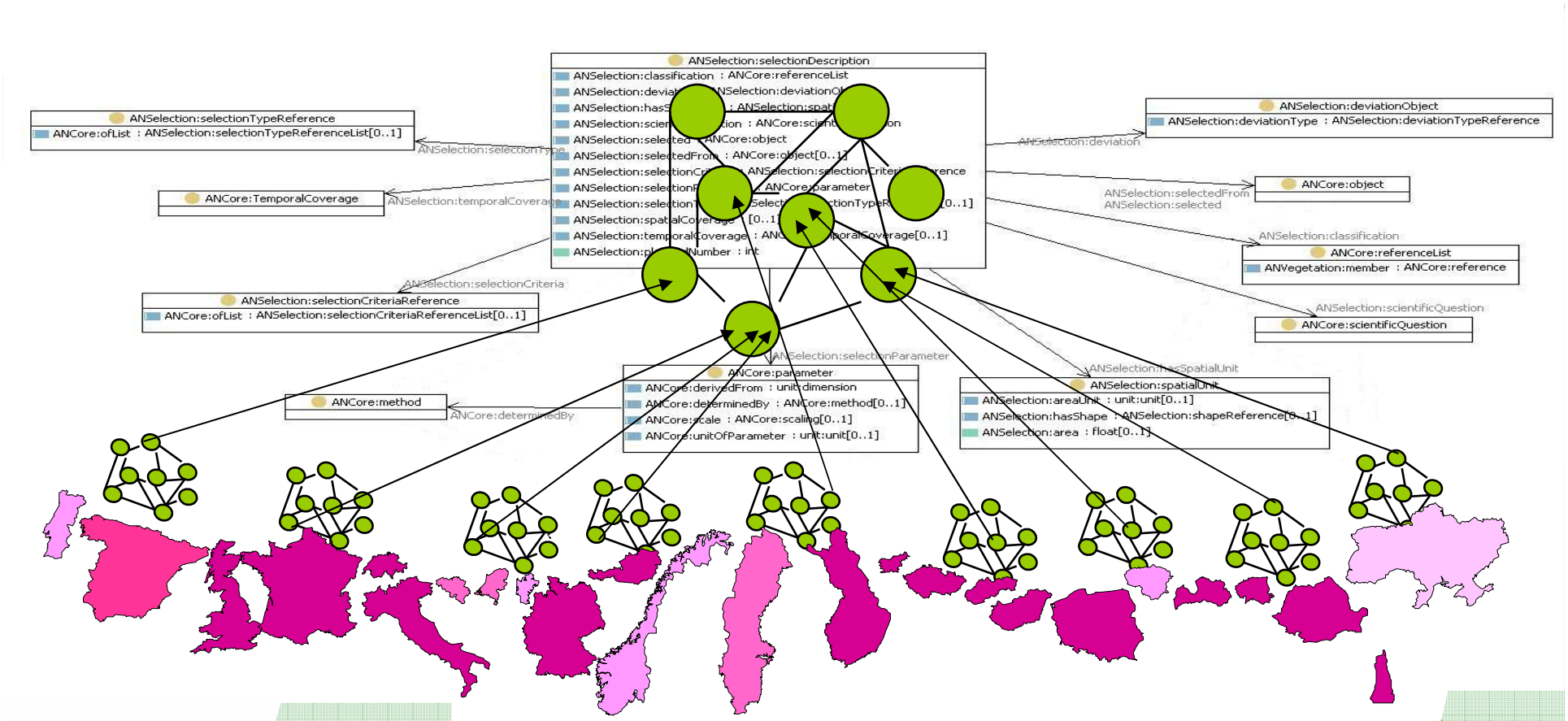
Ontologies – A core element for integrating and documenting environmental research and monitoring data



SEIS country visit, 20. April 2008

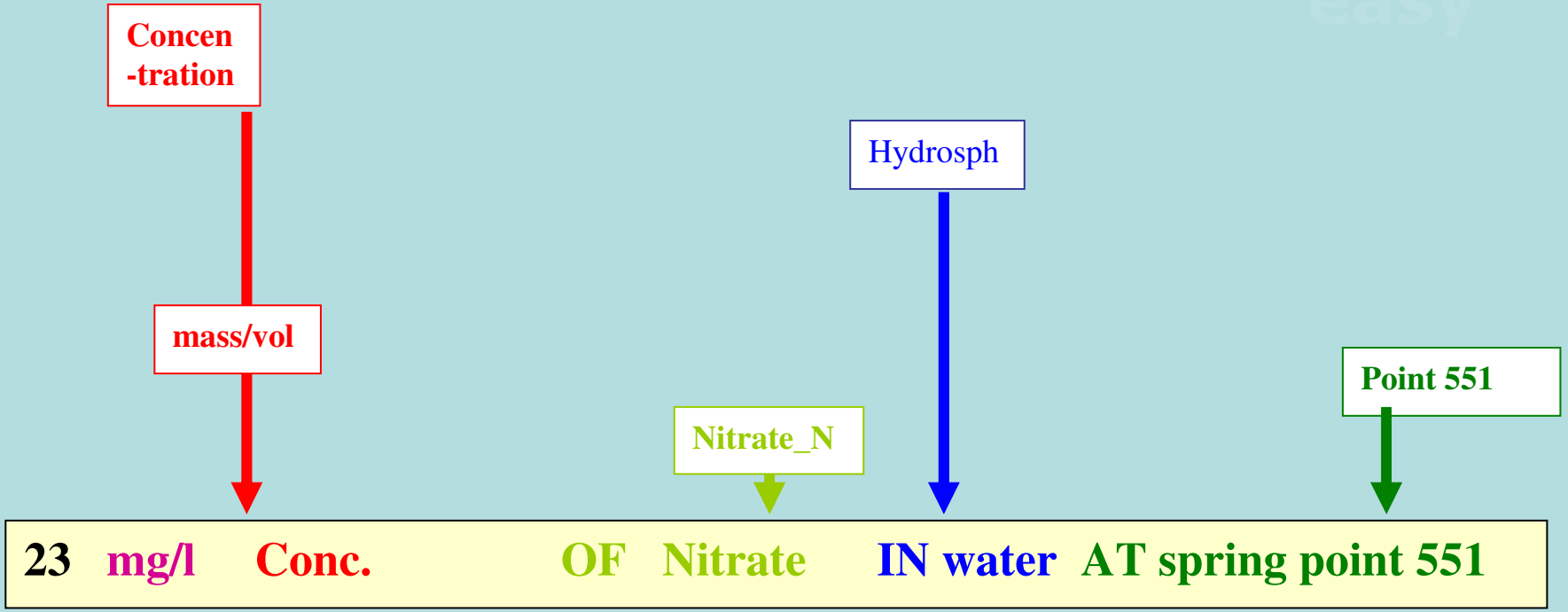
Michael Mirtl, Herbert Schentz, Joahnnes Peterseil, Kathi Schleidt, Barbara Magagna (UBA)

Concen
-tration

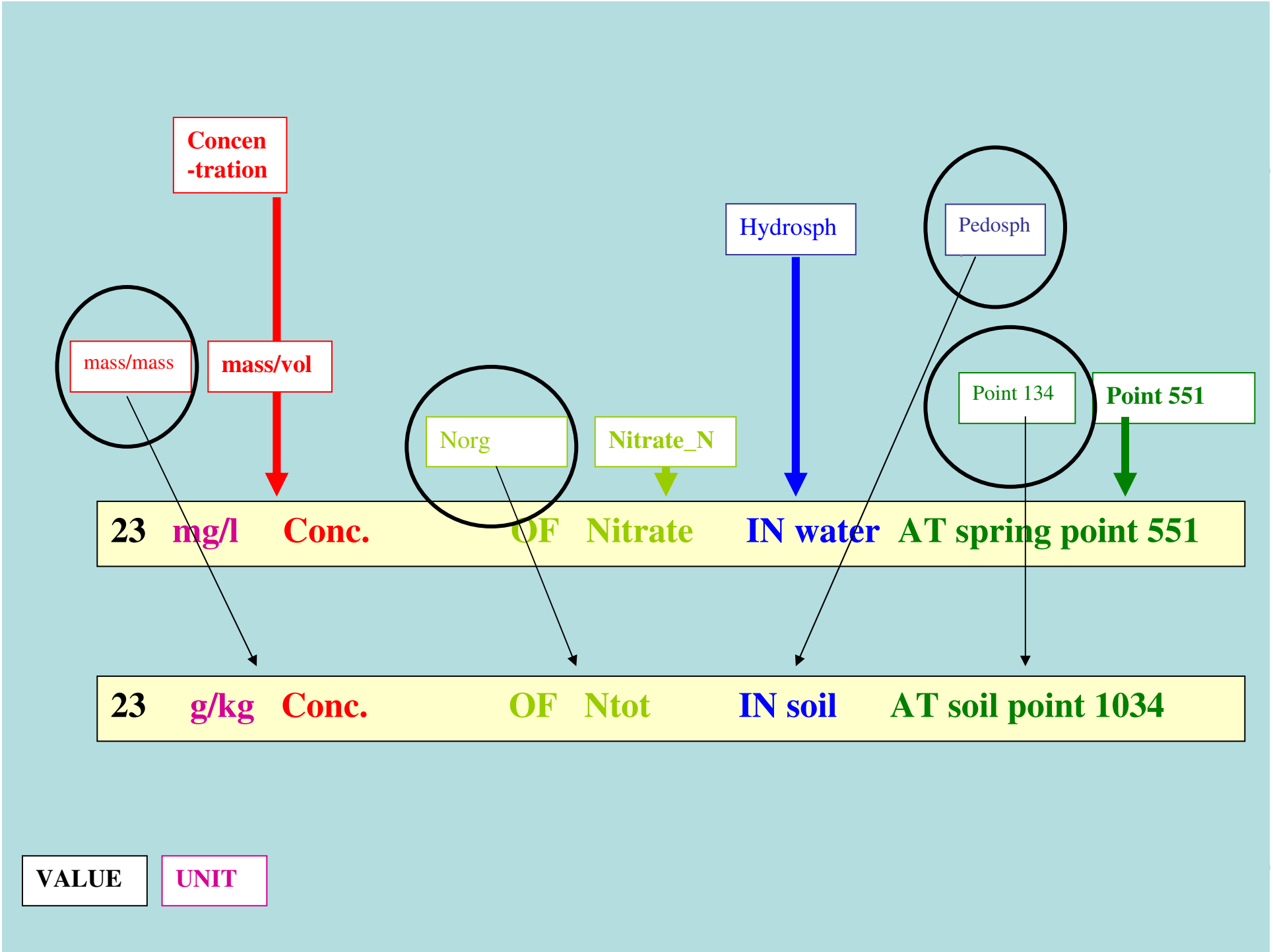
Hydrosph

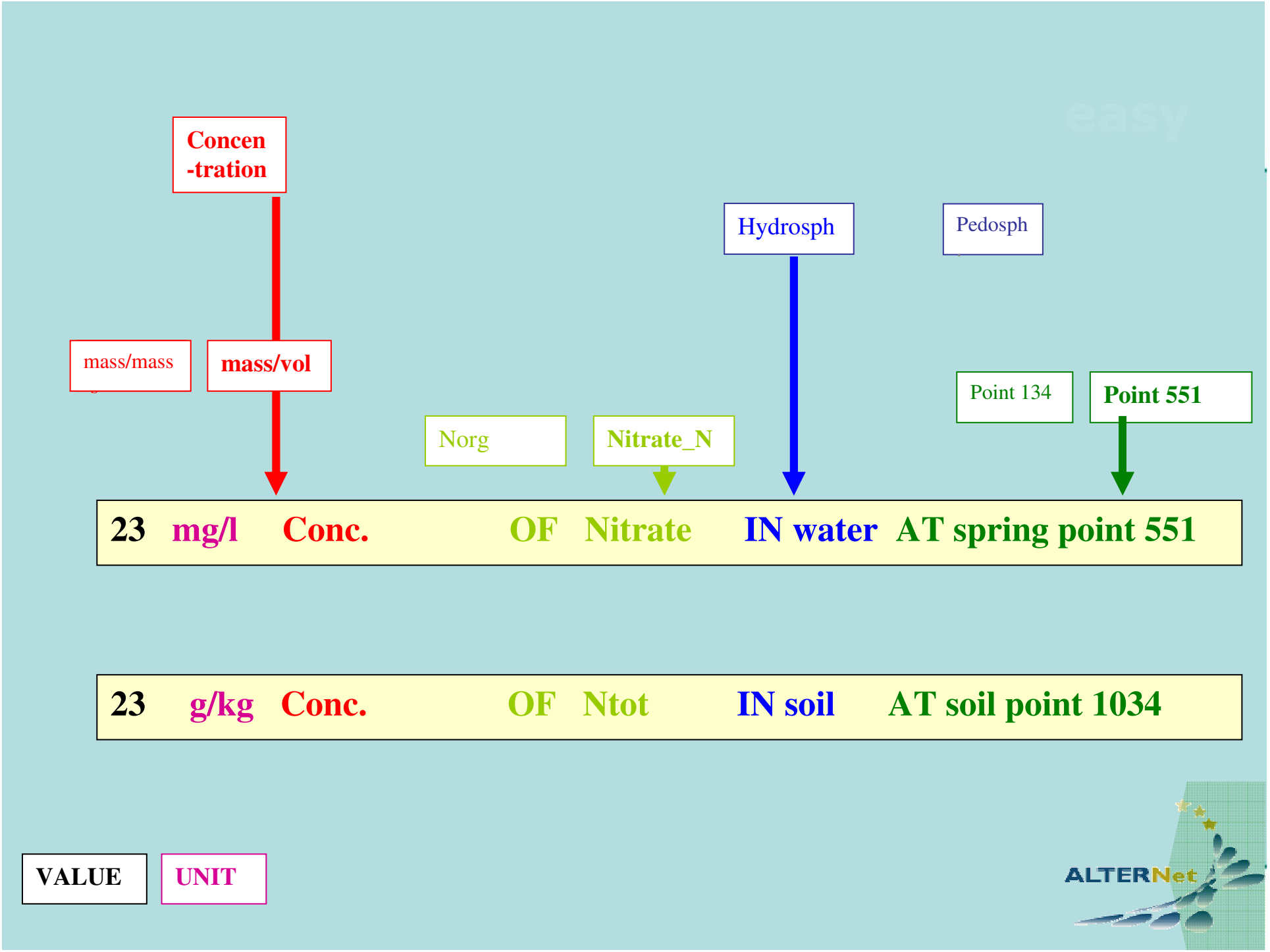
Point 551

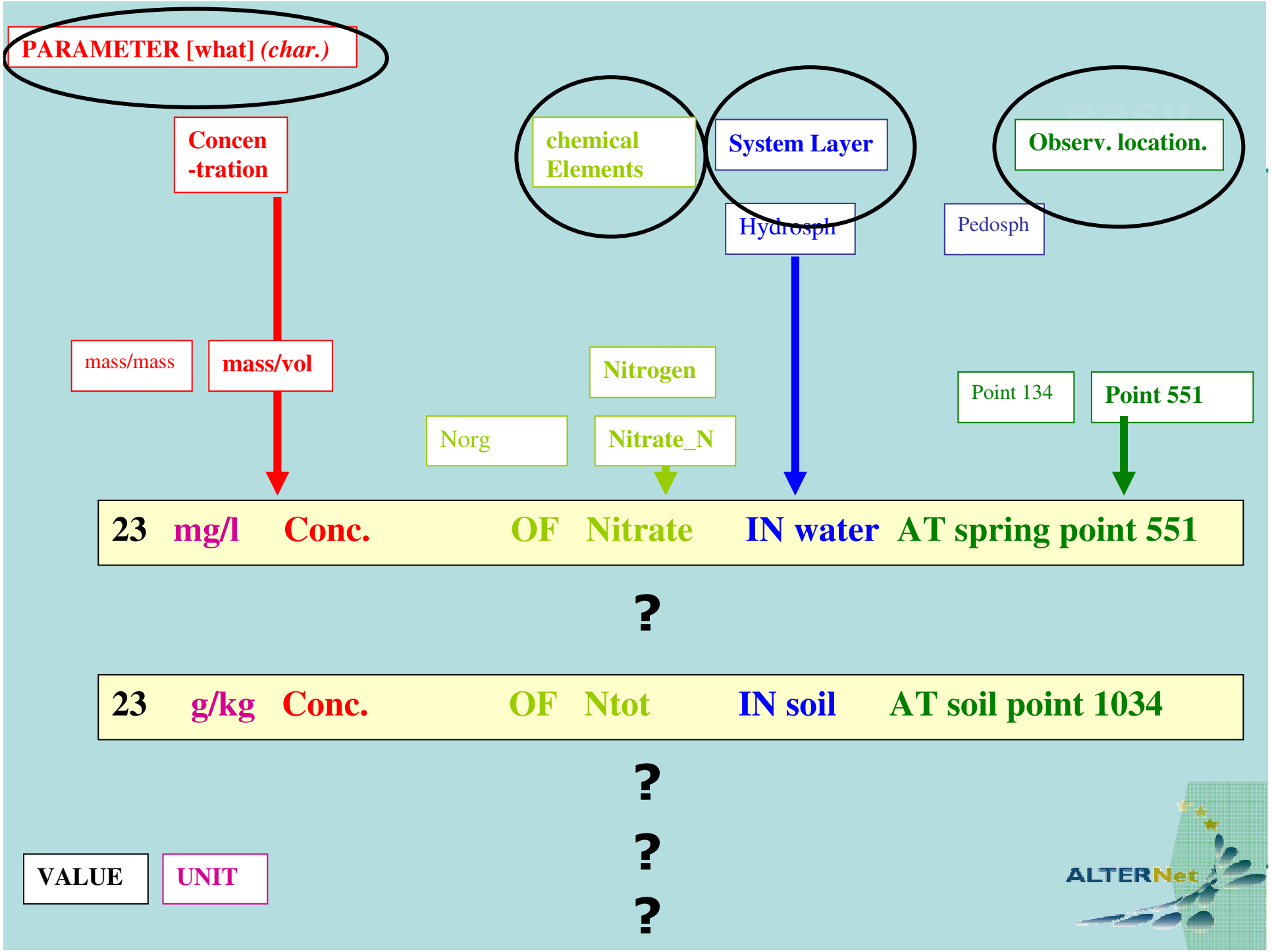
Nitrate_N

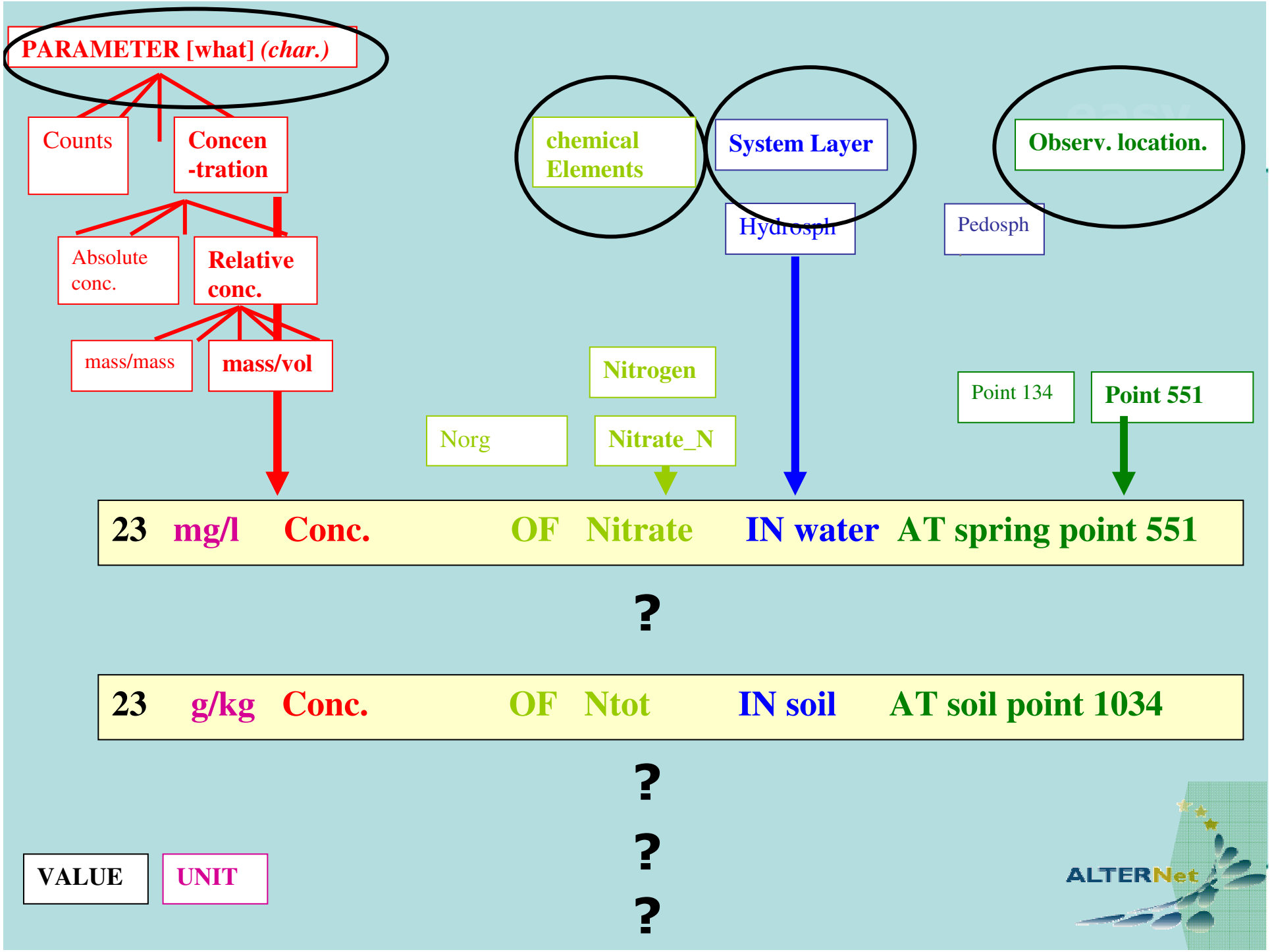

Concen
-tration
mass/vol
Hydrosph
Nitrate_N
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551

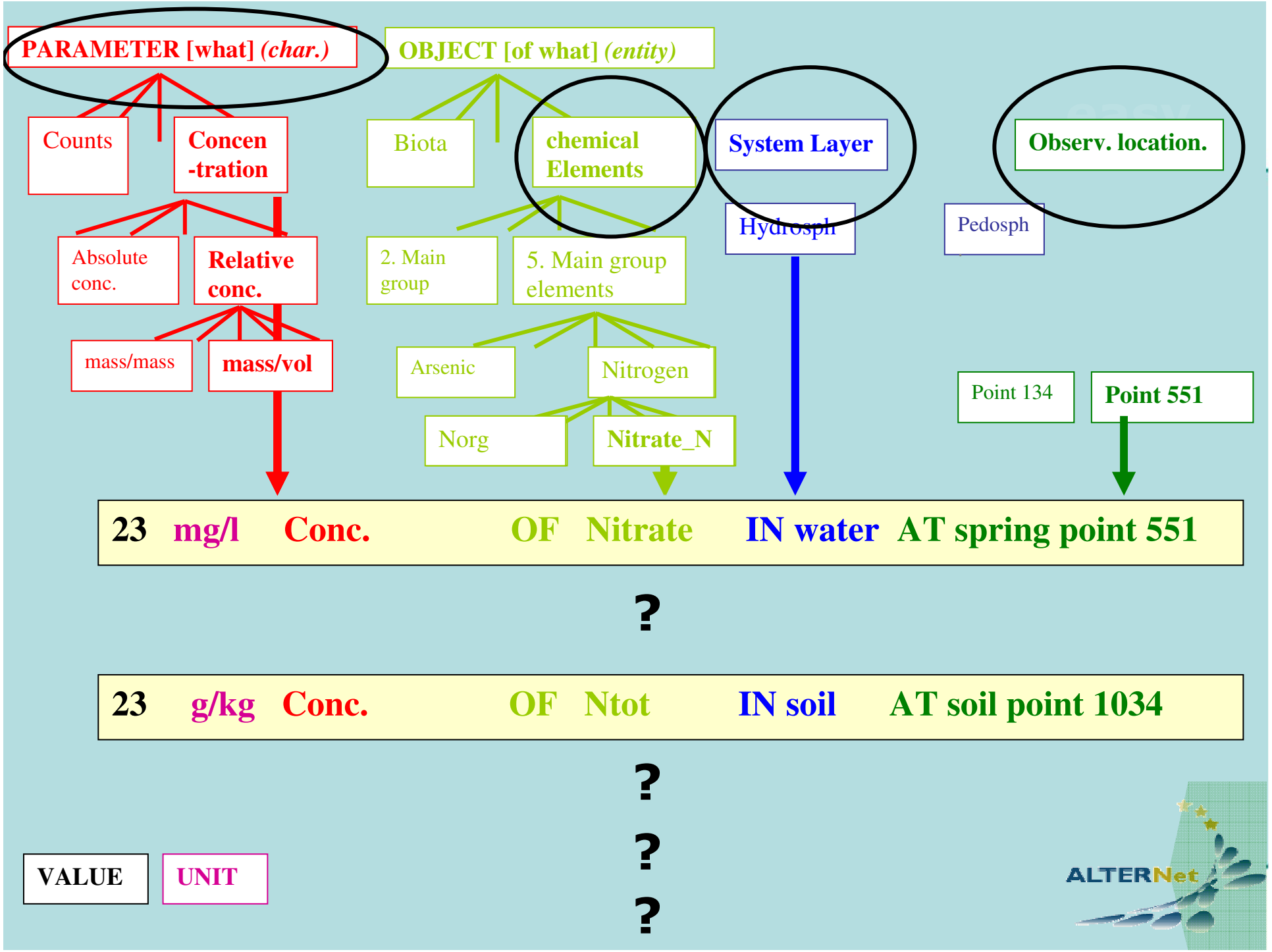
VALUE UNIT

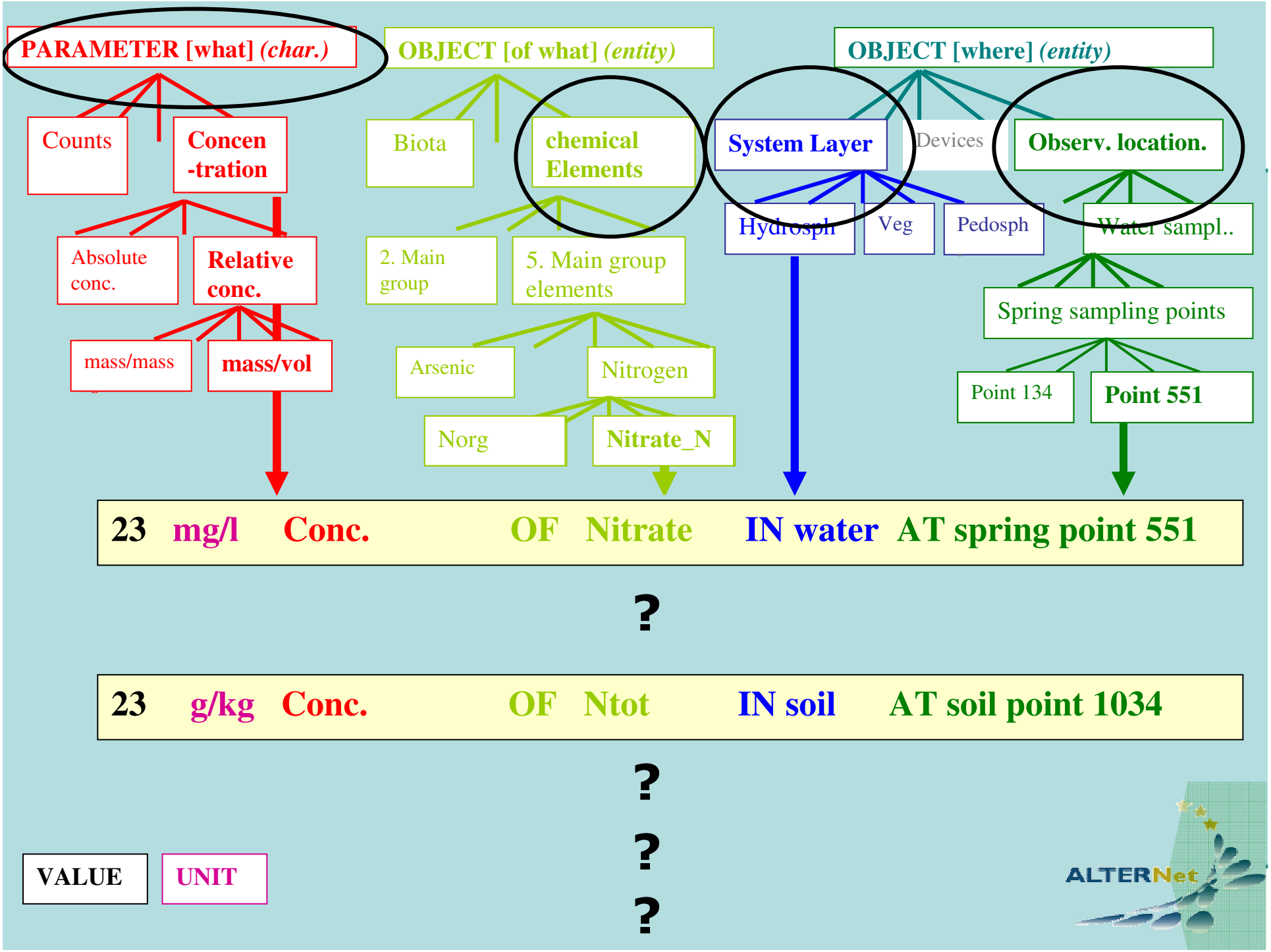

Concen
-tration
mass/mass
mass/vol
Norg
Nitrate_N
Hydrosph
Pedosph
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
VALUE
UNIT

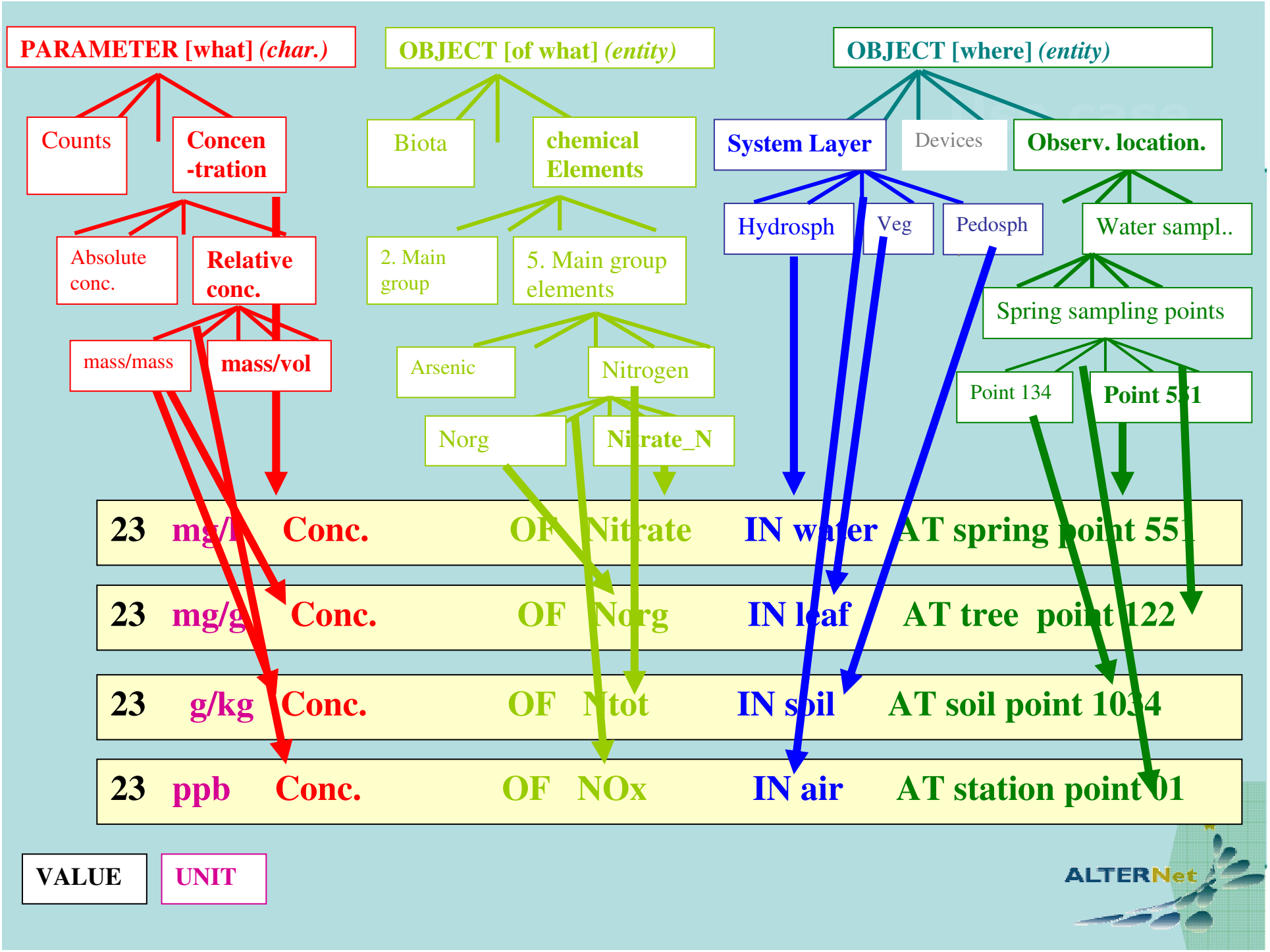

Concen
-tration
mass/mass
mass/vol
Hydrosph
Pedosph
Point 134
Point 551
Norg
Nitrate_N
23 mg/l Conc. OF Nitrate IN water AT spring point 551
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
VALUE
UNIT
ALTERNet

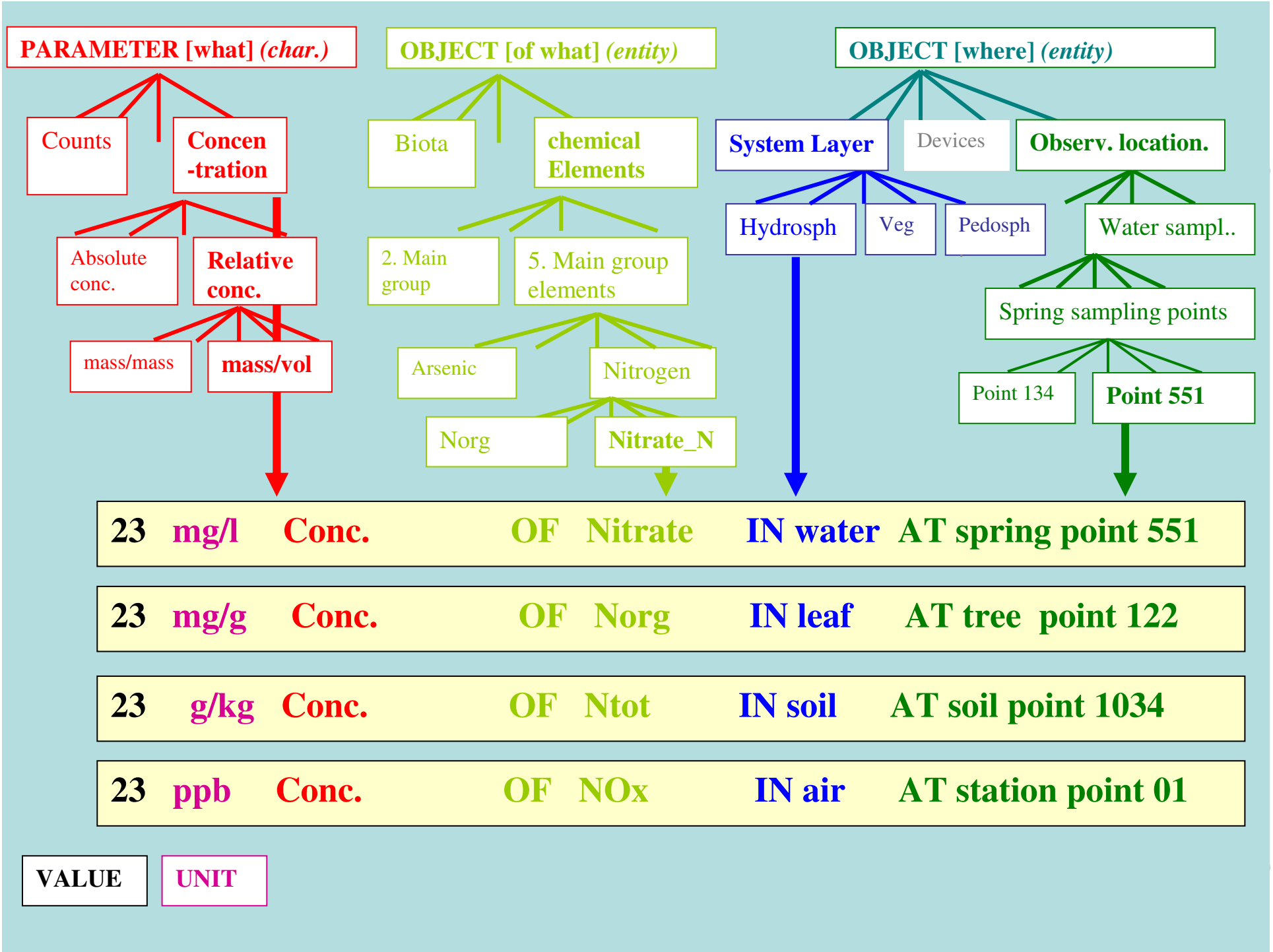

PARAMETER [what] (char.)
Concen -tration
chemical Elements
System Layer
Observ. location.
Hydrosph
Pedosph
mass/mass
mass/vol
Nitrogen
Norg
Nitrate_N
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
?
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
?
?
?
VALUE
UNIT
ALTERNet


PARAMETER [what] (char.)
Counts
Concen -tration
Absolute conc.
Relative conc.
mass/mass
mass/vol
chemical Elements
System Layer
Observ. location.
Hydrosph
Pedosph
Nitrogen
Norg
Nitrate_N
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
?
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
?
?
?
VALUE
UNIT
ALTERNet


PARAMETER [what] (char.)
OBJECT [of what] (entity)
Counts
Concen -tration
Biota
chemical Elements
System Layer
Observ. location.
Absolute conc.
Relative conc.
2. Main group
5. Main group elements
Hydrosph
Pedosph
mass/mass
mass/vol
Arsenic
Nitrogen
Norg
Nitrate_N
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
?
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
?
?
?
VALUE
UNIT
ALTERNet


PARAMETER [what] (char.)
OBJECT [of what] (entity)
OBJECT [where] (entity)
Counts
Concen -tration
Absolute conc.
Relative conc.
mass/mass
mass/vol
Biota
chemical Elements
2. Main group
5. Main group elements
Arsenic
Nitrogen
Norg
Nitrate_N
System Layer
Devices
Observ. location.
Hydrosph
Veg
Pedosph
Water sampl..
Spring sampling points
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
?
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
?
?
?
VALUE
UNIT
ALTERNet


PARAMETER [what] (char.)
OBJECT [of what] (entity)
OBJECT [where] (entity)
Counts
Concen -tration
Absolute conc.
Relative conc.
mass/mass
mass/vol
Biota
chemical Elements
2. Main group
5. Main group elements
Arsenic
Nitrogen
Norg
Nitrate_N
System Layer
Devices
Observ. location.
Hydrosph
Veg
Pedosph
Water sampl..
Spring sampling points
Point 134
Point 551
23 mg/l Conc. OF Nitrate IN water AT spring point 551
23 mg/g Conc. OF Norg IN leaf AT tree point 122
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
23 ppb Conc. OF NOx IN air AT station point 01
VALUE
UNIT
ALTERNet


PARAMETER [what] (char.)
Counts
Concen -tration
Absolute conc.
Relative conc.
mass/mass
mass/vol
OBJECT [of what] (entity)
Biota
chemical Elements
2. Main group
5. Main group elements
Arsenic
Nitrogen
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Nitrate_N
OBJECT [where] (entity)
System Layer
Devices
Observ. location.
Hydrosph
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Water sampl..
Spring sampling points
Point 134
Point 551
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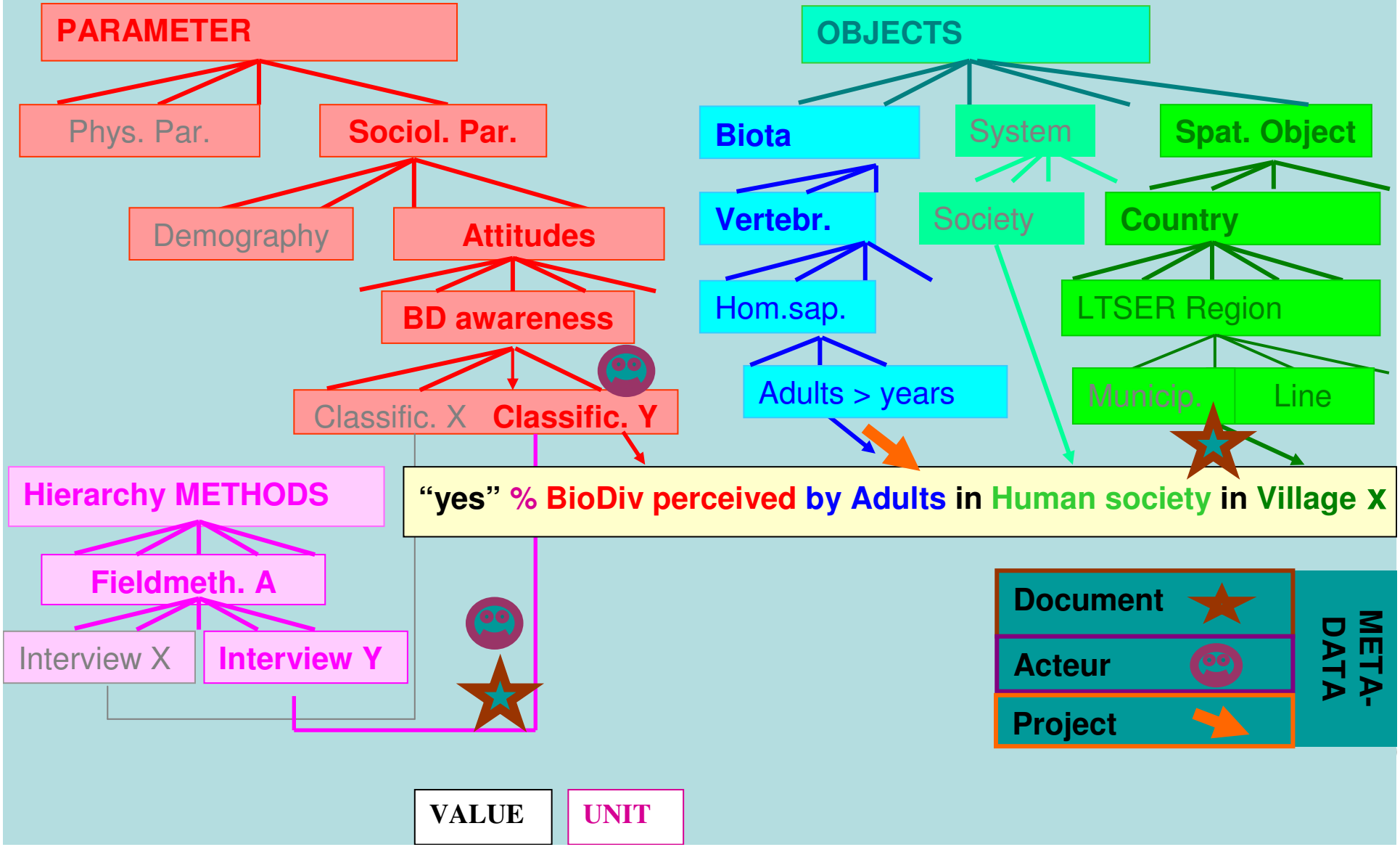
23 mg/g Conc. OF Norg IN leaf AT tree point 122
23 g/kg Conc. OF Ntot IN soil AT soil point 1034
23 ppb Conc. OF NOx IN air AT station point 01
VALUE
UNIT

Testing extensibility
e.g. towards socio-ecological data



Observation

An observation is gaining information on the…

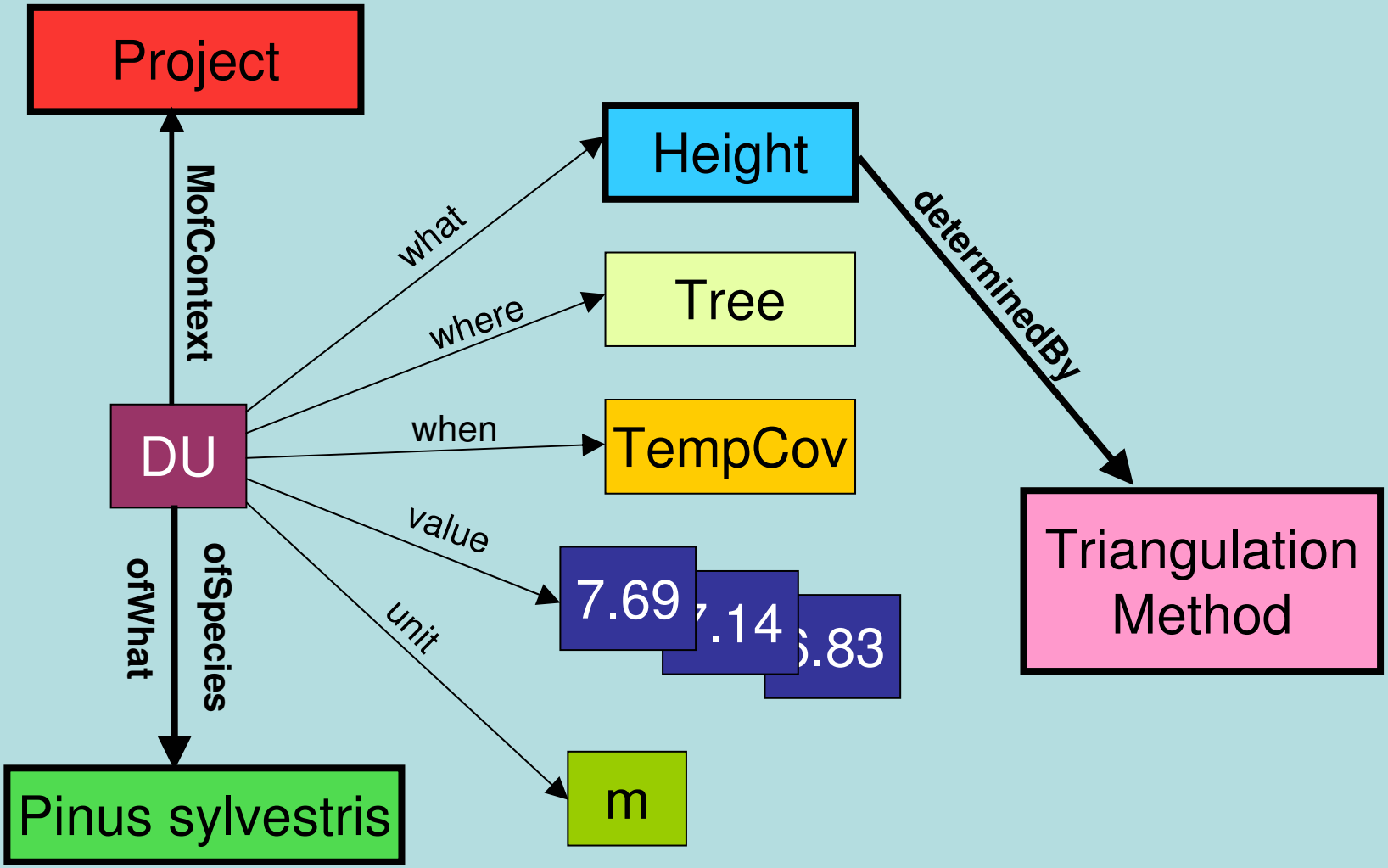
- STATUS OF a PROPERTY
- OF a MEDIUM(object)
- AT a certain LOCATION (object)
- AT given TIME(s)
- Observed by someone/-what by use of a specific METHOD
- Reported by use of and refering to related STANDARDS (unit, reference list)

In addition:

- Method provides certain quality of information (accuracy, applicability constraints = primary metainformation)
- Status observed by an observer acting in the context of a project, pulling individual measurements together
- Observation specified by other secondary metadata

ALTERNet

LTER DataUnit – Classes and Relations



Aims of the LTER Ontology

The overall aim is **sharing data for data analysis**

- Provide a **description of the meaning and the structure** of ecological and socio-ecological data
- Provide **essential information to properly combine** data from different data sources
- **Merge** data (various datasources) and metadata
- Be **understandable** by ecologists
- Be **usable** for IT-people for the development of a query engine and a webbased data management
- Be **acceptable** by the ontology community
- **adhere to W3C standards** (and possibly achieve itself the status of a standard or at least provide input for a W3C standard for ecological observations)

Experiences

- **Consistent system** to map and store ecosystem monitoring&research data (catchment level, all system compartments)
- Implementation of a **REAL** „ontology"-based **tool** (MORIS 1.x)
- Data **management** (transformation, storage, retrieval by use of ontology like structures)
- Development of the **ontology** for the European ecosystem research network (LTER-Europe core&domains)
- Work towards a **globally accepted core** ontology for environmental research (with TDWG, US NSF/NCEAS...)

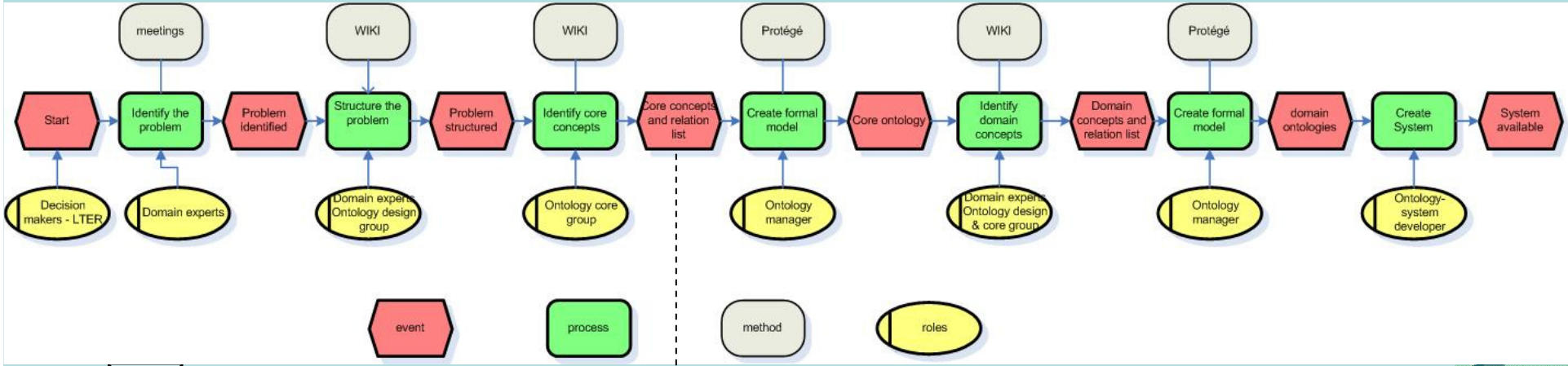
Ontology building process: COMPLEX, ITERATIVE, LONG-LASTING, but worthwhile…

Collaborative process consisting of **four** **main steps** using **tools**:

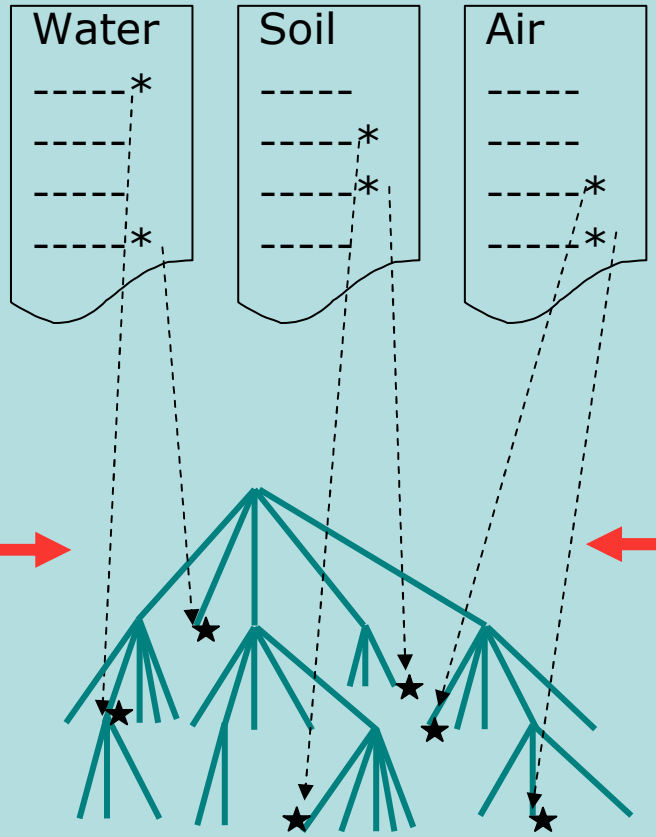
1) Identify the scope and user scenarios
2) Structure the information space (loose concepts) → WIKI
3) Conceptual model (derivation hierarchy, relation structure) → WIKI
4) Formal model (restrictions and rules) → PROTEGE

Contributions of actors with specific **roles**:

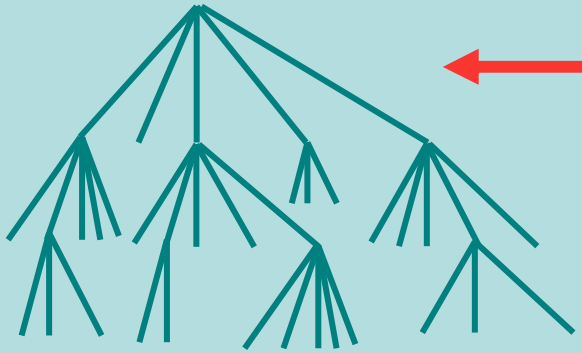
- The knowledge provider and user – the domain expert
- The ontology design group
- The ontology core group
- The ontology-system developer
- The ontology manager
- The project manager

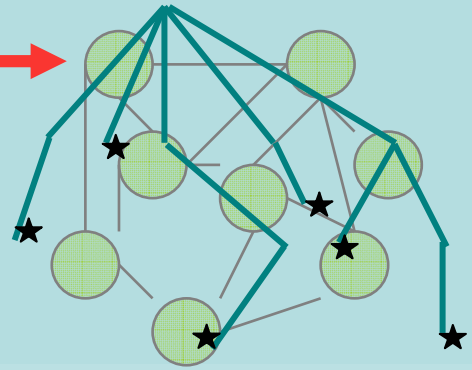


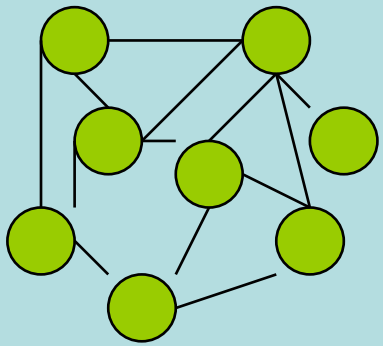
Potential synergies

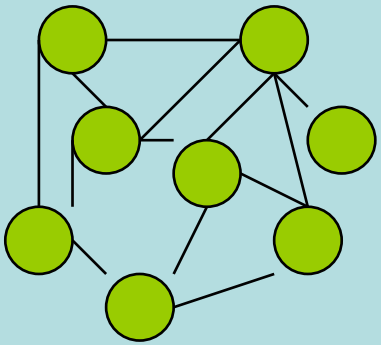


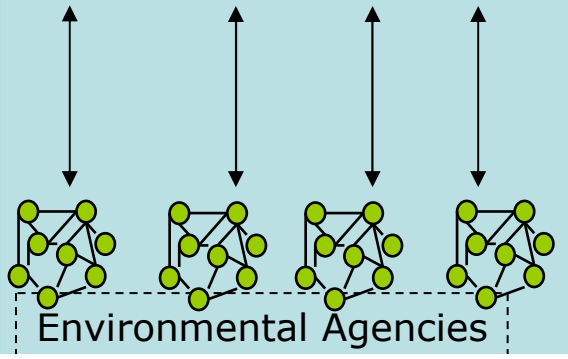
EEA Ontology











Outlook

- Development of the ontology for the Austrian Environmental Agency across all domains (test case?)
- Feasability study: „Applicability of ontological approaches for environmental data integration and reporting“ (including in parallel development of ontology-based IS for conctep proving and practical work)

Discussion & Conclusions

- AT should make work on ontologies part of the national SEIS
- Feasability study should be set up as an international project: matter of acceptance on both the respective national levels and internationally
- Expert workshop EEA-LTEReurope should form the frame for further developing co-operations (Jock $$$, Ronan $$$...)