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in Ecosystem Research

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This document describes the community ExpeER metadata profile within the scope of the ExpeER and EnvEurope projects based on EML (Ecological Metadata Language) specification. A detailed description of metadata crosswalk between EML specification and ISO19115 standard is included together with metadata examples, transformation file and validation report in the appended EnvEurope metadata specification.

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Glossary

EC	European Commission
EU	European Union
EML	Ecological Metadata Language
INSPIRE	Infrastructure for Spatial Information in Europe
HTML	Hypertext Markup Language
ISO	International Organization for Standardization
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSLT	Extensible Stylesheet Language Transformations

1 Executive summary

This document describes the community ExpeER metadata profile within the scope of the ExpeER and EnvEurope projects based on EML (Ecological Metadata Language) specification. A detailed description of metadata crosswalk between EML specification and ISO19115 standard is included together with metadata examples, transformation file and validation report in the appended EnvEurope metadata specification.

2 Introduction

Providing sufficient metadata is one of the crucial aspects in sharing and exchanging data in a scientific network. Information on the background of the observation or experiment and the content of the data files can be summarized in a metadata description and stored and searched in an online catalog. The metadata description also describes how that data file can be accessed. This allows for a centralized metadata catalog with decentralized data storage. Alternatively a data provider can attach a metadata document with the data file. Following existing standards for metadata structure is crucial to ensure not only human readability but also machine readability (e.g. workflow engines).

Within the ENVEurope project a similar evaluation of existing standards and the development of the community profile based on EML was already done for the domain of ecological long term monitoring sites. This document is appended. As there is close match in the characteristics of the sites and the related data especially in relation to the monitoring sites within ExpeER, this metadata specification was taken as the starting point. Because the ENVEurope project envisions a common data model, its metadata specification does not include a e.g. data table description as part of its requirements. As an infrastructure project, combining experimental sites and observational sites, researchers in the ExpeER community are likely to exchange data that varies significantly in data models. Therefore additional metadata is needed to make data sharing in the ExpeER community possible.

Within the ExpeER project the following steps were carried out in order to provide a metadata specification for long term monitoring as well a experimental sites:

- a) to evaluate existing standards relevant for both experimental as well as monitoring data
- b) to define a metadata specification which fulfill the requirements of the ExpeER project.

The resulting document provides the metadata specification proposed for the ExpeER projects for data set level description. It corresponds to the ExpeER Task T3.1. The detailed metadata specification is provided as an annex to the report. It is based on the EnvEurope metadata specification extended by the requirements of the ExpeER project.

In addition, this metadata specification aims to ensure feasible interoperability also with other levels of LTER network and with GeoPortal and other EU data networks. The US LTER (United States Long Term Ecological Research) network adopted EML as its metadata standard in 2003. The International LTER officially adopted EML in 2008. Therefore an EML (Ecological Metadata Language) specification has been defined as a reference metadata standard for the ExpeER metadata profile. It is intended that EML compliant ExpeER metadata documents in will be exported into the LTER-Europe Metacat. The LTER-Europe Metacat server will be a DataOne node when DataOne becomes operational during the second half of 2012 <<https://www.dataone.org/>>. As of 15 January 2012 there were over 25,000 EML documents in the KNB data network <http://knb.ecoinformatics.org/> (precursor of DataOne) of

which over 7,000 are from the US-LTER. In addition to the DataOne network, ExpeER documents will be made available on the INSPIRE GeoPortal.

This metadata specification will also fulfill the requirement to provide metadata from the ExpeER domain to the European Spatial Data Infrastructure as defined by INSPIRE directive framework on the data themes to support policy makers decisions within the ecological domain. To fulfill this goal a metadata crosswalk between the ExpeER metadata (EML) and INSPIRE metadata defined by Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata (based on EN ISO 19115:2005 Geographic information – Metadata) has been developed. More details about this part are described in the chapter 6 of the appended EnvEurope metadata standard..

The general objective of this metadata specification is to provide list of elements defined as important for data exchange in the ExpeER community. By data exchange we mean data discovery, evaluation and use. This specification including the attached EnvEurope report intends to cover all three levels of metadata (discovery, evaluation, synthesis).

This document is a technical specification, not a user guide. In addition, this document is not, a specification for a user interface or software tool.

3 Method

3.1 Requirements from ExpeER

The 33 ExpeER facilities include Highly Instrumented Observational Sites (HIOS), Highly Instrumented Experimental Sites (HIES), 2 Analytical platforms and 2 Ecotrons. However the specification intends to provide standards and guidelines based on the experience gained within a group of representative beneficiaries from HIOS, HIES and Ecotrons. The metadata standard has been defined as a result of user requirements exercises performed within the target stakeholder groups (a subset of ExpeER facilities). The user requirements for content were then compared with the INSPIRE and Ecological Metadata Language (EML) specifications.

3.2 Site Metadata versus Dataset Metadata

Dataset document is distinct from site documentation; however, there is overlap between the concepts. In the ecosystem research community, is increasingly documenting the datasets using international standards. The standard that we are describing in this document is different from the information requested by work package 1. The focus of WP1 is on site documentation. The WP1 questionnaire asks for information about sites, including the kinds of research that is done. This document addresses standards for documenting actual data. One site is likely to produce multiple datasets, and a single dataset may involve more than site. A meta-analysis is an example of a dataset that is likely to include more than one site's information.

3.3 Geographic location

One of the main questions is whether standards developed by the ecosystem research community are applicable to the agricultural research community. Discussions with agricultural researchers made it clear that while the content or the purpose of the research may be different, the structure of the data is sufficiently similar that the same metadata standards can be applied to both kinds of research. Even with ecotrons, the structure of the data is similar. The interpretation of ecotron metadata requires judgment. For example, the location of an ecotron may have little relation to the

environment that it is simulating. However, it is possible that the location of an ecotron may have an effect of the result. Someone may want to compare the results of an ecotron at high altitude with one at low altitude that are attempting to simulate the same environment. If someone is searching a metadata catalog geographically, inappropriate ecotron metadata documents may be returned. The researcher would then ignore that dataset.

The Analytical Platforms can be seen as a different kind of participant. It is unlikely that the analytical platforms would produce datasets of their own, but the results of their analysis would be described in the methodology section of a research project. Even if a laboratory produced its own data, the data could be described using the standard metadata framework.

3.4 Data table

Because the EnvEurope project envisions a common data model, its metadata specification does not include a e.g. data table description as part of its requirements. As an infrastructure project, combining experimental sites and observational sites, researchers in the ExpeER community are likely to exchange data that varies significantly in data models. Therefore it is recommended that data table documentation be included in the ExpeER standard.

3.5 Normative references

The following normative documents provide the context and basis for the development and application of this document:

COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

EN ISO 19115:2005 - Geographic information - Metadata (ISO 19115:2003)

EN ISO 19115:2005/AC:2008 - Geographic information - Metadata (ISO 19115:2003/Cor 1:2006)

CEN ISO/TS 19139:LTER-EUROPE2009 - Geographic information - Metadata - XML schema implementation (ISO/TS 19139:2007)

Ecological Metadata Language (EML) Specification: <http://knb.ecoinformatics.org/eml/>

3.6 Terms and definitions

For the purposes of this metadata specification the following definitions and terms apply.

1. Dataset

Collection of data: A dataset is a collection of single parameters stored in a specific site. The dataset is not time dependent; each dataset can cover different time period with different frequency.

ALTERNATE DEFINITION

A dataset represents one or more data tables (text file, spreadsheet), GIS layers or database views, which the metadata describes. A dataset represents the file or files that will be provided to a person requesting the data. For example, if an Excel spreadsheet is being provided, then the spreadsheet can be considered to be a dataset. If the spreadsheet has three worksheets, then it is a dataset with three data tables. If the site stores its data in a relational database, then the data to be shared would be an exported view (query). The ENVEurope/ExpeER metadata standard does not require documenting the data table. For ENVEurope, a common data model is planned. The data table of the common model can be documented once and appended by the metadata entry tool to the higher-

level metadata document. For legacy data, documenting at the data table level is encouraged, but not required.

2. EML or Ecological Metadata Language

Metadata specification development for ecology discipline and ecological dataset (Michener et al., 1997): EML is implemented as a series of XML document types that can be used in a modular and extensible manner to document ecological data. Each EML module is designed to describe one logical part of the total metadata that should be included with any ecological dataset (<http://knb.ecoinformatics.org>).

3. EPSG

Numeric codes, published by the OGP Surveying and Positioning Committee and created by European Petroleum Survey Group, to identify the geodetic reference systems adopted in different national realities.

4. EUNIS

The European Nature Information System developed and managed by the European Topic Centre on Biological Diversity (ETC/BD in Paris) for the European Environment Agency (EEA) and the European Environmental Information Observation Network (Eionet). EUNIS data are collected and maintained by the European Topic Centre on Biological Diversity for the European Environment Agency and the European Environmental Information Observation Network to be used for environmental reporting and for assistance to the NATURA2000 process (EU Birds and Habitats Directives) and coordinated to the related EMERALD Network of the Bern Convention.

5. GEMET or General Multilingual Environmental Thesaurus

Indexing, retrieval and control tool for the European Topic Centre on Catalogue of Data Sources (ETC/CDS) and the European Environment Agency (EEA). The basic idea for the development of GEMET was to use the best of the presently available excellent multilingual thesauri, in order to save time, energy and funds. GEMET was conceived as a “general” thesaurus, aimed to define a common general language, a core of general terminology for the environment. Specific thesauri and descriptor systems (e.g. on Nature Conservation, on Wastes, on Energy, etc.) have been excluded from the first step of development of the thesaurus and have been taken into account only for their structure and upper level terminology.

6. INSPIRE

An European Community Directive entered into force on May 15, 2007. This Directive lays down a general framework for creating a Spatial Data Infrastructure (SDI) for the purposes of European Community environmental policies and policies or activities which may have an impact on the environment.

7. INSPIRE theme

The INSPIRE Directive addresses 34 spatial data themes needed for environmental applications. These themes are subdivided in the three annexes of the directive (see <http://inspire.jrc.ec.europa.eu> for a list of themes).

8. LTER-Europe Community

Community composed by all Long Term Ecological Research sites. It focuses on different types of ecosystems: marine, lacustrine (lake), river and terrestrial. The mission of the Long Term community is: to track and understand the effects of global, regional and local changes on socio-ecological systems and their feedbacks to environment and society; to provide recommendations and support for solving current and future environmental problems (<http://www.lter-europe.net/>).

9. Metadata

Information about a dataset including, but not limited to, the people/organizations involved in creating the data, methods used, keywords, how to retrieve the data, data use policies, geographic, temporal, and taxonomic coverage. This information is used to discover, evaluate, and retrieve a dataset.

10. NaturaSDI+

European Project which aims at establishing a Best Practice Network dealing with a cluster of the data themes listed in the Annexes I and III of the INSPIRE Directive and focused on the nature conservation issues.

11. Thesaurus

List words grouped together according to similarity of meaning (synonyms). In addition to a list of semantically similar terms in one language, e.g. "arid", "dry", "desert", it may contain, translations into different languages. Also a thesaurus may contain more specific ontology-based definition of the concept represented by the terms in a given thesaurus entry.

12. UID or Unique Identifier

Identifier, which is guaranteed to be unique among all identifiers, used for those objects and for a specific purpose.

1. URI or Uniform Resource Identifier

String of characters used to identify a name or a resource on the Internet.

2. URL or Uniform Resource Locator

Type of URI that specifies where a known resource is available and the mechanism for retrieving it.

3. Web Service

Method for communication between two electronic devices over a network. Web Services were intended to solve three main problems, that is Firewall Traversal, Complexity, and Interoperability.

4. XML or Extensible Markup Language

Set of rules for encoding documents in machine-readable form. Symbol and abbreviated terms

For the purposes of this metadata specification the abbreviations apply:

EC	European Commission
EU	European Union
EML	Ecological Metadata Language
INSPIRE	Infrastructure for Spatial Information in Europe
HTML	Hypertext Markup Language
ISO	International Organization for Standardization
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSLT	Extensible Stylesheet Language Transformations

4 State of the Art / Existing Relevant Standards

Ecological Metadata Language (EML) is a metadata specification developed by the ecosystem researchers for use by the ecology discipline. It is based on prior work done by the Ecological Society of America and associated efforts (Michener et al., 1997, Ecological Applications). EML is implemented as a series of XML schemas that can be used in a modular and extensible manner to document ecological data. Each EML module is designed to describe one logical part of the total metadata that should be included with any ecological dataset.

The EML standard is made up of 23 modules (EML). The modules are grouped into the following groups:

- Root-level structure: **eml** module (metadata container)
- Top-level resource: **eml-dataset** (data sets description), **eml-literature** (citation specific information), **eml-software** (software specific information) and **eml-protocol** module (research protocol specific information). This metadata specification will focus only on eml-dataset.
- **eml-resource** module (provides base information for all resources). While eml-resource group is found in each of the top-level types (dataset, software, literature, and protocol some of its elements are useful only in dataset documentation.
- Supporting modules: **eml-access** (access control rules for resources), **eml-physical** (physical file format information), **eml-party** (used to describe data owners both individuals and organizations and data contacts), **eml-coverage** (information about geographic, temporal and taxonomic coverage extents), eml-project (research projects information) and **eml-methods** (methodological information for the resource)
- Data organization: **eml-entity** (entity level information within dataset), **eml-attribute** (attribute level information) and **eml-constraint** (information about relationships among and within individual data sets)
- Entity types: **eml-dataTable** (information about data table entities), **eml-spatialRaster** (information about regularly gridded geospatial image data), **eml-spatialVector** (information about non-gridded geospatial image data), **eml-storedProcedure** (information about data tables resulting from procedures stored in a database) and **eml-view** (information about data tables resulting from a database query). This report will only describe eml-datatable.
- Utility modules: **eml-text** (text field formatting) **eml-unitTypeDefinitions** (unit definition)

The EML modules used can vary depending on the intended use as described in table below. Each level includes the modules described in lower levels.

adapted from: http://im.lternet.edu/im_practices/metadata/guides/EML_levels

Table 1 EML modules versus metadata levels

Level	Usage	Modules (elements) Involved
L1	Identification	title, creator, contact, abstract, keywords, publisher, publication date
L2	Discovery	eml-coverage (geographic, temporal, taxonomic)
L3	Evaluation	Intellectual Rights, project, methods, dataTable/entityGroup, dataTable/attributes
L4	Access	eml-access, eml-physical
L5	Integration	attributeList (full descriptions), constraint, quality control

Identification level usage of EML provides the minimum level to identify the data: Minimum content for adequate data set discovery in a general cataloging system or repository.

Discovery level usage includes Level 1 content plus coverage information to support targeted searches

Evaluation includes Level 2 content plus data set details to enable end-user evaluation of the methodology and data entities

Access level includes Level 3 content plus data access details to support automated data retrieval. Access in level 4 consists of access rules for the data file. There is a top-level (level 1) use of eml-access that refers to access rules to the metadata document.

Integration level Includes Level 4 content plus complete attribute and quality control details to support computer-assisted data integration and re-sampling

4.1 EN ISO 19115:2005 - Geographic information - Metadata (ISO 19115:2003) standard overview

ISO 19115:2003 defines the schema required for describing geographic information and services. It provides information about the identification, extent, quality, spatial and temporal schema, spatial reference, and distribution of digital geographic data.

ISO 19115:2003 is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets; geographic datasets, dataset series, and individual geographic features and feature properties.

ISO 19115:2003 defines: mandatory and conditional metadata sections, metadata entities, and metadata elements; the minimum set of metadata required to serve the full range of metadata applications (data discovery, determining data fitness for use, data access, data transfer, and use of digital data); optional metadata elements - to allow for a more extensive standard description of geographic data, if required; a method for extending metadata to fit specialized needs.

Though ISO 19115:2003 is applicable to digital data, its principles can be extended to many other forms of geographic data such as maps, charts, and textual documents as well as non-geographic data.

ISO 19115 metadata standard is made up of 14 top-level packages (ISO, 2003):

- **Metadata entity set information:** metadata container and contains metadata about metadata (metadata responsible party, creation date, language, identification and others)
- **Identification information:** basic information required to uniquely identify a resource
- **Constraint information:** restrictions on the access and use of a resource or metadata
- **Data quality information:** package contains a general assessment of the quality of the dataset
- **Maintenance information:** information about the scope and frequency of updating
- **Spatial representation information** (includes grid and vector representation): contains information concerning the mechanisms used to represent spatial information in a dataset
- **Reference system information:** contains the description of the spatial and temporal reference system(s) used in a dataset

- **Content information:** information identifying the feature catalogue used and/or information describing the content of a coverage dataset
- **Portrayal catalogue information:** contains information identifying the portrayal catalogue used
- **Distribution information:** contains information about the distributor of, and options for obtaining, a resource
- **Metadata extension information:** contains information about user specified metadata extensions
- **Application schema information:** contains information about the application schema used to build a dataset
- **Extent information:** contains information about the geographic, temporal and the vertical extent of the dataset
- **Citation and responsible party information:** contains information about the party responsible for dataset

4.2 INSPIRE metadata regulation overview

INSPIRE directive was established in 2007 and had to be transposed into EU member states legislation within 2 years. INSPIRE defines an infrastructure for spatial information in Europe, which consists from 5 components: spatial data, metadata, network services, data sharing and monitoring and reporting. For each abovementioned component EC approves commission regulations. Among others, metadata regulation has been approved in year 2008 and defines metadata elements to be included within the datasets and service description in order to be compliant with INSPIRE legal requirements. This regulation provides within its annex metadata implementing rules where each required metadata element is defined via its identification, name, description and obligation with multiplicity and condition.

INSPIRE metadata regulation is made up of 10 groups containing following elements:

- **Identification** - provides general identification information distributed via these metadata elements: **Resource title, Resource type, Resource locator, Unique resource identifier, Coupled resource and Resource language**
- **Classification of spatial data and services** – provides categorization of the resources via elements **Topic category** and **Spatial data service type**
- **Keyword** – provides further description by keywords with elements **Keyword value** and **Originating controlled vocabulary**
- **Geographic location** – provides spatial extent definition via element **Geographic bounding box**
- **Temporal extent** – provides temporal aspect definition either for temporal range via **Temporal extent** element or just a single date of an event within resource lifecycle via **Date of publication, Date of last revision and Date of creation**
- **Quality and validity** – provides summary information about resource quality via elements **Lineage** and **Spatial resolution**
- **Conformity** – provides information about conformity to particular implementing rules as well as the its degree via **Specification** and **Degree elements**
- **Constraints related to access and use** – provides a set of conditions applying to access and use and limitations on public access via **Conditions applying to access** and use and **Limitations on public access** elements
- **Organizations responsible for the establishment, management, maintenance and distribution of spatial data sets and services** – provides information about responsible

- parties via **Responsible party** (name, organization and e-mail address) and **Responsible party role** elements
- **Metadata on metadata** – provides information describing metadata itself via **Metadata point of contact** (name, organization and e-mail address), **Metadata date** and **Metadata language** elements.

5 Metadata specification: Data Table

The following description of the metadata elements follows in major parts the description of the metadata elements as proposed by the EnvEurope project. This is due to the similarity of the data provided by long term monitoring and experiments.

The specification of the metadata elements is the basis for the implementation. Therefore many descriptions are similar to the EnvEurope report. Extended explanations if necessary are included in the description of the metadata elements.

In addition detailed descriptions of individual elements not covered in the EnvEurope metadata profile are given. In this case the metadata elements are separately marked.

Each metadata element may have more than one sub elements described within the element definition. Examples are given for both EML and ISO/Inspire. In most cases there is a one-to-one mapping between EML and ISO/Inspire, however, this is not always the case. In order to be able to produce valid metadata for both systems, the metadata entry tool may ask for information that is needed by one system, and not by the other. For example, Metadata Date is required by Inspire but is not an element in EML. EML has a method for creating custom structures (<additionalMetadata>) which will be used to provide this element. In other situations, EML may require something that Inspire does not. For example, EML requires a field of <altitudeUnits> while Inspire does not. In cases like that, the metadata entry tool will ask for <altitudeUnits> even though ISO/Inspire does not use this. In general, if Inspire requires an element that is not part of EML then an <additionalMetadata> element will be created to provide that information. Conversely, if EML requires something that is not part of Inspire, then the tool will not make a parallel structure for Inspire. In the case of individual parts of a concept such as geographic coverage, the two structures may not map directly. For example, Inspire incorporates the datum as part of any geographic reference. EML does not. No attempt would be made to create a custom geographic reference structure for EML to include datum information.

The core part of this specification provides list of the metadata elements to be implemented for each data set collected within the ExpeER data exchange system. Each metadata element is described in a tabular form and provides following details:

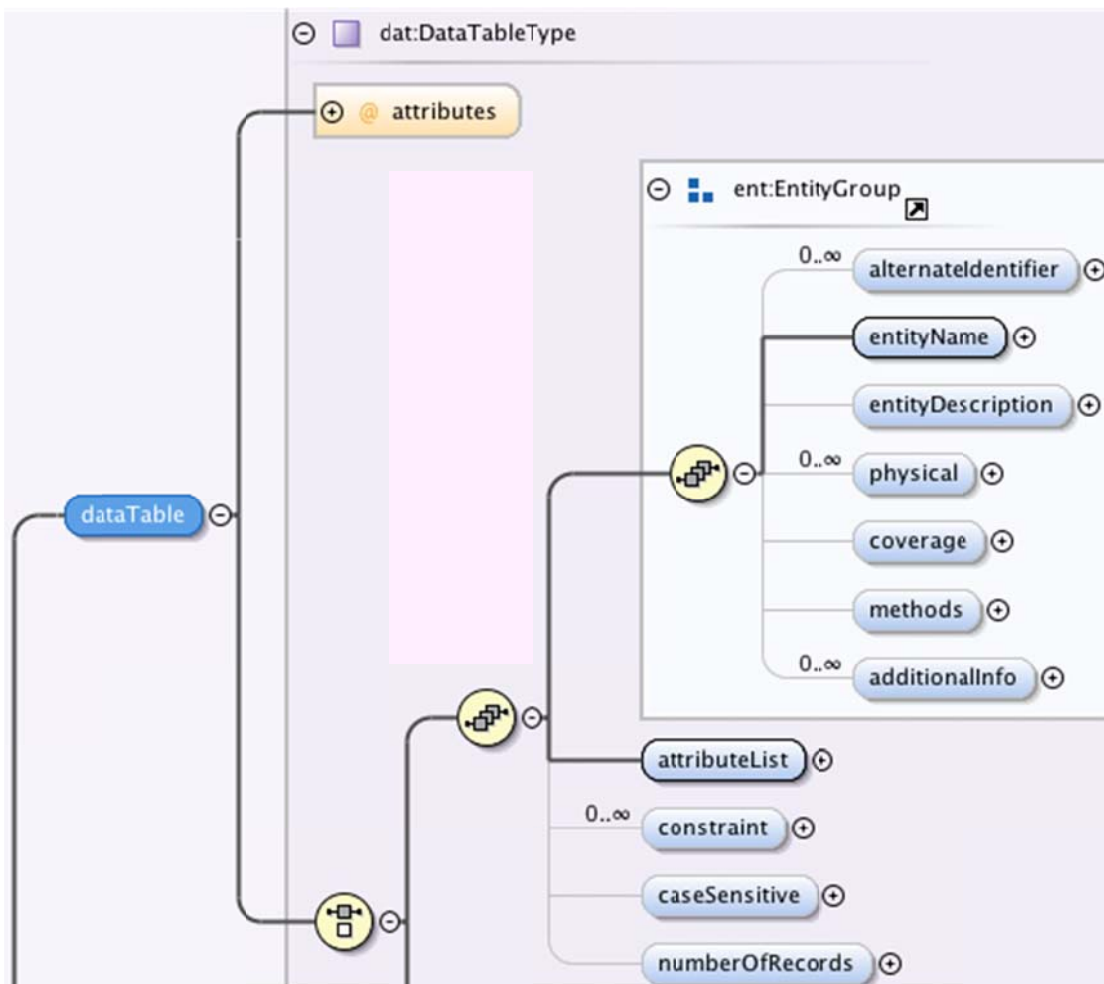
- a) The name of metadata element
- b) Basic definition given by EML¹ specification and amended by ExpeER expert community
- c) Obligation/condition for the metadata element (Required or Optional)
- d) Multiplicity (Number of times an element may appear). Examples: 1 (only 1 and mandatory); 1..* (One required, more than one allowed); 0..* (Optional, but many allowed); 0..1 (optional, but only one allowed)
- e) Corresponding metadata element in INSPIRE/EN ISO metadata model with reference²

¹ EML – Ecological Metadata Language - <http://knb.ecoinformatics.org/software/eml/>

- f) An example of XML encoding in EML
- g) An example of XML encoding in INSPIRE (EN ISO)

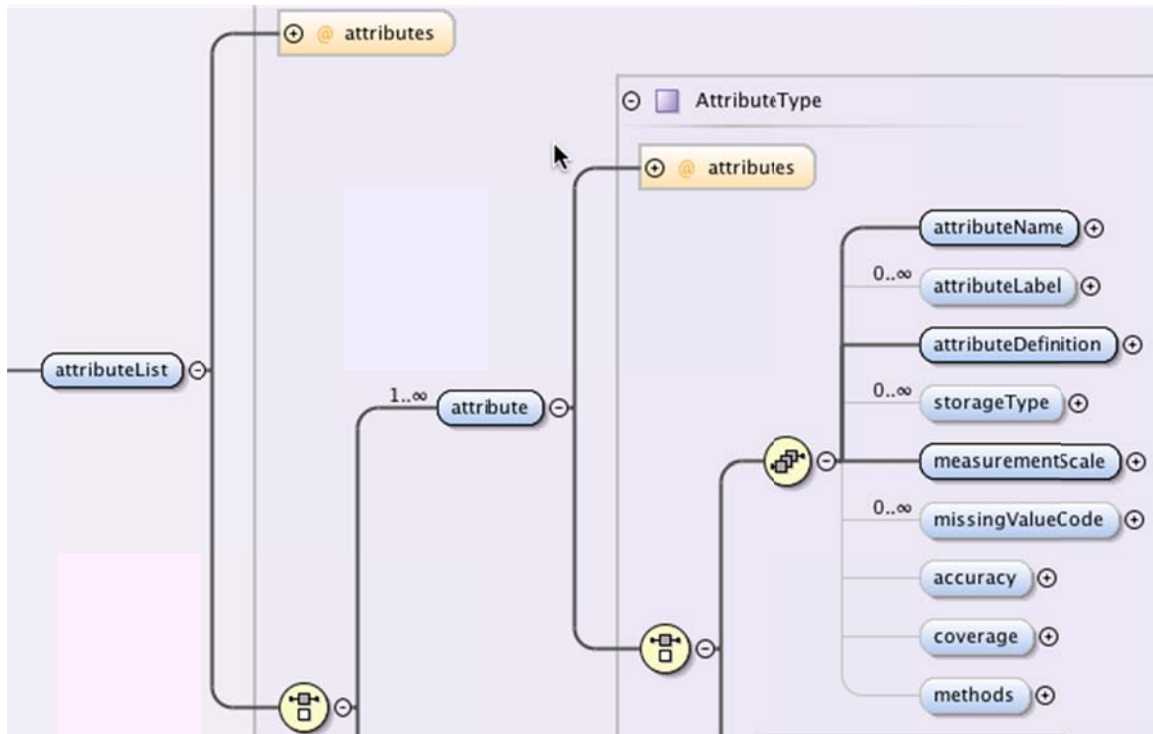
The following section provides a detailed discussion of the dataTable type. Neither ISO 19115 or ISO 19139 have elements that correspondence to dataTable. Other metadata elements are described in detail in the appended EnvEurope metadata specification. A data table is a logical entity with rows and columns and may have several different physical forms, for example: Excel spreadsheet, database table, database view, text file. DataTable metadata are required for data reuse. The key aspects of data table metadata are: attribute (column) names and definitions, and units. Without this information data cannot be reused. This information is necessary for data integration. Having this information does not guarantee that 2 or more datasets can be integrated (differences in sampling methodology or other differences may prevent integration).

The required elements of a dataTable type are: entityName and attributeList.

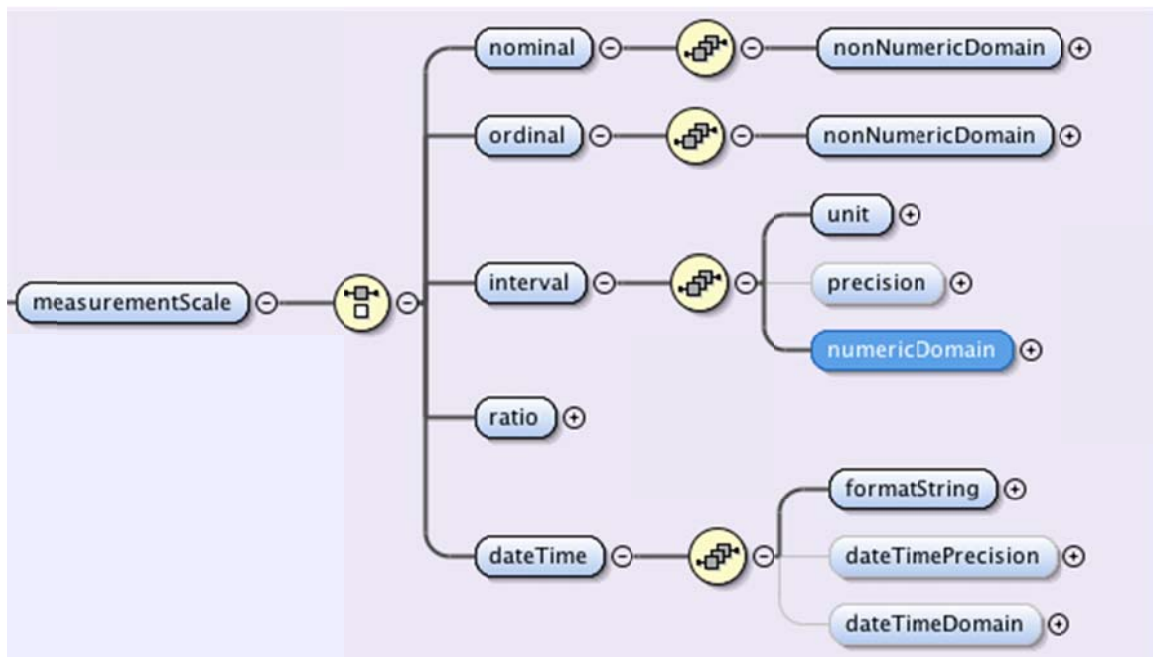


² Reference in INSPIRE means pertaining number in metadata regulation - <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:326:0012:0030:EN:PDF> and in ISO means number of metadata element defined inside the data dictionary in ISO1 9115 standard

The required elements of the attribute list are: attribute name and definition, and measurementScale.



The elements of measurementScale are shown below. A measurement scale is a choice of nominal, ordinal, interval, ratio or dateTime.



6 Technical implementation of the MD System

In practical terms, a web-based metadata entry system will be used. This system is adapted from one developed by the US-LTER and further developed within the EnvEurope project. It has been modified to meet the needs of INSPIRE and follows the EnvEurope community profile. A separate instance of the DEIMS (**D**rupal based **E**cological **I**nformation **M**anagement **S**ystem) will be provided in the runtime of the ExpeER project. The tool will produce both EML and INSPIRE compliant XML documents directly. The eml documents can be harvested by a Metacat server to be made available as part of DataOne. The INSPIRE compliant metadata will be able to be consumed by geoportal services.

The following is an example dataTable fragment of an EML document:

```

<dataTable>
  <entityName>VCR05118</entityName>
  <entityDescription>1996    Parramore    Permanent    Plot    Resurvey:    Subplot
data</entityDescription>
  <physical>
    <objectName>96subplots.csv</objectName>
    <characterEncoding>ASCII</characterEncoding>
    <dataFormat>
      <textFormat>
        <numHeaderLines>1</numHeaderLines>
        <numFooterLines>0</numFooterLines>
        <recordDelimiter>#x0D#x0A</recordDelimiter>
        <physicalLineDelimiter>#x0D#x0A</physicalLineDelimiter>
        <attributeOrientation>column</attributeOrientation>
        <simpleDelimited>
          <fieldDelimiter>,</fieldDelimiter>
          <quoteCharacter>"</quoteCharacter>
          <literalCharacter>\</literalCharacter>
        </simpleDelimited>
      </textFormat>
    </dataFormat>
    <distribution>
      <online>
        <url
function="download">http://metacat.lternet.edu/das/dataAccessServlet?docid=knb-lter-
vcr.94.10&urlTail=1/VCR05118/VCR05118/96subplots.csv</url>
        </online>
        <access authSystem="knb" order="allowFirst">
          <allow>
            <principal>public</principal>
            <permission>read</permission>
          </allow>
          <allow>
            <principal>uid=VCR,o=lter,dc=ecoinformatics,dc=org</principal>
            <permission>all</permission>
          </allow>
        </access>
      </distribution>
    </physical>
  </dataTable>

```

```

    </allow>
  </access>
</distribution>
</physical>
<attributeList>
  <attribute id="VCR05118.PLOT_N">
    <attributeName>PLOT_N</attributeName>
    <attributeLabel>plot number</attributeLabel>
    <attributeDefinition>PLOT_N - plot number</attributeDefinition>
    <storageType
      datatype="integer" typeSystem="http://www.w3.org/2001/XMLSchema-
    </storageType>
    <measurementScale>
      <nominal>
        <nonNumericDomain>
          <textDomain>
            <definition>plot number</definition>
          </textDomain>
        </nonNumericDomain>
      </nominal>
    </measurementScale>
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    <attributeDefinition>SUBPLOT - subplot number</attributeDefinition>
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datatypes">integer</storageType>
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  <attributeLabel>azimuth from plot center</attributeLabel>
  <attributeDefinition>AZIMUTH - azimuth from plot center</attributeDefinition>
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  <attributeLabel>distance from plot center (to nearest 1 m)</attributeLabel>
  <attributeDefinition>DIST - distance from plot center (to nearest 1
m)</attributeDefinition>
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datatypes">integer</storageType>
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      <nonNumericDomain>
        <textDomain>

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subplot</attributeLabel>
    <attributeDefinition>CREKDIS - shortest distance to the nearest creekbank from
subplot</attributeDefinition>
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subplot</definition>
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    <attributeLabel>PAR ceptometer reading at Breast Height</attributeLabel>
    <attributeDefinition>CEPTDBH - PAR ceptometer reading at Breast
Height</attributeDefinition>
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datatypes">integer</storageType>
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        </nominal>
    </measurementScale>
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level</attributeLabel>
    <attributeDefinition>CEPT20 - PAR ceptometer reading at 20cm above ground/water
level</attributeDefinition>
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level</definition>
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    <attributeDefinition>CEPTOPN - open sun PAR ceptometer
reading</attributeDefinition>
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          <definition>time of ceptometer readings</definition>
        </textDomain>
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present</attributeLabel>
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present</attributeDefinition>
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20)</attributeLabel>
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20)</attributeDefinition>
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20)</attributeLabel>
  <attributeDefinition>BARE_ON - "outer" BARREN ground cover point count (out of
20)</attributeDefinition>
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        <textDomain>
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        </textDomain>
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    </nominal>
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20)</attributeDefinition>
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datatypes">integer</storageType>
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        </textDomain>
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20)</attributeLabel>
  <attributeDefinition>H2O_ON - "outer" WATER ground cover point count (out of
20)</attributeDefinition>
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datatypes">integer</storageType>
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  <attributeDefinition>GRAS_ON - "outer" GRASS ground cover point count (out of
20)</attributeDefinition>
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datatypes">integer</storageType>
  <measurementScale>
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        </textDomain>
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    </nominal>
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  <attributeName>GRAS_IH</attributeName>
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10cm)</attributeLabel>
  <attributeDefinition>GRAS_IH - "inner" GRASS average height (to nearest 5 or

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10cm)</attributeDefinition>
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datatypes">integer</storageType>
  <measurementScale>
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        </textDomain>
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10cm)</attributeLabel>
  <attributeDefinition>GRAS_OH - "outer" GRASS average height (to nearest 5 or
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  <attributeDefinition>REED_IN - "inner" REED ground cover point count (out of
20)</attributeDefinition>
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    </nonNumericDomain>
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20)</attributeLabel>
    <attributeDefinition>HERB_IN - "inner" HERBACEOUS ground cover point count (out
of 20)</attributeDefinition>
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of 20)</attributeDefinition>
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20)</definition>
                </textDomain>
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10cm)</definition>
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</attribute>

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    <attributeDefinition>VINE_IN - "inner" VINE ground cover point count (out of
20)</attributeDefinition>
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datatypes">integer</storageType>
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  <attributeDefinition>VINE_ON - "outer" VINE ground cover point count (out of
20)</attributeDefinition>
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        </textDomain>
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  <attributeDefinition>VINE_IH - "inner" VINE average height (to nearest 5 or
10cm)</attributeDefinition>
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datatypes">integer</storageType>
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    <attributeDefinition>VINE_OH - "outer" VINE average height (to nearest 5 or
10cm)</attributeDefinition>
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            <definition>"outer" VINE average height (to nearest 5 or 10cm)</definition>
          </textDomain>
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20)</attributeLabel>
    <attributeDefinition>WOOD_IN - "inner" WOODY ground cover point count (out of
20)</attributeDefinition>
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datatypes">integer</storageType>
    <measurementScale>
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        <nonNumericDomain>
          <textDomain>
            <definition>"inner" WOODY ground cover point count (out of 20)</definition>
          </textDomain>
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      </nominal>
    </measurementScale>
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      <code>.</code>
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  <attribute id="VCR05118.WOOD_ON">

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20)</attributeLabel>
    <attributeDefinition>WOOD_ON - "outer" WOODY ground cover point count (out of
20)</attributeDefinition>
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datatypes">integer</storageType>
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    </textDomain>
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    <attributeLabel>"inner" WOODY average height (to nearest 5 or
10cm)</attributeLabel>
    <attributeDefinition>WOOD_IH - "inner" WOODY average height (to nearest 5 or
10cm)</attributeDefinition>
    <storageType typeSystem="http://www.w3.org/2001/XMLSchema-
datatypes">integer</storageType>
    <measurementScale>
    <nominal>
    <nonNumericDomain>
    <textDomain>
    <definition>"inner" WOODY average height (to nearest 5 or 10cm)</definition>
    </textDomain>
    </nonNumericDomain>
    </nominal>
    </measurementScale>
    <missingValueCode>
    <code>.</code>
    <codeExplanation>missing</codeExplanation>
    </missingValueCode>
</attribute>
<attribute id="VCR05118.WOOD_OH">
    <attributeName>WOOD_OH</attributeName>
    <attributeLabel>"outer" WOODY average height (to nearest 5 or

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10cm)</attributeLabel>
  <attributeDefinition>WOOD_OH - "outer" WOODY average height (to nearest 5 or
10cm)</attributeDefinition>
  <storageType typeSystem="http://www.w3.org/2001/XMLSchema-
datatypes">integer</storageType>
  <measurementScale>
    <nominal>
      <nonNumericDomain>
        <textDomain>
          <definition>"outer" WOODY average height (to nearest 5 or 10cm)</definition>
        </textDomain>
      </nonNumericDomain>
    </nominal>
  </measurementScale>
  <missingValueCode>
    <code>.</code>
    <codeExplanation>missing</codeExplanation>
  </missingValueCode>
</attribute>
</attributeList>
</dataTable>
```

7 Acknowledgments and Contact

This metadata specification could not have been developed without the valuable and fruitful help and contribution of some members from the working groups within the ExpeER and EnvEurope (LIFE08 ENV/IT/000339) project, and other LTER-Europe and International LTER project involvements. Moreover technical and moral support from other colleagues coming from the US-LTER and NCEAS is appreciated. Therefore we would like to thank them all for their contribution.

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Annexes

8 APPENDIX 1: Validation by ExpeER partners

Final version of the Deliverable 3.1 Data policy and guidelines and D3.2 ExpeER metadata standard for dataset level have been uploaded to the ExpeER website in April 2012, the links to the deliverables in the website have been sent to all ExpeER participant via the internal bulletin in April 2012 as well. A deadline (17 May) was set to receive feedback and comments. No comments were received. To ensure the validation of these deliverables by each ExpeER partner, an individual email was sent to all ExpeER partner to ask for feedback by 15 June. After this deadline, principle contacts of each ExpeER partner were asked to send an email of validation to the project manager by 27 June. They were asked to use the following format:

I have read and agree to the following ExpeER deliverables : D3.1 “ExpeER data policy and guidelines” and D3.2 “ExpeER Metadata standard for dataset level”. I confirm that they comply with the data management of (name of the organization).

Here is the list of ExpeER partners whose confirmation email were received till the submission of this deliverable.

Partner n°	Short name	Country	Confirmation to validate D3.1 D3.2
2	BFW	Austria	yes
3	BGU	Israel	yes
4	Bioforsk	Norway	yes
7	CSIC	Spain	yes
8	DTU	Denmark	yes
10	ERCE	Poland	yes
13	FSU JENA	Germany	yes
14	MTA ÖK	Hungary	yes
15	Imperial	UK	only for D3.1 so far
17	Jülich	Germany	yes
18	KIT	Germany	yes
21	Rothamsted Research	UK	ask for amendment in D3.1
23	SOTON	UK	yes
24	SYKE	Finland	yes
25	TUM	Germany	yes
26	UA	Belgium	yes
27	UB	Romania	yes
28	UFZ	Germany	yes

Partner n°	Short name	Country	Confirmation to validate D3.1 D3.2
29	UHEL	Finland	yes
30	ULUND	Sweden	yes
31	UNITO	Italy	yes
32	UNIUD	Italy	yes
33	UNIVLEEDS	UK	yes
34	UNS	Serbia	yes
36	VUA	The Netherlands	yes

9 APPENDIX 2: ENVEurope Metadata Specification - attached
