Developing semantic interoperability in ecology and ecosystem studies

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17th Plenary

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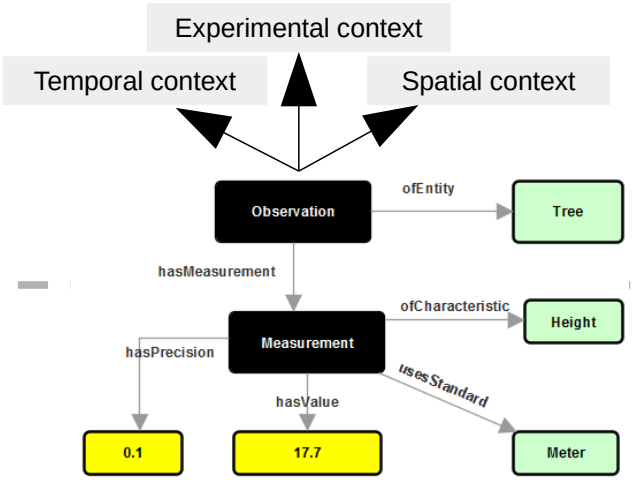
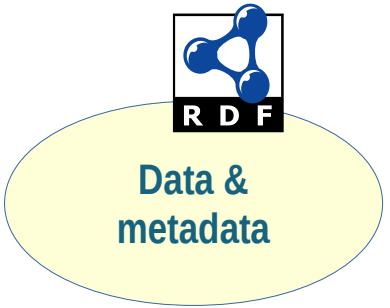
Obs. & exp. on ecosystems

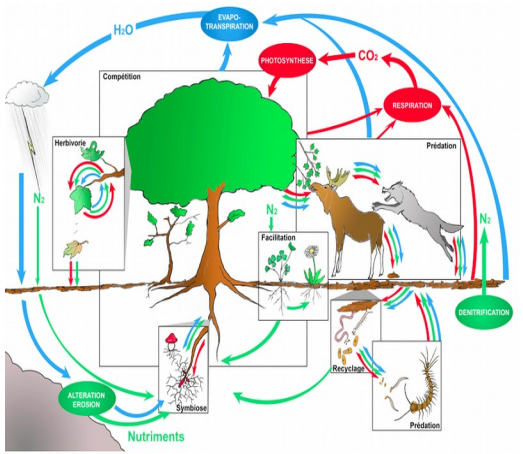


Graph data modeling



Semantic interoperability

Rationale

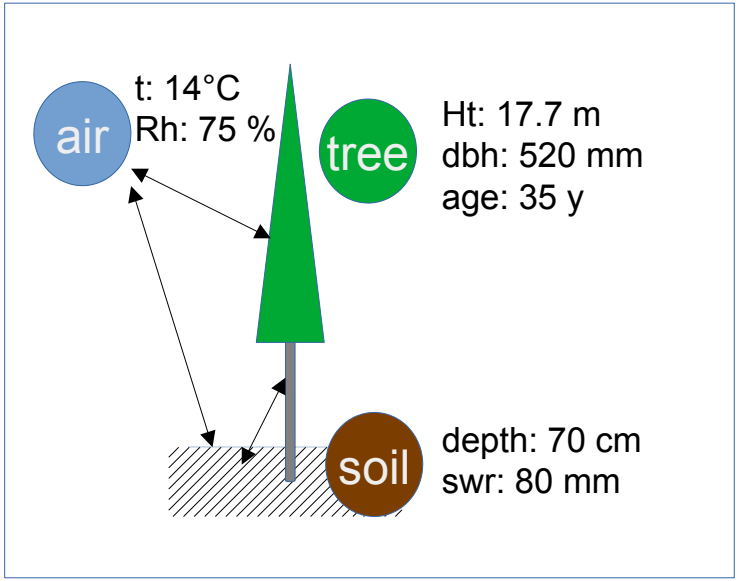


Ecosystem study requires complex research and deals with heterogeneous, varied and widespread data.

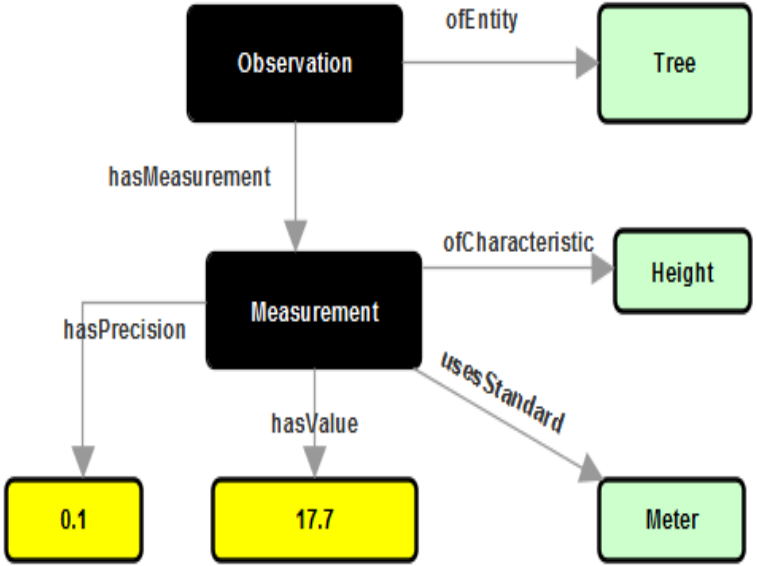
The proper understanding and interoperability of
the information sources remains one of the greatest challenges

Method

1) Identify
- the components of the system
- and their relationships



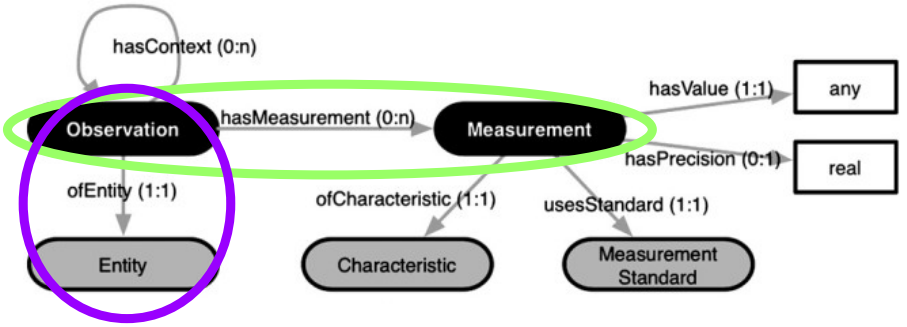
2) Model the system
using semantic vocabularies



Implementation

AnaEE* RI as scientific context:
The Research Infrastructure offers services for experimentation on continental ecosystems

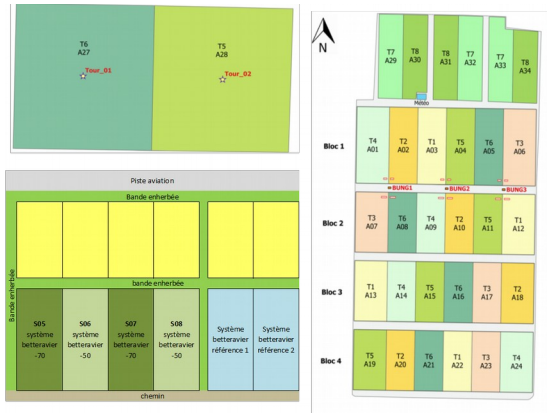
OBOE* as ontological framework:
The ontology provides the atomic elements for modeling observations

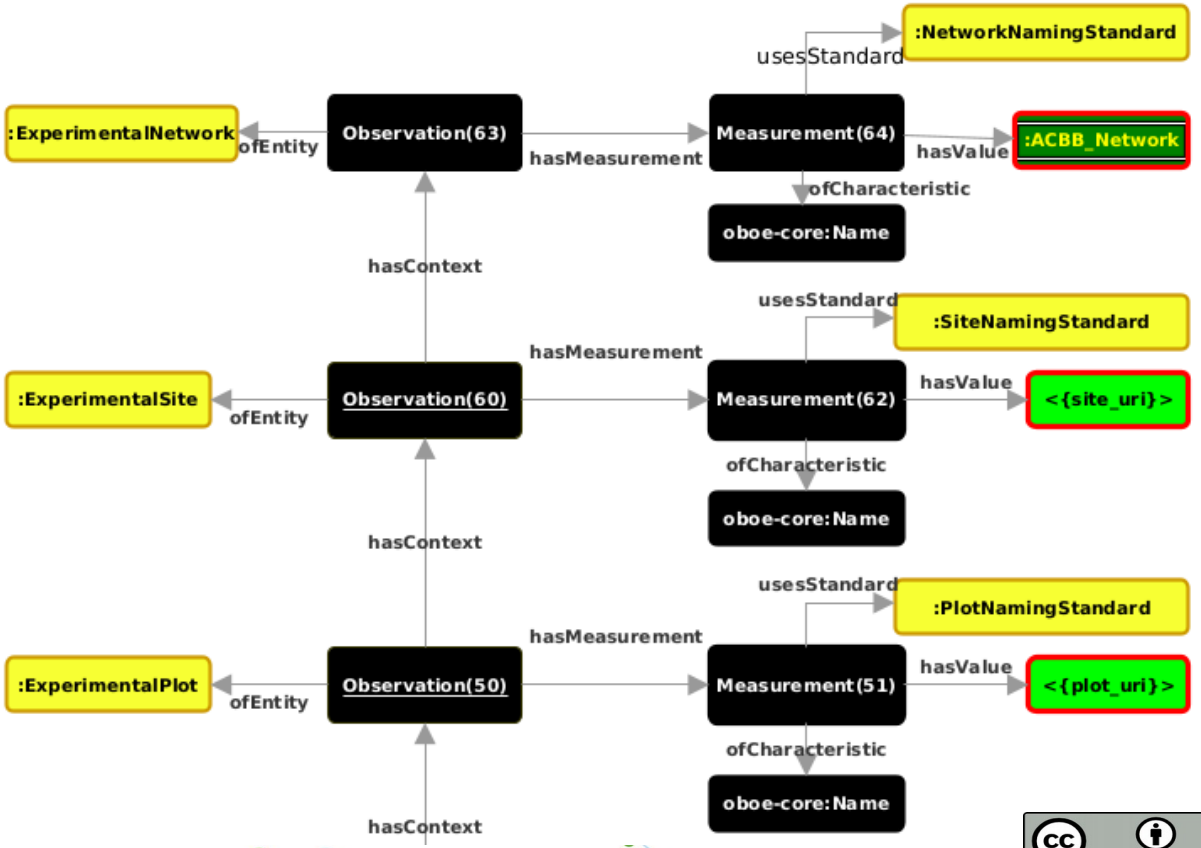


*Mark Schildhauer, Matthew B. Jones, Shawn Bowers, Joshua Madin, Sergeui Krivov, Deana Pennington, Ferdinando Villa, Benjamin Leinfelder, Christopher Jones, and Margaret O'Brien. 2016. OBOE: the Extensible Observation Ontology, version 1.2. KNB Data Repository. doi:10.5063/F1125R0F

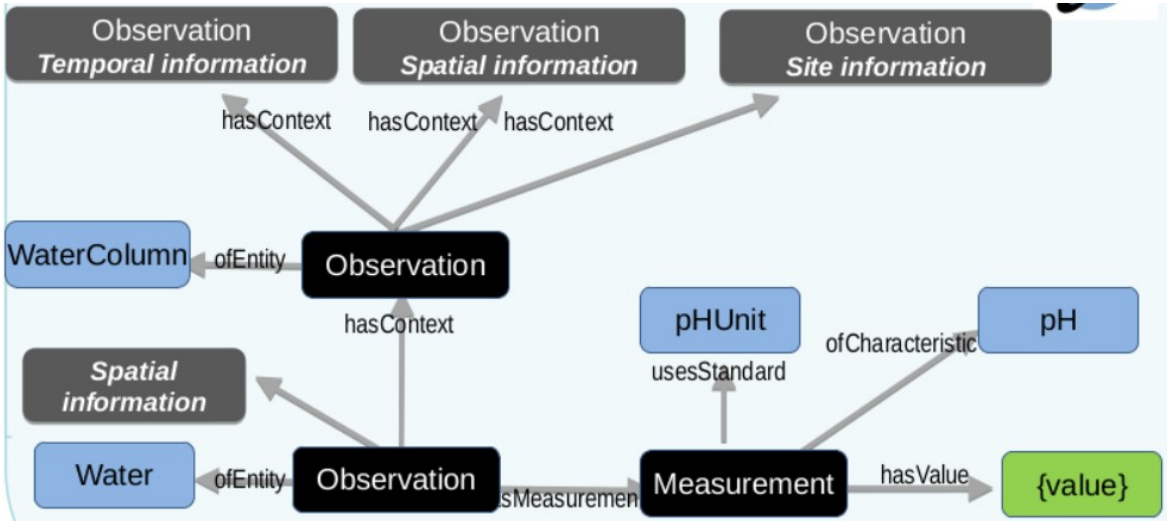
Implementation

Modeling the experimental context





Modeling the measured variables



Implementation

Graph pattern approach:

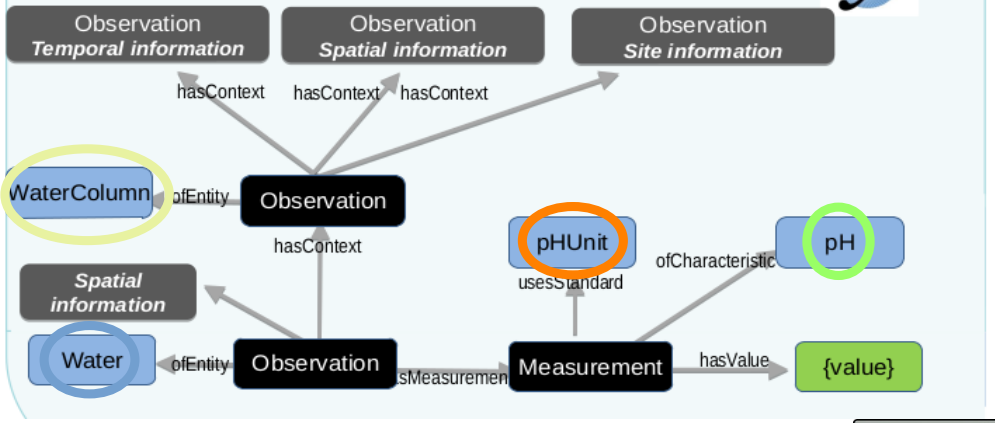
Design parametric graphs suitable for a set of variables

Variable semantic description

.csv

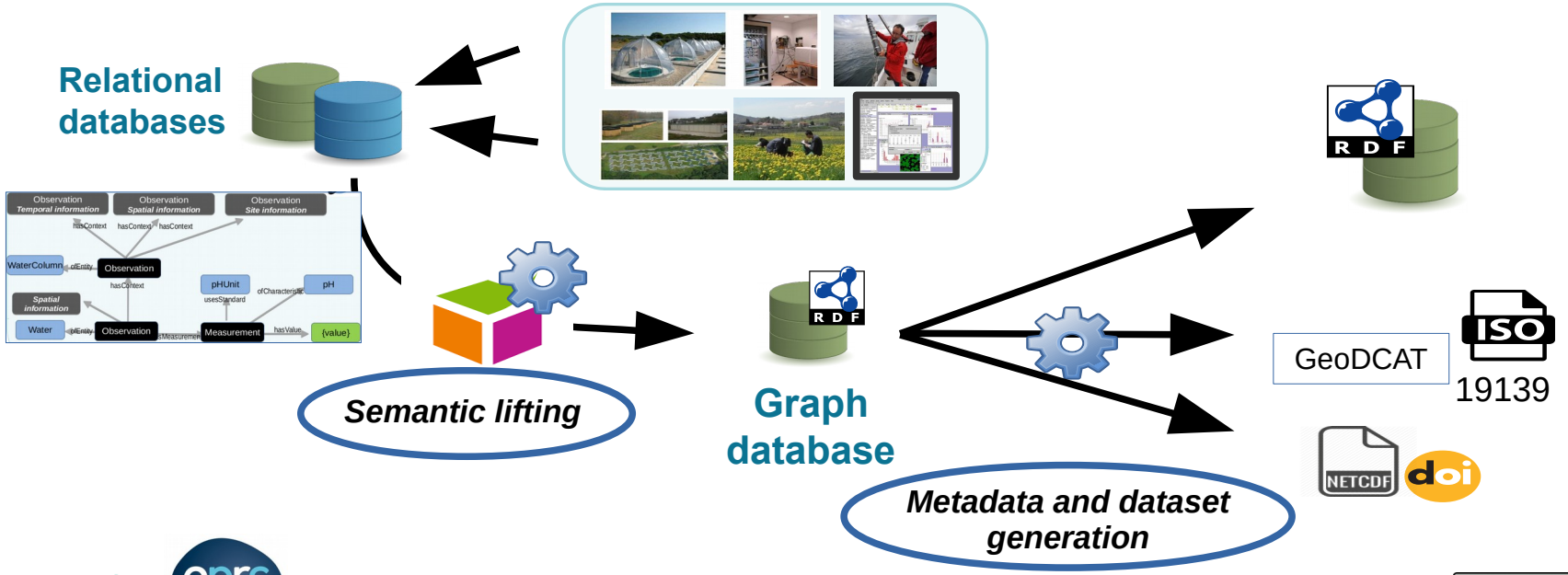
AnaEE standard	Category	Context	Entity	Characteristic	Unit
Phytoplankton	Biodiversity	Water	Phytoplankton	Volume Per Volume	MicroMeterCubed Per Millimeter
WaterPH	Physical Chemistry	Water Column	Water	pH	pHUnit
...	...	...	...	...	...

Semantic data graph (per category)



Semantic lifting and data exploitation

Graph patterns and variable semantic descriptions are processed by a pipeline for semantic lifting of the data before their exploitation



Lessons from this work

- The OBOE generic ‘observation model’ allows for efficient atomic modeling of the components of the system and of their nested or crossed relationships.
- In addition to the provided OBOE extensions (characteristics, spatial, temporal, standards), the unique identification of the system components is ensured through new classes and individuals especially for Entity (e.g experimental entities) and Standards (e.g lists of variable names or of experimental facilities).
- A graph pattern approach for the modeling of the variables leads to a more efficient investment at greatly reduced cost
- When data are initially managed in structure databases, the data modeling is directly exploitable by pipelines for mass lifting to rdf graphs
- The whole process produces syntactically and semantically interoperable data, contributing to FAIR sharing and data reuse