BIODIVERSITY BUILDING BLOCKS FOR POLICY

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EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards

EBV Data Team

iDiv

NATURA CONNECT

In collaboration with NaturaConnect

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

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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

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

By
Henrique Pereira
Lina Estupinan-Suarez
Emmanuel Oceguera

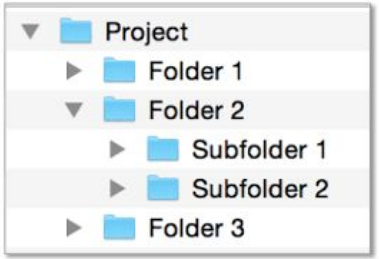
The problem

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.



zenodo

DRYAD

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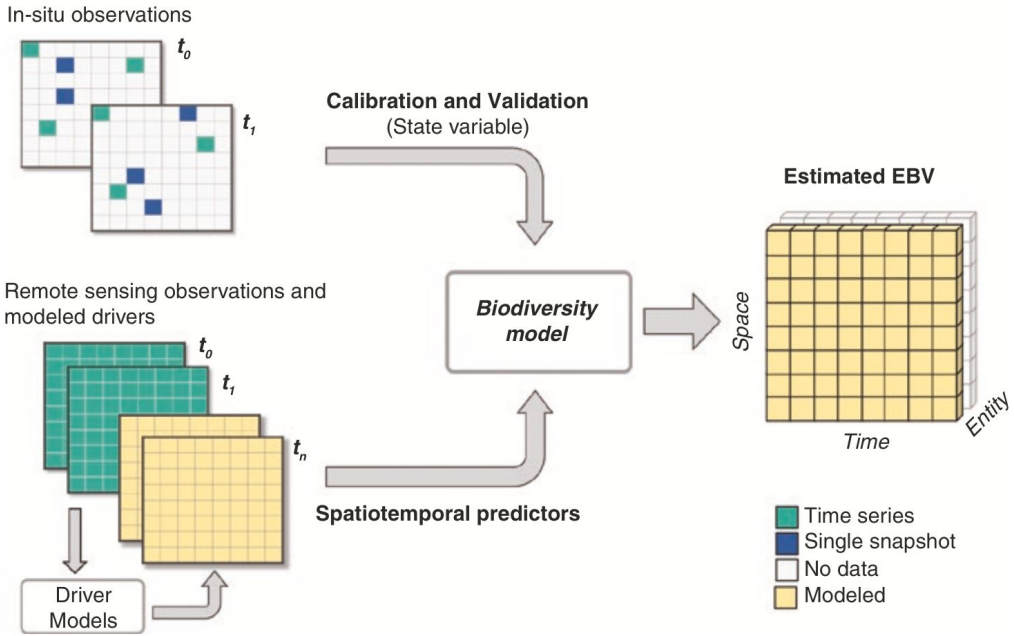
EBV workflows



Fernández ... Pereira (2020) in Remote Sensing of Plant Biodiversity

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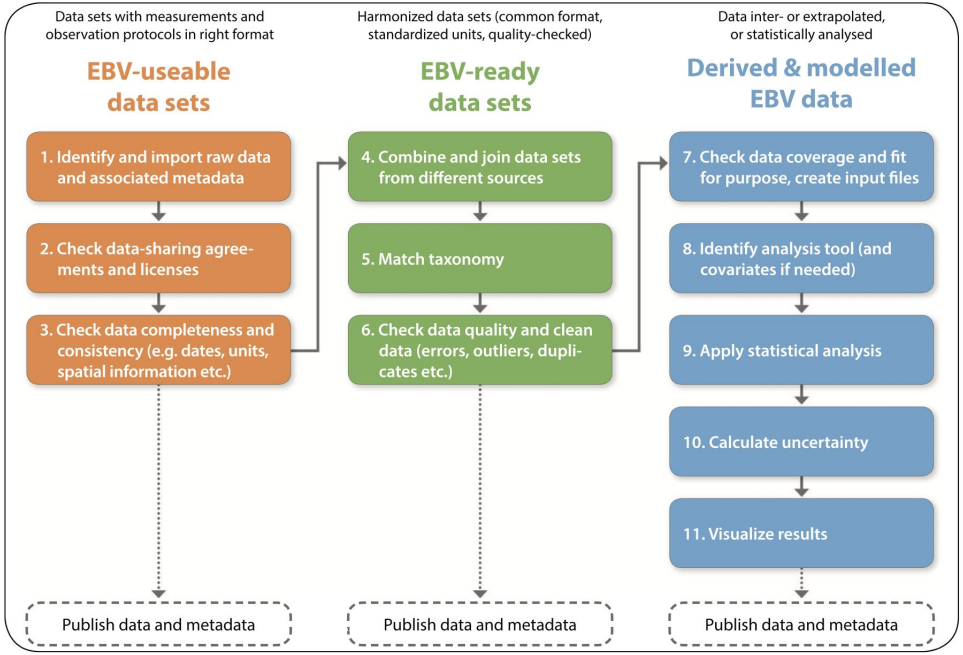
EBV workflows

BIOLOGICAL REVIEWS
Cambridge Philosophical Society
Biol. Rev. (2018), **93**, pp. 600–625.
doi: 10.1111/brv.12359
600

Building essential biodiversity variables (EBVs) of species distribution and abundance at a global scale

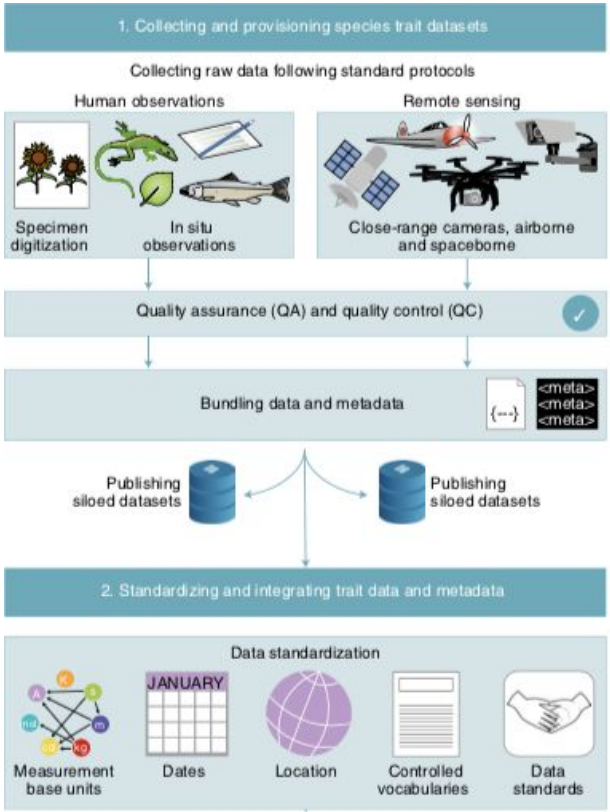
W. Daniel Kissling[1,*], Jorge A. Ahumada[2], Anne Bowser[3], Miguel Fernandez[4,5,6], Néstor Fernández[5,7], Enrique Alonso García[8], Robert P. Guralnick[9], Nick J. B. Isaac[10],



nature ecology & evolution
PERSPECTIVE
https://doi.org/10.1038/s41559-018-0667-3
OPEN

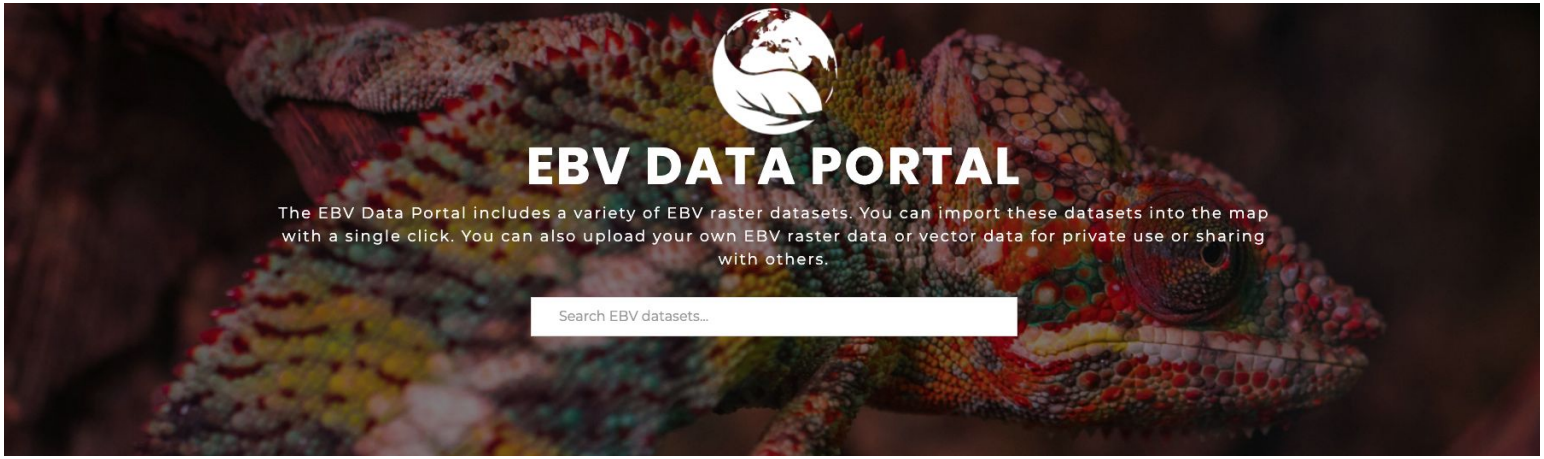
Towards global data products of Essential Biodiversity Variables on species traits

W. Daniel Kissling[1*], Ramona Walls[2], Anne Bowser[3], Matthew O. Jones[4], Jens Kattge[5,6], Donat Agosti[7], Josep Amengual[8], Alberto Basset[9], Peter M. van Bodegom[10], Johannes H. C. Cornelissen[11], Ellen G. Denny[12], Salud Deudero[13], Willi Egloff[7], Sarah C. Elmendorf[14,15],



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

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)*

Biodiversity Building Blocks for policy

GEO BON

e-shape

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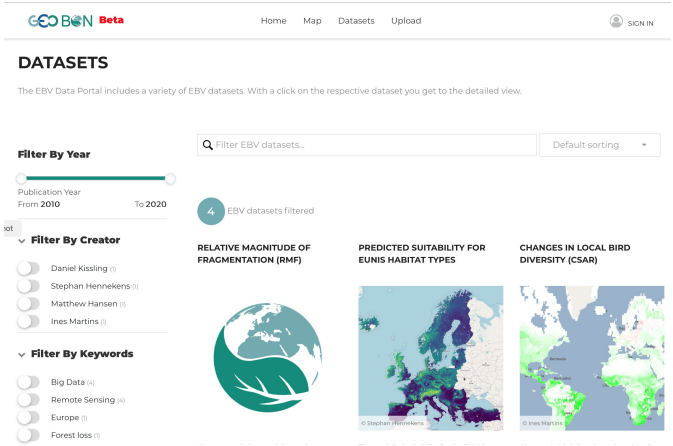
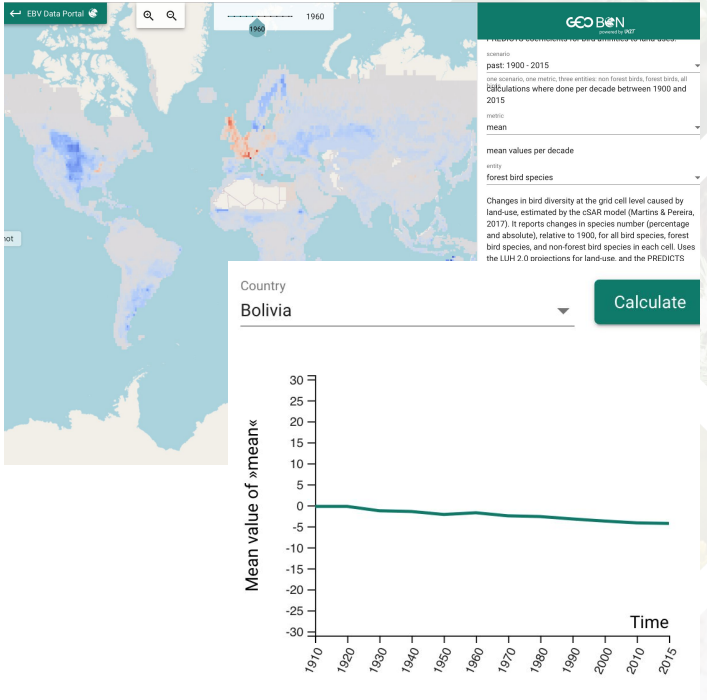
EBV Portal

Catalog



Web GIS with Indicator tool



https://portal.geobon.org

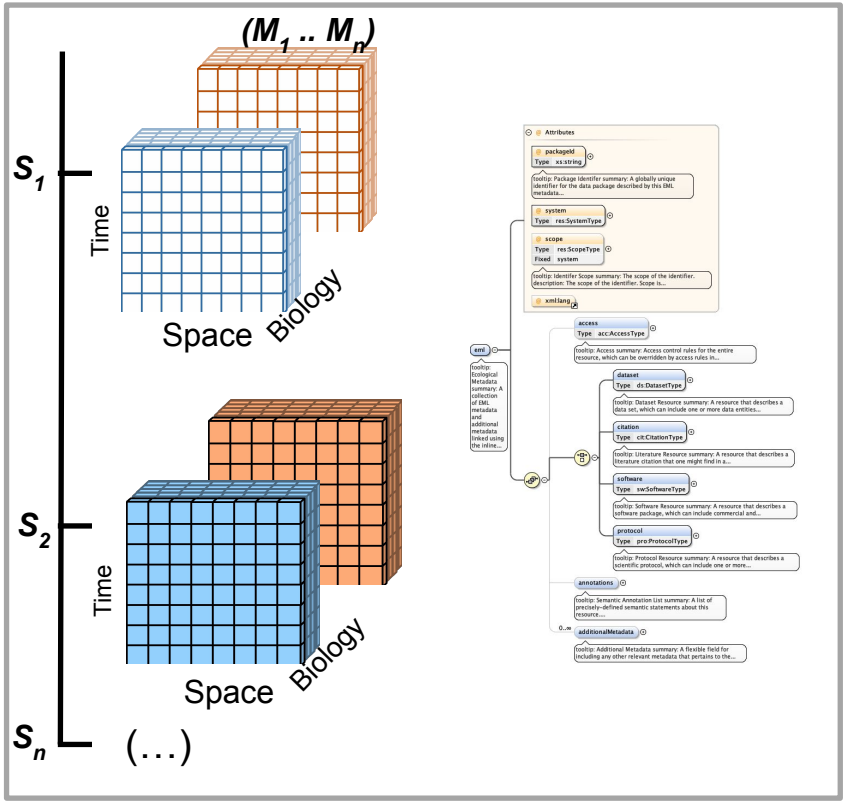
Open EBV Datasets with the EBV Cube Standard

- **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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EBV Cube: a standard for spatiotemporal biodiversity data

NetCDF file structure

Groups

Scenario
(optional)

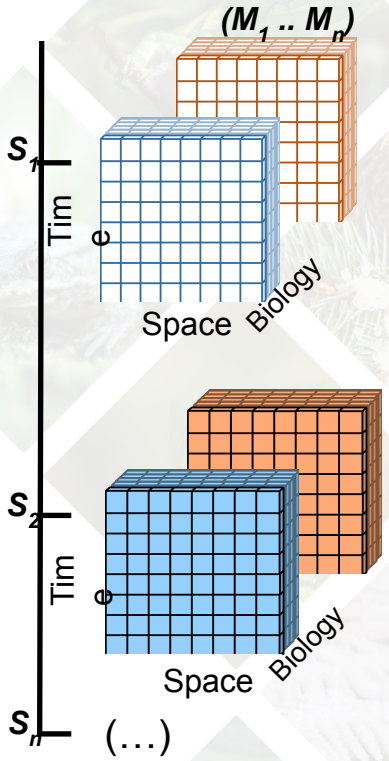
$S_1 \dots S_n$

Metric
(E.g. alpha-diversity)

$M_1 \dots M_n$

Dimensions

Entity x Space x Time



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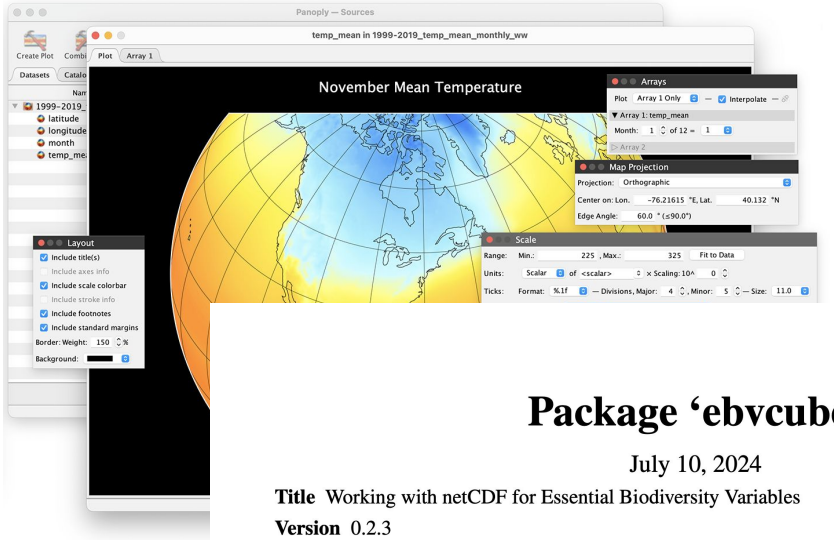
The EBVCube ecosystem



- 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>),
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Henrique Miguel Pereira [aut] (<https://orcid.org/0000-0003-1043-167

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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

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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

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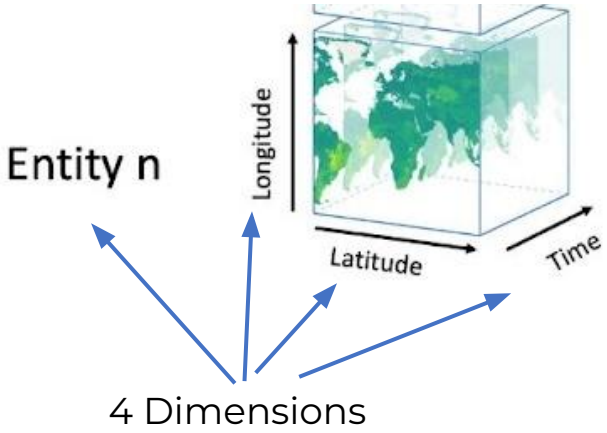
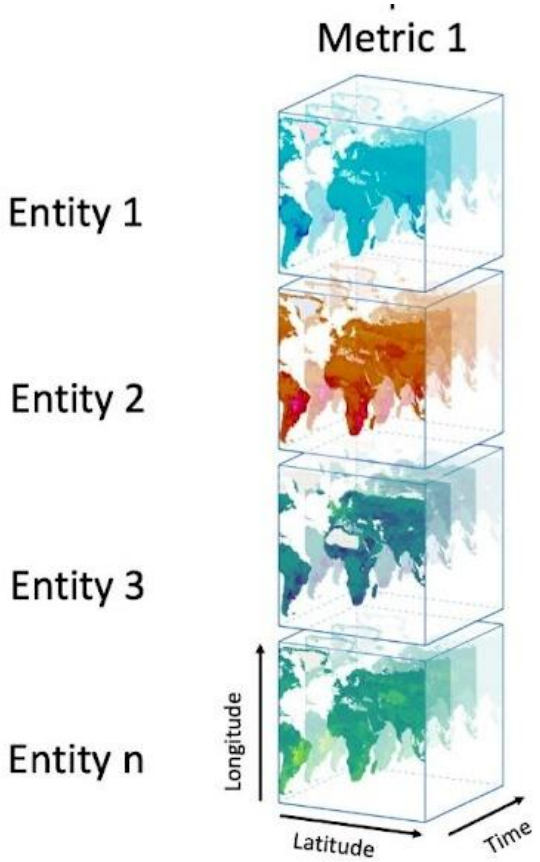
Hierarchical structure of the EBV Cube Format

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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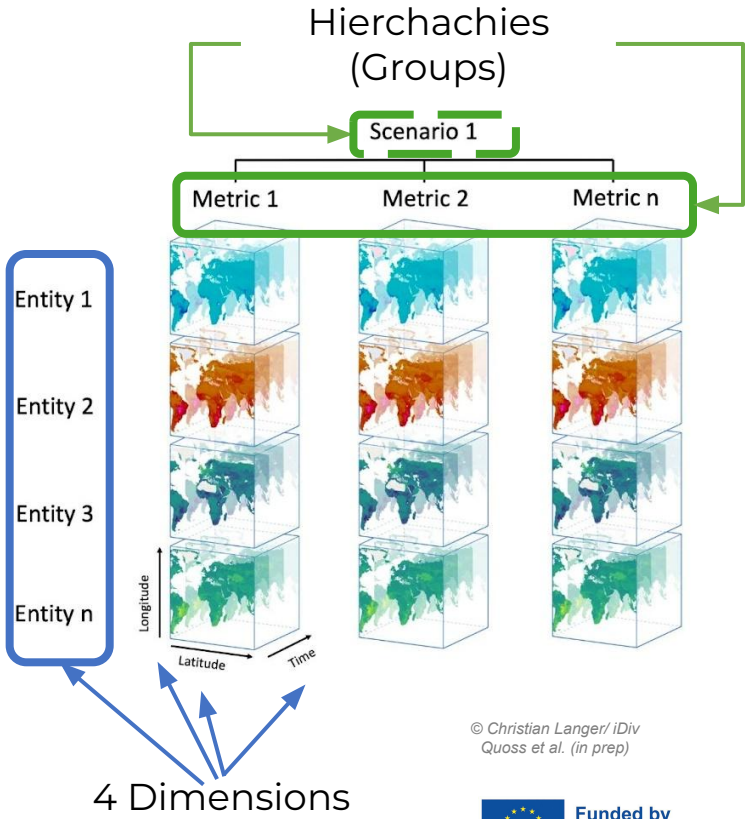
Hierarchical structure of the EBV Cube Format

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

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Metadata

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

lovetoknowpets (2024)

canit (2024)

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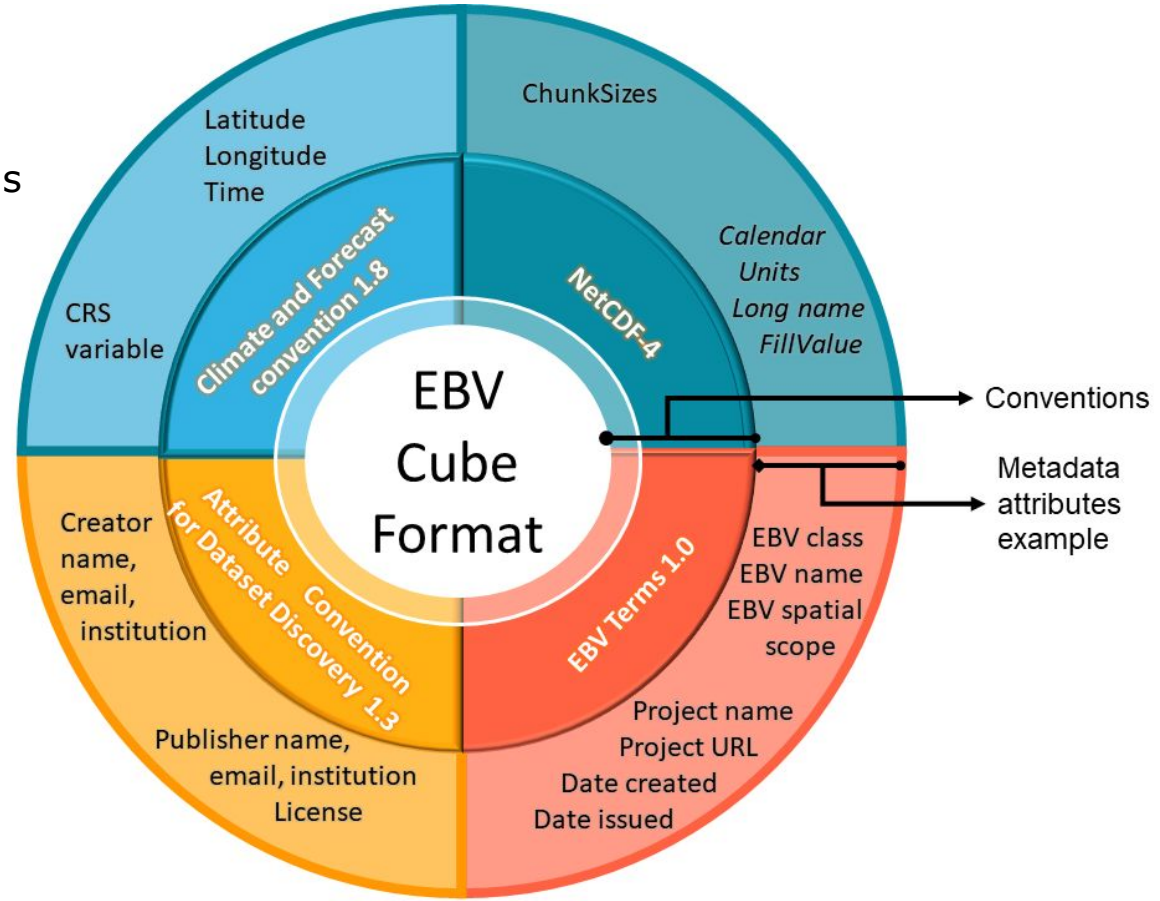
Metadata conventions implemented in the EBV Cube Format

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]**)

- *Self-described*
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	NetCDF component			Convention /Source			
Attributes	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				

[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

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

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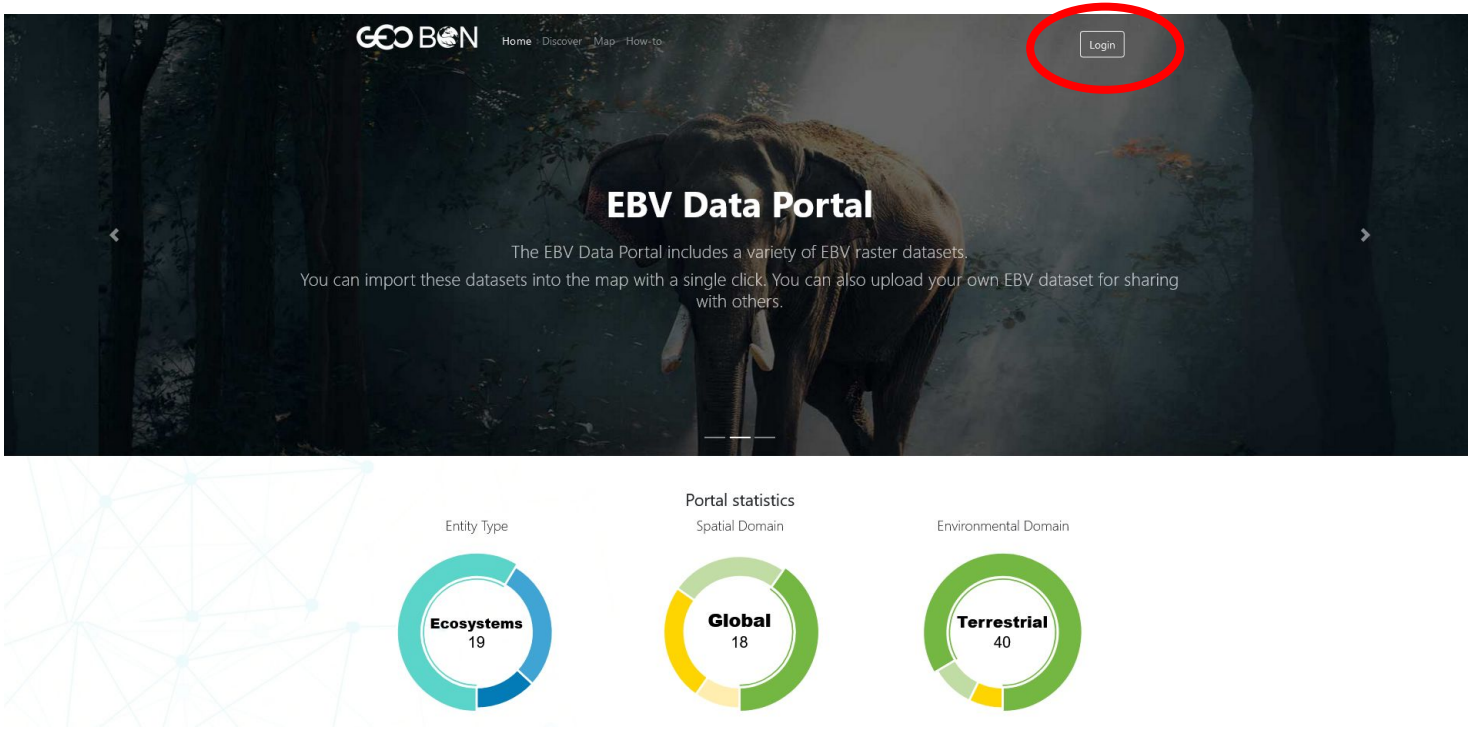
EBV Data Portal

https://portal.geobon.org/



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The EBV Cube in Panoply

Visualisation of EBV Cubes

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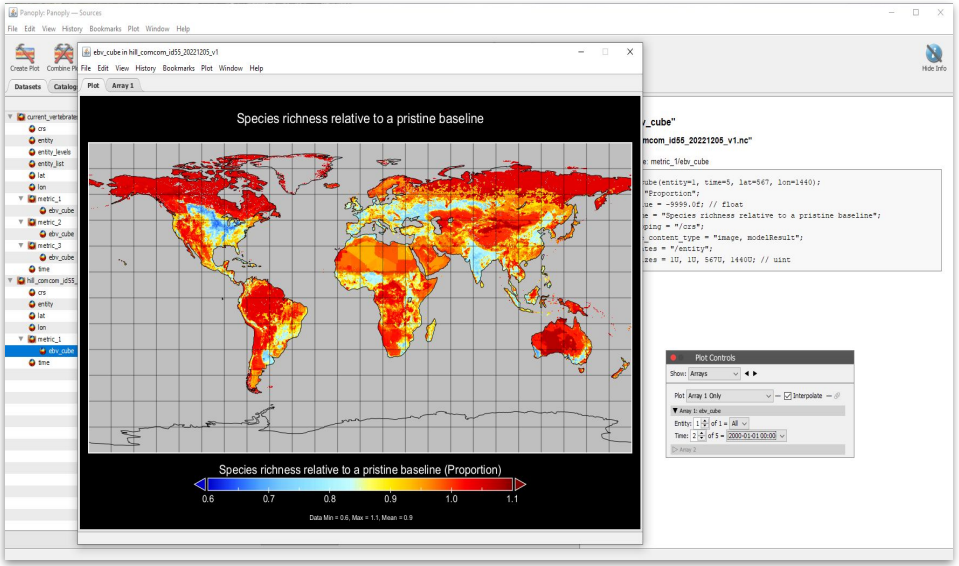
An Overview of Panoply for Exploring EBVs

- 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).

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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

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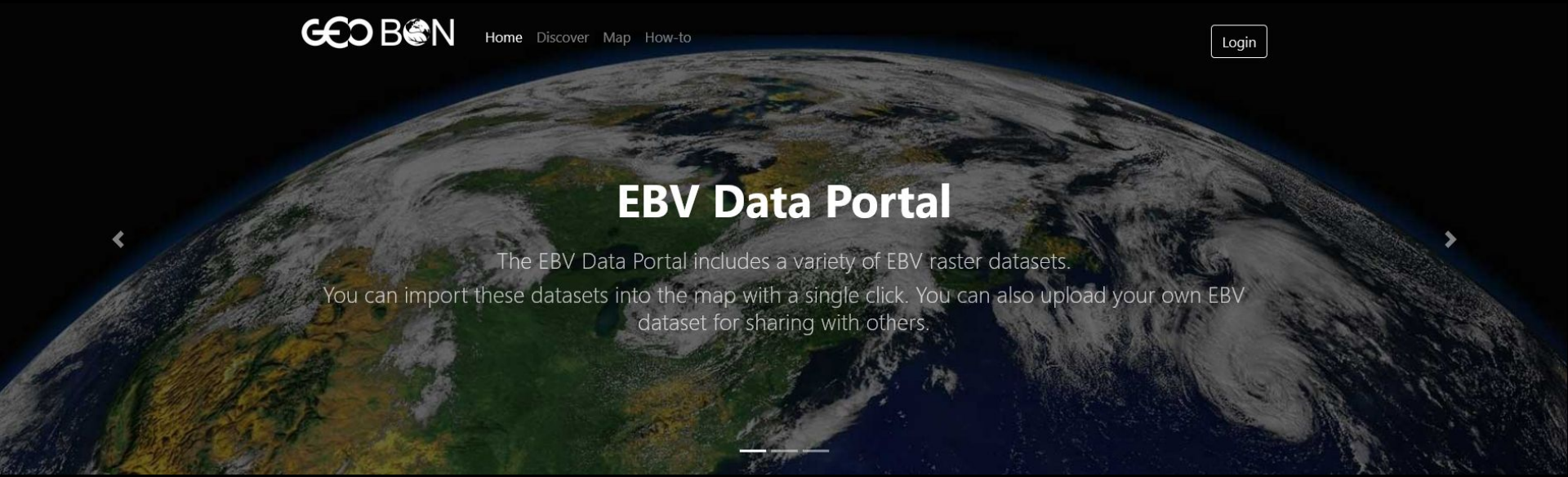
Thank you!



b-cubed.eu @BCubedProject B-Cubed Project

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.

Tasks

1. Install one of the following softwares:
   I. Panoply or
      A. https://www.giss.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.

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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.

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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., Santamaria, 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. https://doi.org/10.1111/brv.12359
- Kissling, W.D., Walls, R., Bowser, A. *et al*. Towards global data products of Essential Biodiversity Variables on species traits. *Nat Ecol Evol* 2, 1531–1540 (2018). https://doi.org/10.1038/s41559-018-0667-3
- canit (2024). Tins for Sale. Accessed Online 02.12.2024, URL: https://canit.co.za/tins/tins-for-sale/
- lovetoknowpets (2024). Dog raising paw. Accessed Online 02.12.2024, URL: https://cf.ltkcdn.net/dogs/images/std/65818-411x292-Dog_raising_paw.jpg

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