BIODIVERSITY BUILDING BLOCKS FOR POLICY

Scaling data cubes for Essential Biodiversity Variables

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iDiv/MLU

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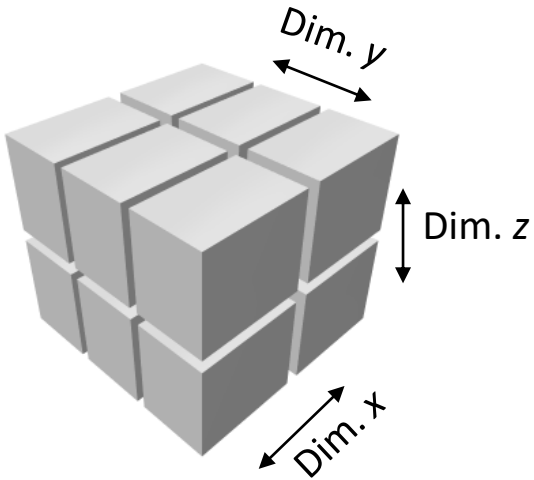
What are data cubes?



Multi-dimensional data structure

- … or a Multi-dimensional array
- From 1 to n-dimensions
- Each dimension has its-own attributes
  e.g., Time → Date, Month, DOY, …
- Facilitates computations across dimensions:
  - *Cube slices
  - *Collapse (aggregate) dimensions
  - *Dicing
  - *…

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Data structure

Species data over time for one location

Coordinates
Latitude x1 Longitude y1

Taxon	Time 1	Time 2	Time 3	Time 4	Time 5	... Time n
Sp. 1	0	0	0	0	10	20
Sp. 2	12	12	12	12	12	12
Sp. 3						
Sp. 4						
Sp. 5						
Sp. 6						
Sp. 7						
Sp. 8						
Sp. 9						
Sp. 10						
Sp. 11						
Sp. 12						
Sp. 13						
Sp. 14						
Sp. 15						

Coordinates
Latitud x2 Longitude y2

Taxon	Time 1	Time 2	Time 3	Time 4	Time 5	... Time
Sp. 1	0	0	20	25	14	
Sp. 2	3	3	3	3	3	
Sp. 3						
Sp. 4						
Sp. 5						
Sp. 6						
Sp. 7						
Sp. 8						
Sp. 9						
Sp. 10						
Sp. 11						
Sp. 12						
Sp. 13						
Sp. 14						

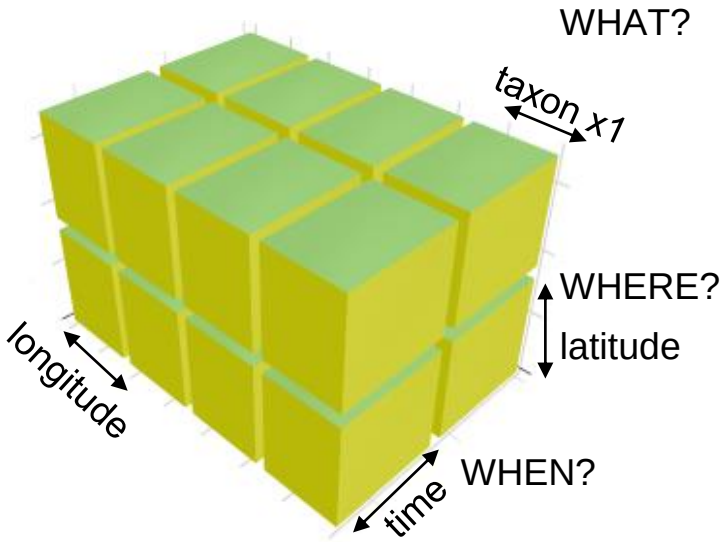
Latitude	Longitude	Taxon	Time 1	Time 2	Time 3	Time 4	Time 5	... Time n
x1	y1	Sp. 1	0	0	0	0	10	20
x1	y1	Sp. 2	12	12	12	12	12	12
x1	y1	Sp. 3						
x1	y1	Sp. 4						
x1	y1	Sp. 5						
x1	y1	Sp. 6						
x1	y1	Sp. 7						
x1	y1	Sp. 8						
x1	y1	Sp. 9						
x1	y1	Sp. 10						
x1	y1	Sp. 11						
x1	y1	Sp. 12						
x1	y1	Sp. 13						
x1	y1	Sp. 14						
x1	y1	Sp. 15						
x2	y2	Sp. 1	0	0	20	25	14	22
x2	y2	Sp. 2	3	3	3	3	3	3
x2	y2	Sp. 3						
x2	y2	Sp. 4						
x2	y2	Sp. 5						
x2	y2	Sp. 6						
x2	y2	Sp. 7						
x2	y2	Sp. 8						
x2	y2	Sp. 9						
x2	y2	Sp. 10						
x2	y2	Sp. 11						
x2	y2	Sp. 12						
x2	y2	Sp. 13						
x2	y2	Sp. 14						
x2	y2	Sp. 15						

- Data redundancy
- Inefficient access

Big data

Cloud computing

Green deal data space



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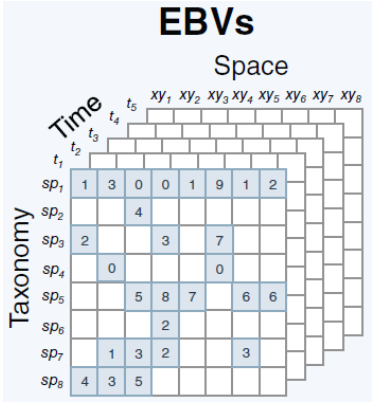
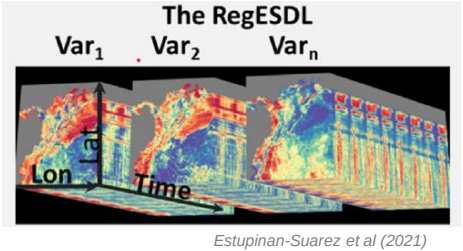
Data cubes

Geospatial data

- Remote sensing (multi & hyper spectral imagery)
- Climate science (time series e.g., 15 min temporal resolution)
- Biodiversity
  * RegESDL (*Estupinan-Suarez et al. 2021)*
  * EBVCube (Kissling et al 2018, Jetz et al 2019, *Quoss et al*. 2023 *in prep.*)
  * Species occurrence cubes



Kissling et al (2018)



Estupinan-Suarez et al (2021)

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Consortium

Meise Botanic Garden

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

RESEARCH INSTITUTE NATURE AND FOREST

SANBI Biodiversity for Life South African National Biodiversity Institute

GBIF

Stellenbosch University iYunivesithi Universiteit

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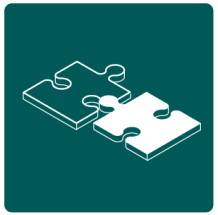
Biodiversity Building Blocks for policy (B-Cubed)

About B-Cubed

Challenges

The global biodiversity crisis requires **rapid, reliable and repeatable biodiversity monitoring data** which decision makers can use to evaluate policy.



Opportunities

Such information – from local to global level and within relevant timescales – calls for an **improved integration of data on biodiversity** from different sources.

Aim

B-Cubed is **standardising access to biodiversity data** empowering policymakers to address the impacts of biodiversity change.

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Biodiversity Building Blocks for Policy (B-Cubed)

B-Cubed cores

Policy alignment to enhance the use of biodiversity indicators in policy decisions

Evidence base to provide fast access to pre-aggregated and modelled data for policy

Automated workflows to pack known methods together into standardized workflows

Cloud computing enabling user-driven cubes configuration by demand in the cloud

Capacity building developing guidelines and training programs in biodiversity informatics

Case studies to test solution effectiveness at contrasting geographic extents, data availability and biodiversity richness

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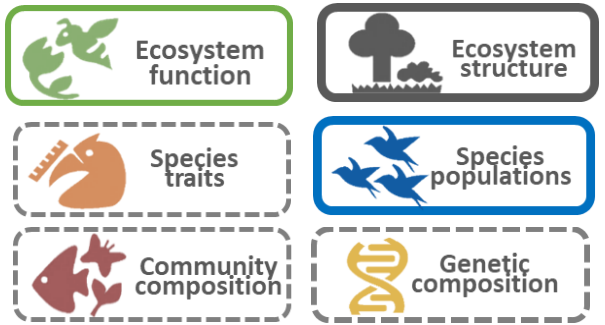
EU Policy alignment

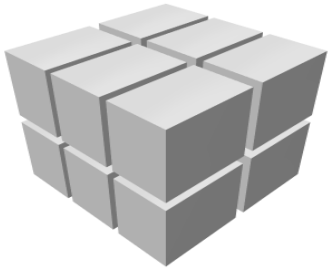
EBVs Priority List

- Key EBVs for biodiversity monitoring in EU
- EBVs of importance to policy (e.g., Habitats directive, birds directive, IAS, ...)

Essential Biodiversity Variables

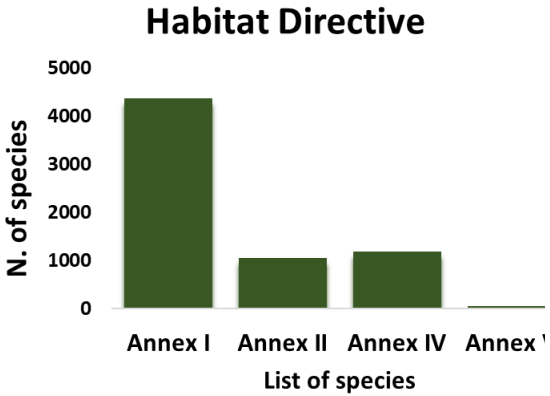


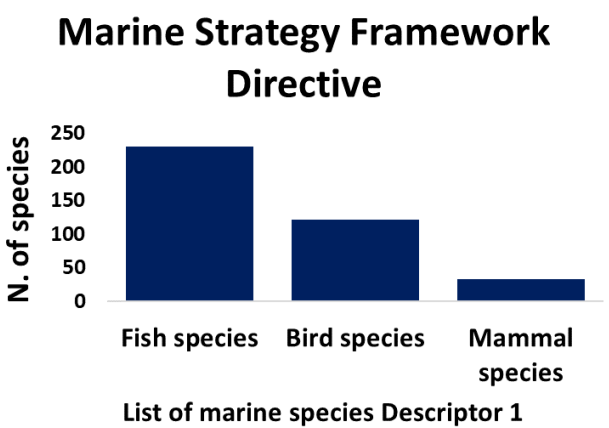
Species occurrence cubes

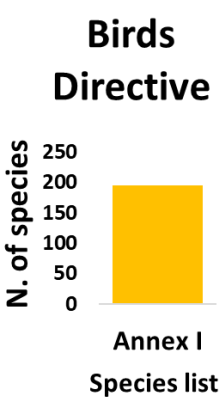


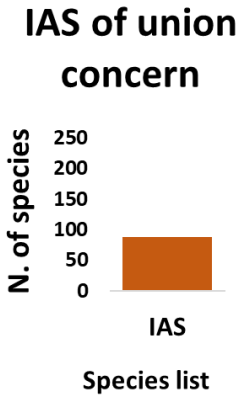
EU Policy alignment

Data source: EEA 2023









Habitats Directive

Annex I: natural habitat types of community interest whose conservation requires the designation of special

Annex II: animal and plant species of community interest whose conservation requires the designation of special areas of conservation

Annex IV: animal and plant species of community interest in need of strict protection

Annex V: animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures

Birds Directive

Annex I: Species subject of special conservation (194 Species.

Evidence base

Slide from Andrew Rodrigues

GBIF

Species occurrence cubes

- B-Cubed is building software to help develop services and community access models
- Researchers can configure and calculate species occurrence cubes on demand based on their parameterization
- Resulting cubes will be stored in the cloud and accessible via a DOI.

First species occurrence cube tests is planned in November!

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B-Cubed outcomes

Biodiversity cubes

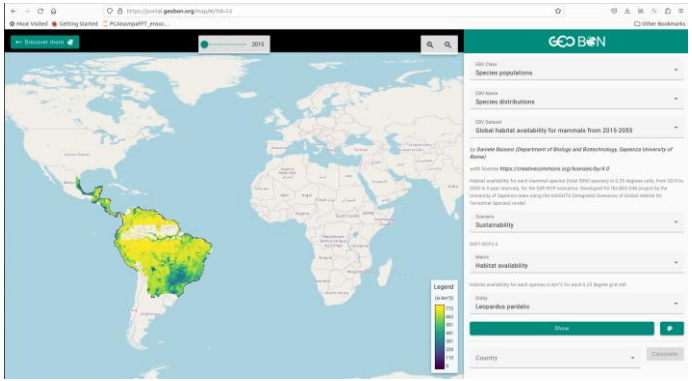
Suitability cube

Species occurrence cube

Dissimilarity cube

Network invasibility cube

EBVs Web Portal



https://portal.geobon.org/

Biodiversity indicators

Impacts of alien taxa indicators

Phylogenetic indicators

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Thank you!

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Hacking Biodiversity Data Cubes for policy April 2024!

b-cubed.eu @BCubedProject B-Cubed Project

Biodiversity Building Blocks for policy

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