

Measurement Ontologies: A Field of Dreams for Essential Biodiversity Variables

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Essential Biodiversity Variables

Biological data are collected at great expense, with the expectation that they will improve our capacity for science-based decisionmaking, aimed at protecting natural ecosystems and *sustaining* the services that they provide.

The Marine Biodiversity **Networks (MBON)** strengthen our understanding of marine biodiversity through scientific observations that form the basis of Essential Biodiversity Variables (EBV)¹.



EBVs characterize critical aspects of ecosystems, and are intended to function as *interfaces* between *raw data*, and *indicators* of biodiversity change² (EXAMPLE EBV)

EBV Class: *Ecosystem Function* **EBV Candidate:** *NPP- Net Primary Production*³

Measurements of carbon fixation and flux are collected in many different ways, as determined by scope and context. This measurement heterogeneity creates challenges in estimating NPP

Many Chamber and remote-sensed datasets estimating NPP are publicly available, with rich metadata & values in units of "(Carbon) mass per area per time"

However, most measurements of NPP are not readily harmonized





Satellite image for estimating NPP from space

Margaret O'Brien^{1,2}, Mark Schildhauer², Steven S Chong², Robert J Miller¹

Disambiguating heterogeneous data through Controlled Vocabularies

- **Controlled Vocabularies**:
- Fall on a spectrum
- More complex structures yield more inferential power
- Should be community-vetted
- Each term referenced by a URI!



Ontologies Clarify Content of Primary Observations

Binding Data to Ontology Concepts With *semantic annotation*, datasets should reference communityaccepted measurements whenever possible. Applications can access the complete description of a term from an Ontology via its URI Metadata (EML): <attribute> <attributeName>pctcov</attributeName> <attributeLabel>percent cover</attributeLabel> <attributeDefinition>The percent ground cover on the field</attributeDefinition> <annotation: abel="contains measurements of type">ECSO:containsMeasurementsOfType</propertyURI> <propertyURI 1 bel="Plant Cover Percentage">http://purl.dataone.org/odo/ECSO_00001197</valueURI> <valueURI] </annotation </attribute> **Darwin Core Archive:** measurement URIs can populate the measurementID field, here using a defined measurement for volumetric abundance, describing EBV, "Population Abundance" easurementValue measurementUn http://purl.dataone.org/odo/ECSO_000012 5960 numberPerLiter http://purl.dataone.org/odo/ECSO_00001201 3040 numberPerLiter 2680 numberPerLiter http://purl.dataone.org/odo/ECSO_00001201 http://purl.dataone.org/odo/ECSO 00001201 4740 numberPerLiter <gmd:MD_Band> <qmd:sequenceIdentifi Metadata (ISO 19115): aco:MemberName <aco: aName: <gco:CharacterString>biomass</gco:CharacterString</pre> URIs would appear in code lists, referenced </gco:aName <gco:attributeType> [6 lines] </gco:MemberName> in the column descriptor. Ideally, URI's refer /gmd:sequenceIdentifier amd: descriptor> <gco:CharacterString>Biomass /amd:descriptor <gmd:units xlink:hr sofmeasure.ora/ucum.html#ka' </gmd:MD_Band> **Complementary work - Species Traits** Kissling et al³ (2018, Fig 2., right) suggest five EBVs within the class 'species traits' and define their measurements, temporal sensitivity and societal relevance. Traits selected for EBVs (e.g., body mass, plant height) Chemical or physical functions promoting organism fitness and allow quantification of species' response to global change at the population level. **EBV-relevant Traits** will be defined in ONTOLOGIES to make them clear and comparable Alchi: – SDG: 13, 15

URI reference to ontology term embedded in EML attribute metadata, indicating a measure of EBV "Population Abundance"



eventID	date	Taxon	taxonID	measurementOrFac
80116_1_5m	16-Jan-2008	Pseudo-nitzschia	ITIS:584561	cells_liter
80116_1_5m	16-Jan-2008	Leptocylindrus	ITIS:2394	cells_liter
80116_1_5m	16-Jan-2008	Thalassiosira	ITIS:2484	cells_liter
80116_1_5m	16-Jan-2008	Chaetoceros	ITIS:2758	cells_liter

to terms defined in OWL Ontologies

OWL Ontologies:

- Describe classes, instances, properties, and relationships
- Provide consistent machine- readable interpretations

References, Links and Datasets

1.	Perreira et al. 2013. d
2.	Kissling et al. 2018. do
3.	Kissling et al. 2018. do
4.	https://geobon.org/el
5.	ENVO: <u>http://environ</u>
6.	PATO: <u>http://www.ob</u>
7.	PCO: <u>http://www.obo</u>
8.	OBOE: https://github.
9.	Dataset doi: 10.6073/
10.	Dataset doi: 10.6073
11.	Dataset doi: 10.6073/
12.	Dataset doi: 10.6073/
13.	Dataset doi: 10.6073/
14.	Dataset doi: 10.6073/

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