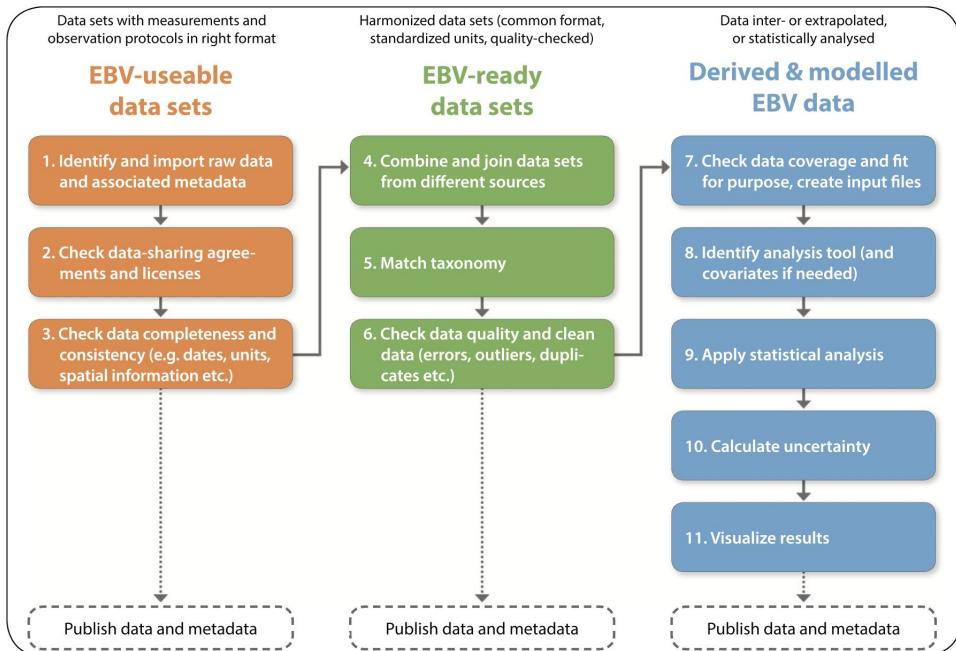
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Essential Biodiversity Variables (EBVs)

EBVs workflows



EBV workflows



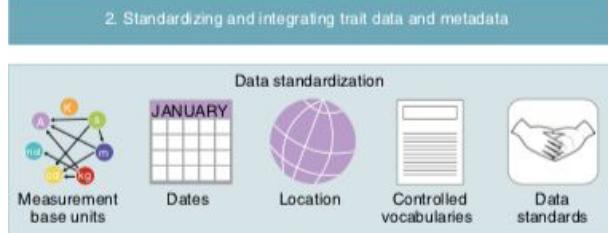
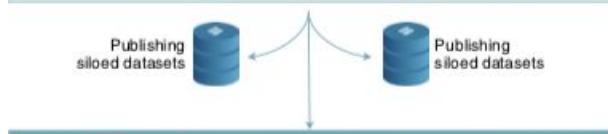
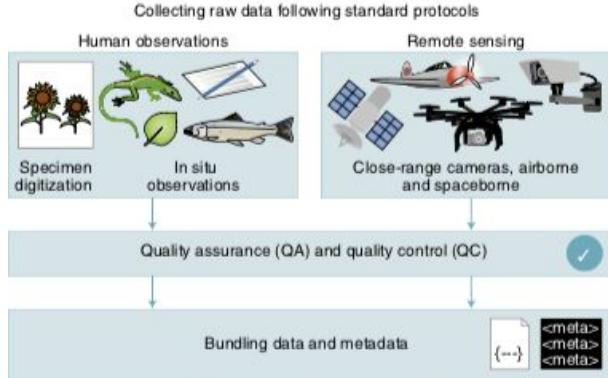
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Kissling et al. (2018a), Kissling et al. (2018b)

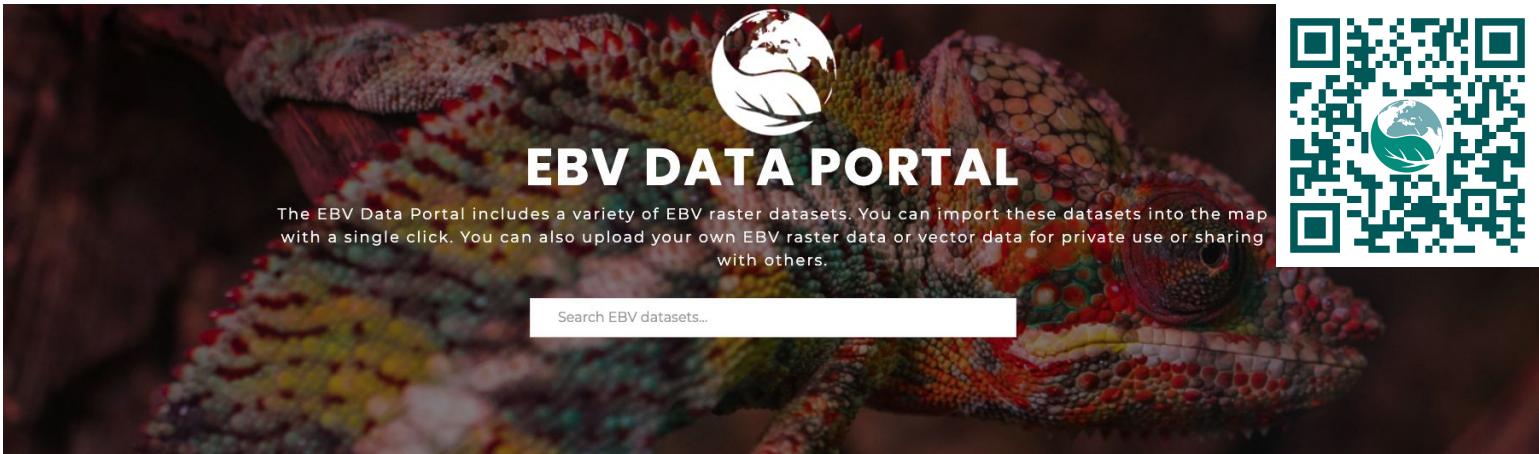
Towards global data products of Essential Biodiversity Variables on species traits

W. Daniel Kissling ^{1*}, Ramona Walls², Anne Bowser³, Matthew O. Jones⁴, Jens Kattge ^{5,6}, Donat Agostí⁷, Josep Amengual⁸, Alberto Bassett⁹, Peter M. van Bodegom¹⁰, Johannes H. C. Cornelissen¹¹, Ellen G. Denny¹², Salud Deudero¹³, Willi Egloff^{14,15}, Sarah C. Elmendorf^{14,15},

1. Collecting and provisioning species trait datasets



A platform for discovering Essential Biodiversity Variables



Datasets distributed using the new **EBV-cube** standards

- *Interoperable data across thematic, spatial and temporal dimensions*
- *Consistently documented in a way that maximizes usability*
- *Traceable (both resources and production pipelines)*



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EBV Portal

Catalog



GEO BON Beta

Home Map Datasets Upload SIGN IN

DATASETS

The EBV Data Portal includes a variety of EBV datasets. With a click on the respective dataset you get to the detailed view.

Filter By Year
Publication Year
From 2010 To 2020

Filter By Creator
Daniel Kissling (1)
Stephan Henninkens (1)
Matthew Hansen (1)
Ines Martins (1)

Filter By Keywords
Big Data (4)
Remote Sensing (4)
Europe (1)
Forest loss (1)

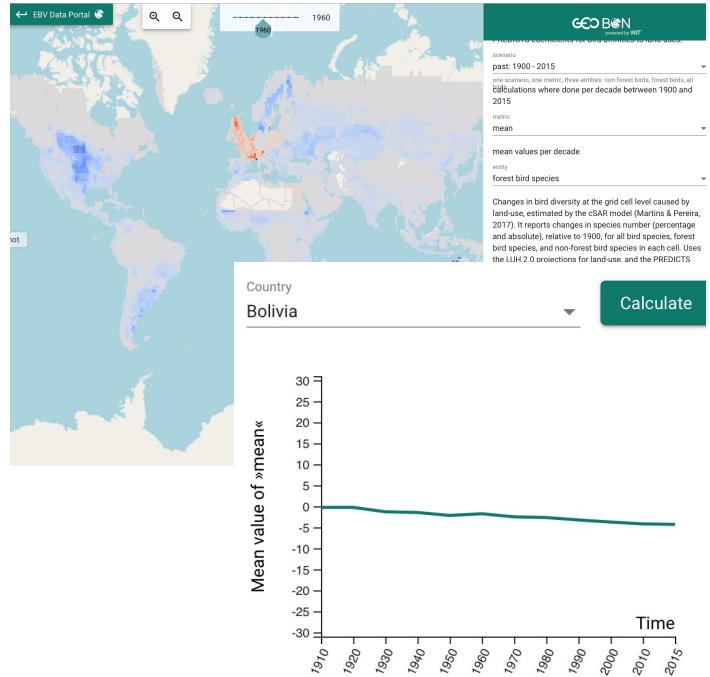
EBV datasets filtered (4)

RELATIVE MAGNITUDE OF FRAGMENTATION (RMF)


PREDICTED SUITABILITY FOR EUNIS HABITAT TYPES


CHANGES IN LOCAL BIRD DIVERSITY (CSAR)


Web GIS with Indicator tool



<https://portal.geobon.org>



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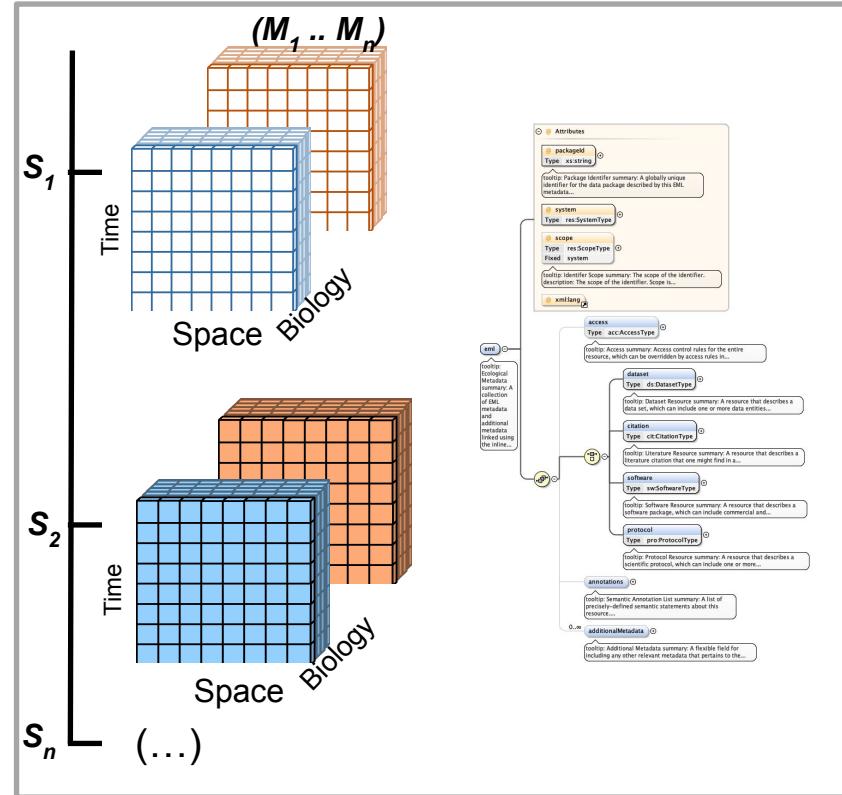
e
e-shape

GEO BON
Group on Earth Observations
Biodiversity Observation Network

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Open EBV Datasets with the EBV Cube Standard

- NetCDF specification with a **unified hierarchical structure** for organizing EBV data
- A **minimum information** specification using **ACDD** terms (with translation into **EML**)
 - *Self-described*
 - *Compliant with FAIR and GEOSS-DMP*



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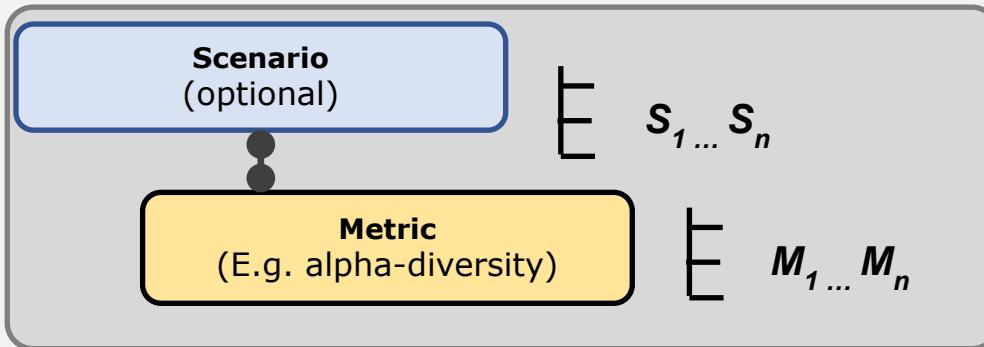


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EBV Cube: a standard for spatiotemporal biodiversity data

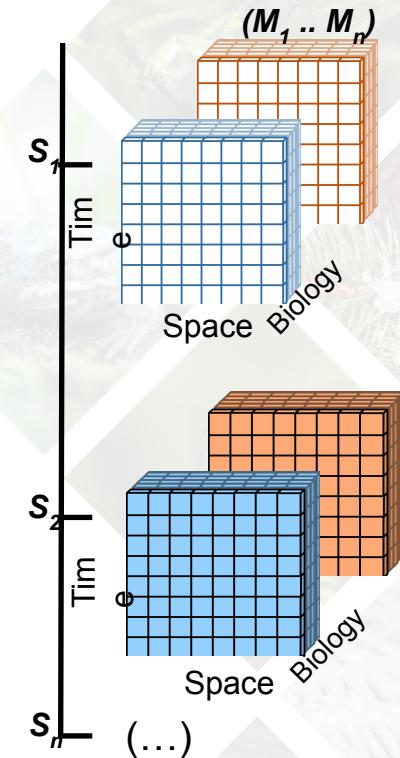
NetCDF file structure

Groups



Dimensions

Entity x Space x Time



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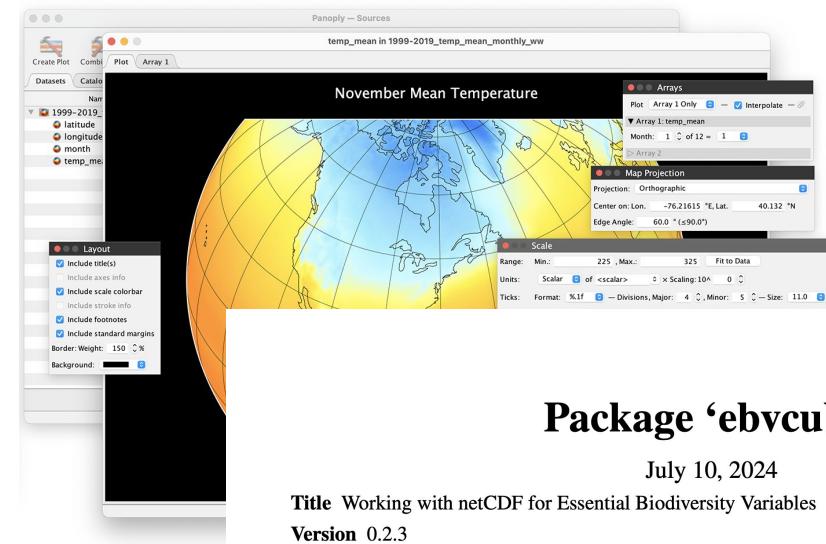
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The EBVCube Data Ecosystem

- EBVcube R package
- Panoply
- QGIS EBVcube Plug-in
- Jupiter notebook
- In general, anything compatible with CF netcdf



Package ‘ebvcube’

July 10, 2024

Title Working with netCDF for Essential Biodiversity Variables

Version 0.2.3

Date 2024-07-10

Author Luise Quoss [aut, cre] (<<https://orcid.org/0000-0002-9910-1252>>),
Nestor Fernandez [aut] (<<https://orcid.org/0000-0002-9645-8571>>),
Christian Langer [aut] (<<https://orcid.org/0000-0003-1446-3527>>),
Jose Valdez [aut] (<<https://orcid.org/0000-0003-2690-9952>>),
Henrique Miguel Pereira [aut] (<<https://orcid.org/0000-0003-1043-1677>>)



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The EBVCube Data Ecosystem

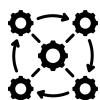
EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards



Search data option



Data is easily accessible



Data formats are interoperable and follow data standards



DOI makes sources are persistent

F_{indable} A_{ccessible} I_{nteroperable} R_{Reusable}

Different users profiles are covered



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EBV Portal: Take home messages

- An open platform
- A platform for all: different scales, different approaches, different systems
- Seamless exploration of many types of biodiversity spatial data
 - The power of the EBV metadata and datacube structure



Training Needs Assessment

- Which operating system are you using on your computer?
- Do you have administrative rights to install new software?
- Do you have R and RStudio installed on your computer?
- What is your proficiency level in R?
- Have you worked with netCDF before?
- Are you familiar with the concept of Essential Biodiversity Variables (EBV)?
- What is your experience with data cubes?
- What is your level of experience with spatial data analysis?

EBV Cube Format

A data format for multidimensional geospatial data of biodiversity

Recap slides

'ebvcube' R package

EBVCube Format: A data format for multidimensional geospatial data of biodiversity

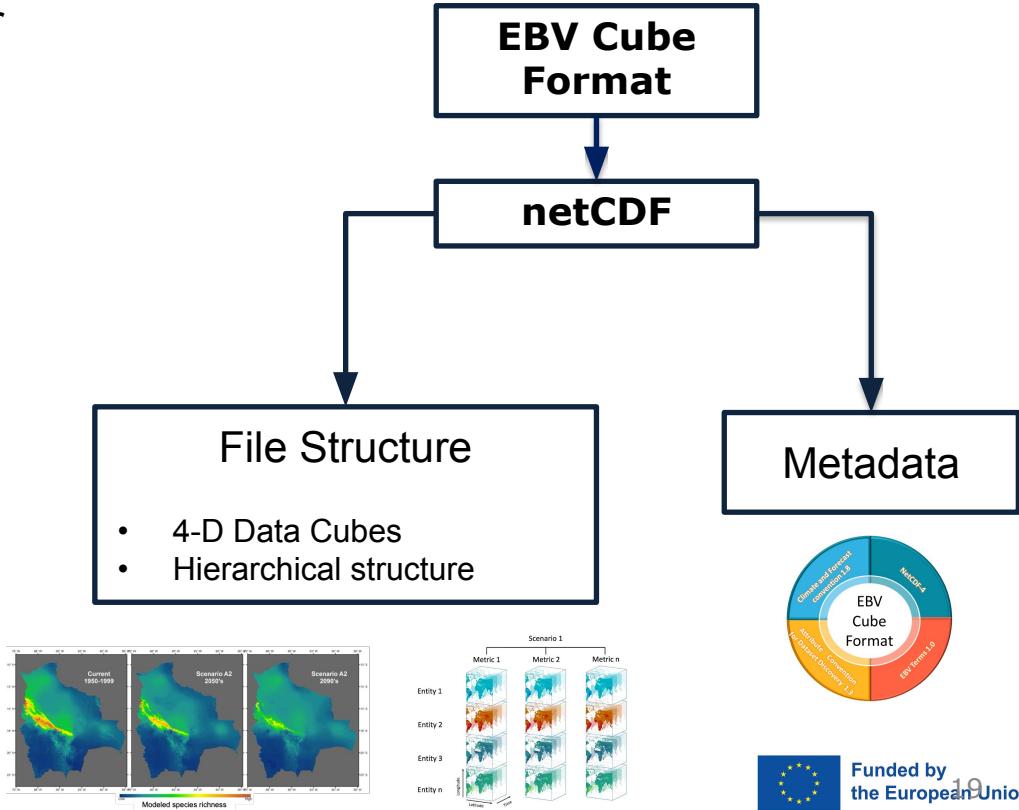


Package 'ebvcube'

July 10, 2024



Biodiversity Building Blocks for policy

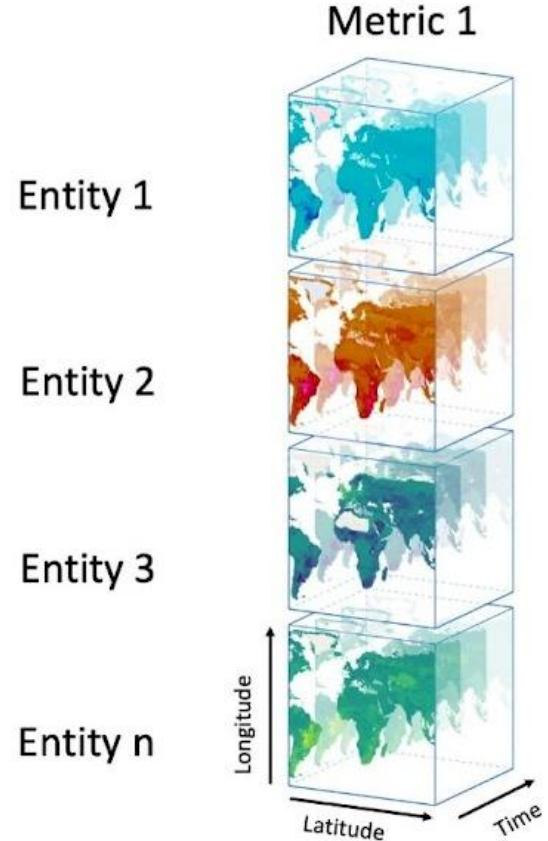
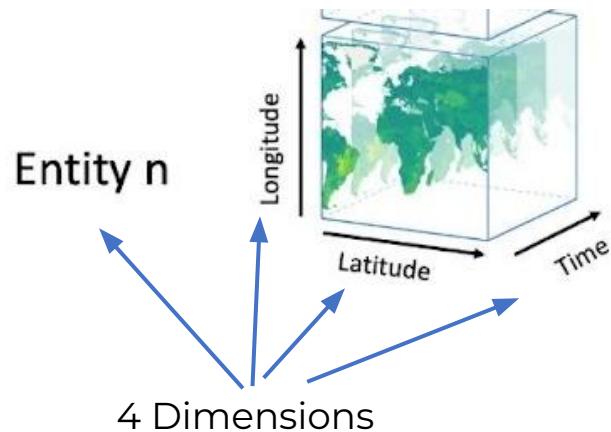


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Hierarchical structure of the EBV Cube Format

A data format for multidimensional
geospatial data of biodiversity

4D Data cube



How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf

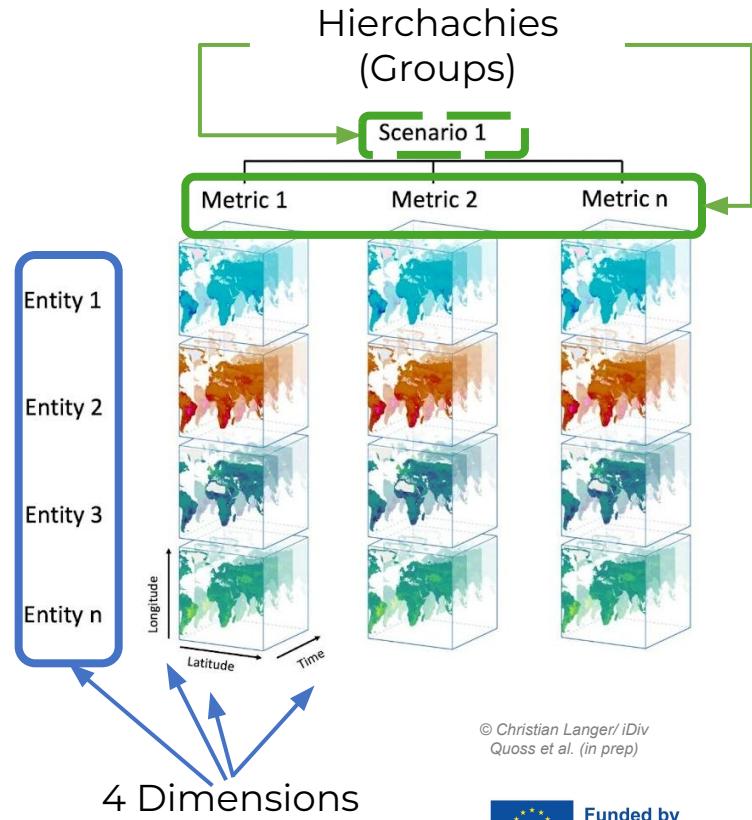


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Hierarchical structure of the EBV Cube Format

A data format for multidimensional geospatial data of biodiversity

NetCDF specification with a **unified hierarchical structure** for organizing geospatial data for EBV



How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf

Metadata

Are Metadata incantations written in some strange, secret language only understood by a small band of metadata geeks?



lovetoknowpets (2024)

Cans of mystery



canit (2024)



Biodiversity Building Blocks for policy



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Metadata

A data format for multidimensional geospatial data of biodiversity

What does the data set describe?

Who produced the data set?

Who prepared the metadata?

When and how frequently were the data collected?

Where were the data collected and with what spatial resolution? (include coordinate reference system)

What is the use and distribution policy of the data set?

Provide any references to use of data in publications

Cans of mystery



canit (2024)

https://portal.geobon.org/downloads/pdf/how_to-10082023.pdf



Biodiversity Building Blocks for policy

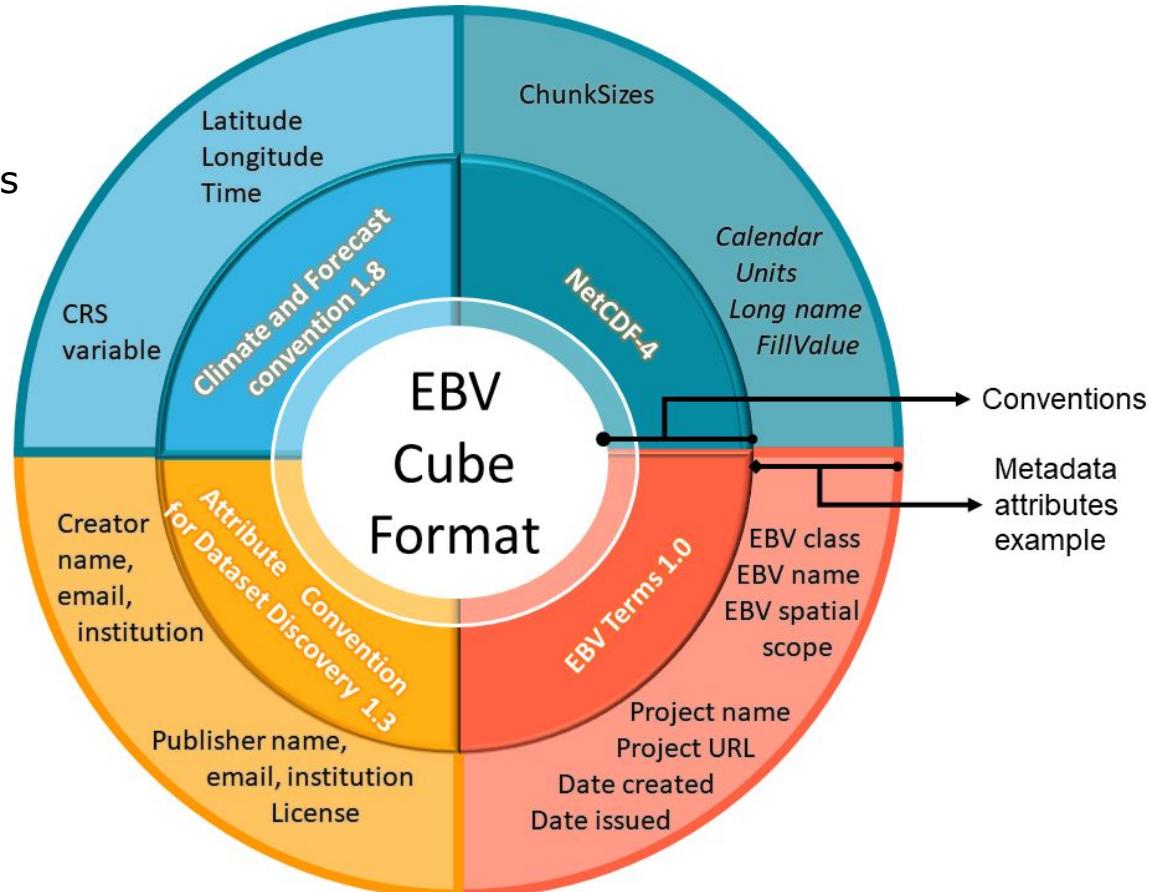


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Metadata conventions implemented in the EBV Cube Format

A **minimum information** specification using **ACDD[1]** terms (with translation into **EML[2]**)

- *Self-described*
- *Compliant with FAIR and GEOSS-DMP [3]*



[1] ACDD: The Attribute Convention for Dataset Discovery

[2] EML: Ecological Metadata Language

[3] GEOSS - DMP: The Global Earth Observation System of Systems Data Management Principles

Metadata conventions implemented in the EBV Cube Format

A **minimum information** specification using **ACDD[1]** terms (with translation into **EML[2]**)

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[1] ACDD: The Attribute Convention for Dataset Discovery

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[3] GEOSS - DMP: The Global Earth Observation System of Systems Data Management Principles

Attributes	NetCDF component	Convention /Source
	Root level Group 4D Cubes	ACDD 1.3 CF 1.8 EBV Terms 1.0 netCDF-4
long_name	x x	
standard_name	x x	
units	x x	
name	x	
email	x	
institution of the creator	x	
co-creator(s)	x	
publisher	x	
geospatial_bounds	x	
time coverage resolution	x	
title	x	
summary	x	
source	x	
references	x	
id	x	
naming_authority	x	
Conventions	x	
ebv_class	x	
ebv_name	x	
ebv_entity_type		x

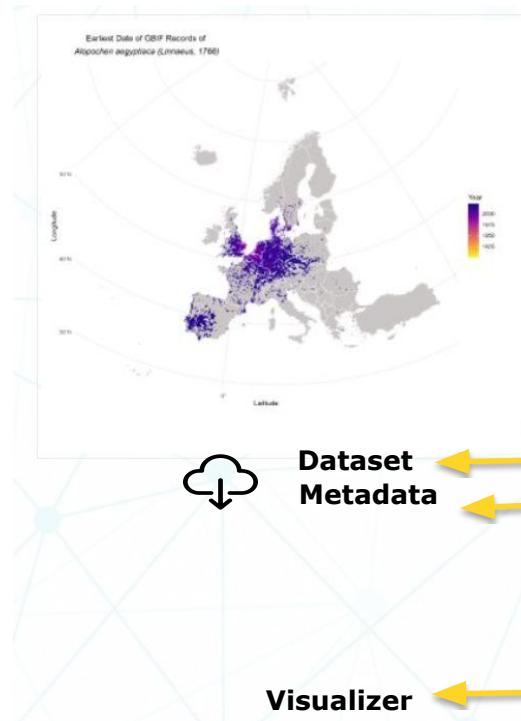
How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf



EBV Data Portal



Catalog of datasets



Occurrence Metrics for Invasive Alien Species of Union Concern in EU27: A 10 km prototype using GBIF occurrence cubes

by Lina Estupinan-Suarez

This dataset includes GBIF occurrences of species listed under Regulation (EU) 1143/2014 on invasive alien species (IAS). The IAS list, adopted in 2016 and updated in 2017, 2019, and 2022, currently includes 88 species subject to strict environmental restrictions.



For this study, we used the most recent IAS list from the European Topic Centre on Biodiversity and Ecosystems (ETC BE) and the European Environment Agency (EEA) as of June 2 ...[\(continue reading\)](#)

[doi 10.25829/w0vf54](#)

DOI Citation



[Data: netCDF \(2.75MB\)](#)

[Metadata: ACDD \(JSON\) | EML \(XML\)](#)

Invasive alien species of union concern

European Union

Species occurrence

Basis of record

Cube occurrence

GBIF records

Visualizer

Show on map



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Biodiversity Building Blocks for policy

26

EBV Data Portal

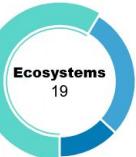


<https://portal.geobon.org/>

A screenshot of the EBV Data Portal homepage. The page features a large background image of an elephant in a forest. At the top left is the GEOBON logo and navigation links: Home, Discover, Map, How-to. At the top right is a red-circled "Login" button. In the center, the text "EBV Data Portal" is displayed above a paragraph about datasets. Below the paragraph are three circular infographics showing statistics: Entity Type (Ecosystems 19), Portal statistics (Spatial Domain 18, Global 18), and Environmental Domain (Terrestrial 40).

The EBV Data Portal includes a variety of EBV raster datasets.
You can import these datasets into the map with a single click. You can also upload your own EBV dataset for sharing with others.

Entity Type	Portal statistics	Environmental Domain
Ecosystems 19	Spatial Domain 18 Global 18	Terrestrial 40

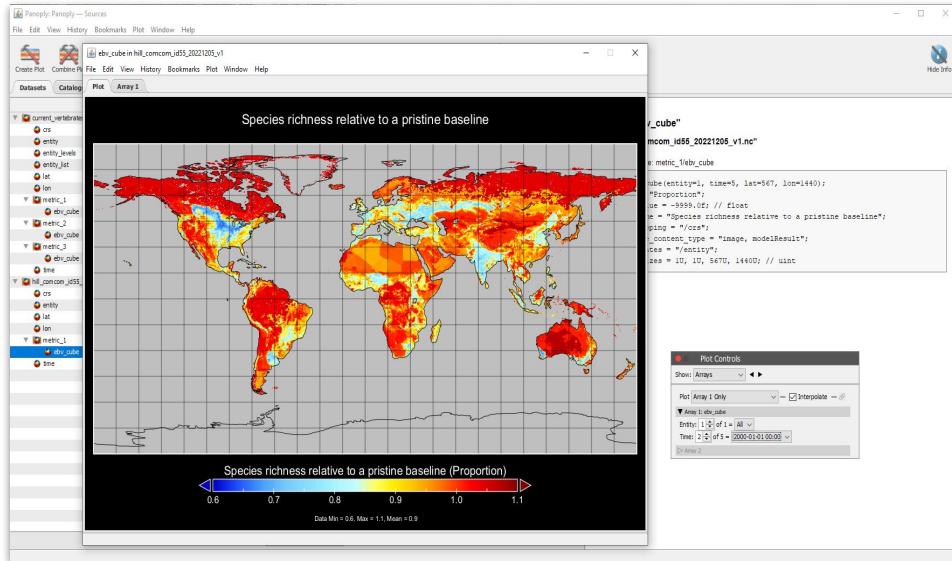


The EBV Cube in Panoply

Visualisation of EBV Cubes

An Overview of Panoply for Exploring EBVs

- A **cross-platform tool** for visualizing geo-gridded data in **netCDF**, HDF and GRIB formats
- It provides a **graphical interface** for **inspecting** and **visualizing** netCDF data.
- Ideal for **visualizing EBVs** across **spatial**, **temporal** and **biodiversity** (e.g. taxonomy) **dimensions**.
- Panoply shows the **full structure** including **technical components** (e.g. coordinate variables)



Download link: <https://www.giss.nasa.gov/tools/panoply/>
Panoply developed by NASA (Dr. Robert Schmunk).



Recap of Panoply Demonstration

- ❖ **Exploring Data with Panoply**
 - Opened and loaded EBV in netCDF format
 - Navigate spatial, temporal, biodiversity components
 - Visualized data using various plot types
- ❖ **Technical set up**
 - Java Runtime Environment(JRE)
 - Memory consideration
- ❖ **Key Features Highlighted**
 - Visualization primarily
 - User-friendly interface
- ❖ **Alternatives for Analysis**
 - R, Python and QGIS

Thank you!



Home Discover Map How-to

Login

EBV Data Portal

The EBV Data Portal includes a variety of EBV raster datasets.

You can import these datasets into the map with a single click. You can also upload your own EBV dataset for sharing with others.



@BCubedProject



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This project receives funding from the European Union's Horizon Europe Research and Innovation Programme (ID No 101059592). Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the EU nor the EC can be held responsible for them.

Photo by Viridiflavus - Own work, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=4956453>

Tasks

1. Install one of the following softwares:

- I. Panoply or
 - A. <https://www.qiss.nasa.gov/tools/panoply/>
 - B. Install Java 11 or later if you don't have it
- II. EBVcube visualizer Plugin
 - A. GitHub repo: <https://github.com/EBVcube/EBVCubeVisualizerPlugin>
 - B. How-To install:
<https://www.ncesc.com/geographic-pedia/how-to-install-plugin-from-zip-in-qgis/>

2. Download one EBVCube netCDF from the EBV Data Portal, such as the BES-SIM Predicts dataset and explore it in the newly installed software.

3. Plan your own EBVCube dataset: Do you have a dataset that corresponds to an EBV? Think about how this dataset maps into the hierarchical structure with the 4D data cubes.

If you can publish this data set openly on the EBV Data Portal, fill the metadata into the form on the website. We can create and publish this dataset in the next session.



Prepare the second session

1. Install R and RStudio, if you haven't so far, following the steps bundled [here](#).
2. Install all required R packages using the [00_install_packages.R](#) script.
3. Download the material for the second session following the first slide of [02_session_EBVCube-workshop.pdf](#).



Image Sources

- Fernández, Néstor, et al. "Essential biodiversity variables: Integrating in-situ observations and remote sensing through modeling." *Remote sensing of plant biodiversity* (2020): 485-501.
- Kissling, W.D., Ahumada, J.A., Bowser, A., Fernandez, M., Fernández, N., García, E.A., Guralnick, R.P., Isaac, N.J.B., Kelling, S., Los, W., McRae, L., Mihoub, J.-B., Obst, M., Santamaría, M., Skidmore, A.K., Williams, K.J., Agosti, D., Amariles, D., Arvanitidis, C., Bastin, L., De Leo, F., Egloff, W., Elith, J., Hobern, D., Martin, D., Pereira, H.M., Pesole, G., Peterseil, J., Saarenmaa, H., Schigel, D., Schmeller, D.S., Segata, N., Turak, E., Uhlir, P.F., Wee, B. and Hardisty, A.R. (2018), Building essential biodiversity variables (EBVs) of species distribution and abundance at a global scale. *Biol Rev*, 93: 600-625.
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