### D2.8.III.7 Data Specification on Environmental Monitoring Facilities – Draft Guidelines

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Foreword

How to read the document?

This document describes the “INSPIRE data specification on Environmental Monitoring Facilities – Guidelines” version 2.0 as developed by the Thematic Working Group (TWG) Environmental monitoring facilities using both natural and a conceptual schema language. This version is now available for the public consultation. Based on the results of the consultation (received comments and the testing reports), the final version 3.0 will be prepared by the TWGs.

The data specification is based on a common template used for all data specifications and has been harmonised using the experience from the development of the Annex I data specifications.

This document provides guidelines for the implementation of the provisions laid down in the draft Implementing Rule for spatial data sets and services of the INSPIRE Directive.

This document includes two executive summaries that provide a quick overview of the INSPIRE data specification process in general, and the content of the data specification on Environmental Monitoring Facilities in particular. We highly recommend that managers, decision makers, and all those new to the INSPIRE process and/or information modelling should read these executive summaries first.

The UML diagrams (in Chapter 5) offer a rapid way to see the main elements of the specifications and their relationships. The definition of the spatial object types, attributes, and relationships are included in the Feature Catalogue (also in Chapter 5). People having thematic expertise but not familiar with UML can fully understand the content of the data model focusing on the Feature Catalogue. Users might also find the Feature Catalogue especially useful to check if it contains the data necessary for the applications that they run. The technical details are expected to be of prime interest to those organisations that are/will be responsible for implementing INSPIRE within the field of Environmental Monitoring Facilities.

The technical provisions and the underlying concepts are often illustrated by examples. Smaller examples are within the text of the specification, while longer explanatory examples and descriptions of selected use cases are attached in the annexes.

In order to distinguish the INSPIRE spatial data themes from the spatial object types, the INSPIRE spatial data themes are written in italics.

The document will be publicly available as a ‘non-paper’. It does not represent an official position of the European Commission, and as such cannot be invoked in the context of legal procedures.

Legal Notice

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.
Interoperability of Spatial Data Sets and Services – General Executive Summary

The challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information are common to a large number of policies and activities and are experienced across the various levels of public authority in Europe. In order to solve these problems it is necessary to take measures of coordination between the users and providers of spatial information. The Directive 2007/2/EC of the European Parliament and of the Council adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment.

INSPIRE will be based on the infrastructures for spatial information that are created and maintained by the Member States. To support the establishment of a European infrastructure, Implementing Rules addressing the following components of the infrastructure are being specified: metadata, interoperability of spatial data themes (as described in Annexes I, II, III of the Directive) and spatial data services, network services and technologies, data and service sharing, and monitoring and reporting procedures.

INSPIRE does not require collection of new data. However, after the period specified in the Directive 1 Member States have to make their data available according to the Implementing Rules.

Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. It is important to note that “interoperability” is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and efforts on understanding and integrating data when they build their applications based on data delivered within INSPIRE.

In order to benefit from the endeavours of international standardisation bodies and organisations established under international law their standards and technical means have been utilised and referenced, whenever possible.

To facilitate the implementation of INSPIRE, it is important that all stakeholders have the opportunity to participate in specification and development. For this reason, the Commission has put in place a consensus building process involving data users, and providers together with representatives of industry, research and government. These stakeholders, organised through Spatial Data Interest Communities (SDIC) and Legally Mandated Organisations (LMO) 2, have provided reference materials, participated in the user requirement and technical surveys, proposed experts for the Data Specification Drafting Team 3 and Thematic Working Groups 4.

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1 For all 34 Annex I, II and III data themes: within two years of the adoption of the corresponding Implementing Rules for newly collected and extensively restructured data and within 5 years for other data in electronic format still in use
2 Number of SDICs and LMOs on 8/6/2011 was 461 and 249 respectively
3 Surveys on unique identifiers and usage of the elements of the spatial and temporal schema,
4 The Data Specification Drafting Team has been composed of experts from Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Switzerland, UK, and the European Environmental Agency
5 The Thematic Working Groups of Annex II and III themes have been composed of experts from Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey, UK, the European Commission, and the European Environmental Agency
This open and participatory approach was successfully used during the development of the data specification on Annex I data themes as well as during the preparation of the Implementing Rule on Interoperability of Spatial Data Sets and Services for Annex I spatial data themes.

The development framework elaborated by the Data Specification Drafting Team aims at keeping the data specifications of the different themes coherent. It summarises the methodology to be used for the data specifications and provides a coherent set of requirements and recommendations to achieve interoperability. The pillars of the framework are four technical documents:

- The Definition of Annex Themes and Scope describes in greater detail the spatial data themes defined in the Directive, and thus provides a sound starting point for the thematic aspects of the data specification development.

- The Generic Conceptual Model defines the elements necessary for interoperability and data harmonisation including cross-theme issues. It specifies requirements and recommendations with regard to data specification elements of common use, like the spatial and temporal schema, unique identifier management, object referencing, a generic network model, some common code lists, etc. Those requirements of the Generic Conceptual Model that are directly implementable will be included in the Implementing Rule on Interoperability of Spatial Data Sets and Services.

- The Methodology for the Development of Data Specifications defines a repeatable methodology. It describes how to arrive from user requirements to a data specification through a number of steps including use-case development, initial specification development and analysis of analogies and gaps for further specification refinement.

- The “Guidelines for the Encoding of Spatial Data” defines how geographic information can be encoded to enable transfer processes between the systems of the data providers in the Member States. Even though it does not specify a mandatory encoding rule it sets GML (ISO 19136) as the default encoding for INSPIRE.

Based on these framework documents and following the successful development of the Annex I Data specifications (Technical Guidelines) and the Implementing Rules, the new Thematic Working Groups have created the INSPIRE data specification for each Annex II and III theme. These documents – at the version 2.0 – are now publicly available for INSPIRE stakeholders for consultation. The consultation phase covers expert review as well as feasibility and fitness-for-purpose testing of the data specifications.

The structure of the data specifications is based on the “ISO 19131 Geographic information - Data product specifications” standard. They include the technical documentation of the application schema, the spatial object types with their properties, and other specifics of the spatial data themes using natural language as well as a formal conceptual schema language.


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11 UML – Unified Modelling Language
19100 series, the INSPIRE Generic Conceptual Model, and the application schemas\(^\text{12}\) developed for each spatial data theme. The multilingual INSPIRE Feature Concept Dictionary contains the definition and description of the INSPIRE themes together with the definition of the spatial object types present in the specification. The INSPIRE Glossary defines all the terms (beyond the spatial object types) necessary for understanding the INSPIRE documentation including the terminology of other components (metadata, network services, data sharing, and monitoring).

By listing a number of requirements and making the necessary recommendations, the data specifications enable full system interoperability across the Member States, within the scope of the application areas targeted by the Directive. They will be published (version 3.0) as technical guidelines and will provide the basis for the content of the Amendment of the Implementing Rule on Interoperability of Spatial Data Sets and Services for data themes included in Annex II and III of the Directive. The Implementing Rule Amendment will be extracted from the data specifications keeping in mind short and medium term feasibility as well as cost-benefit considerations. The Implementing Rule will be legally binding for the Member States.

In addition to providing a basis for the interoperability of spatial data in INSPIRE, the data specification development framework and the thematic data specifications can be reused in other environments at local, regional, national and global level contributing to improvements in the coherence and interoperability of data in spatial data infrastructures.

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\(^\text{12}\) Conceptual models related to specific areas (e.g. INSPIRE themes)
Environmental Monitoring Facilities – Executive Summary

Due to the fact that the thematic area covered by the INSPIRE spatial data theme Environmental Monitoring Facilities (EF) is cross-cutting to any thematic area dealing with environment and that the scope could reach from survey and sampling campaigns to satellites using remote sensing technology the focus is on environmental monitoring facilities as linking element between spatial data themes as defined by INSPIRE directive and observations and measurements on specific aspects of the environment (e.g. like air quality, atmospheric conditions, water quality). Some of those are not explicitly quoted in the INSPIRE directive but are of high relevance for the environmentally linked European directives.

The data specification provided in version 2.0 tries to address both dimensions. On the one hand environmental monitoring facilities are linked to information describing aggregations/collections of monitoring facilities and their thematic or organisational grouping and background. On the other hand environmental monitoring facilities link to observations and measurements taken. This part of our data specification will be covered by using Observations and Measurements standard tailored to a common structure used in INSPIRE data specification across all thematic areas. The structure and harmonised use of the O&M standard in INSPIRE is addressed by the guideline document (DS-D2.9).

The INSPIRE EF theme is one of the INSPIRE themes making the strongest use of this standard. Thus, several O&M concepts have been included in the data specification of theme EF. The decision which concepts are to be retained within the EF model and which are to be shifted to other parts of the INSPIRE specifications will be reached after the commenting and testing phase.

The proposed structure creates less thematic dependencies but has to be embedded in theme specific context. The specification gives the freedom to thematic communities to implement the model according to their needs. Various ways of linking environmental monitoring facilities reaching from hierarchical cascades, genealogical relations to any thematic link gives the opportunity to provide information at the appropriate level of detail/aggregation and a good scalability to thematic needs. Documentation of legislation at all levels from local to European or global is essential background information for monitoring activities. As an advanced feature (for future use) a relation from environmental monitoring facilities to environmental reporting is included in the model. E-reporting could be supported in future in case information belonging to the thematic area environmental monitoring facilities has to be included in this setup.

The model provided in version 2.0 of the data specification has developed through several steps towards a more generic but scalable approach. The model provided is a common frame how to describe environmental monitoring facilities in a common way across thematic areas whereas the harmonisation for detailed aspects remains with the thematic communities. Only a few elements are defined as not domain specific and cross domain to provide a minimum common denominator like rough categorisation of environmental monitoring facilities.
Acknowledgements

Many individuals and organisations have contributed to the development of these Guidelines.

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Other contributors to the INSPIRE data specifications are the Drafting Team Data Specifications, the JRC data specifications team and the INSPIRE stakeholders - Spatial Data Interested Communities (SDICs) or Legally Mandated Organisations (LMOs).

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1 Scope

This document specifies a harmonised data specification for the spatial data theme Environmental Monitoring Facilities as defined in Annex III of the INSPIRE Directive.

This data specification provides the basis for the drafting of Implementing Rules according to Article 7 (1) of the INSPIRE Directive [Directive 2007/2/EC]. The entire data specification will be published as implementation guidelines accompanying these Implementing Rules.

2 Overview

2.1 Name and acronyms

INSPIRE data specification for the theme Environmental Monitoring Facilities

2.2 Informal description

Definition:

Location and operation of environmental monitoring facilities includes observation and measurement of emissions, of the state of environmental media and of other ecosystem parameters (biodiversity, ecological conditions of vegetation, etc.) by or on behalf of public authorities. [Directive 2007/2/EC]

Description:

The scope as defined in the INSPIRE directive includes two aspects. The environmental monitoring facility as a spatial object in context of INSPIRE and observations and measurements linked to the environmental monitoring facility. After Version 1 of data specification for Annex II and III themes it was decided to address the observation and measurement aspect in an additional work group with the task to tailor the ISO 19156 standard for observations and measurements (O&M) for harmonised use in INSPIRE data specification. A specific guideline paper (DS-D2.9) is available.

The overall target of theme EF data specification is to provide a generic model which can be used across various domains and leave the necessary freedom to thematic domains to bring in specific needs while keeping a shared structure. So the data specification provides a common structure but not a thematic harmonisation across domains. The recursive structure might look highly complex but it enables thematic communities to specify environmental monitoring facilities and the linked observations and measurements to the appropriate level of detail which is relevant for data exchange. The data specification tried to keep the balance between being generic (fit across domain) and being not too abstract and readable by thematic experts without UML expertise for review and commenting. EF defines ONLY vocabulary which has to be used cross domains and provides an option to access information from a cross domain point of view. So the challenge is to adjust the domain specific needs to the EF generic elements.

Descriptive elements in natural language and examples are, by nature of a cross domain usable data specification, never complete. The experts of the thematic working group provided examples from their domains. The examples focus on explaining the structure of our model to non UML expert from thematic domains. We hope that the examples make the generic model easier to understand even for environmental thematic experts from other domains.
Open issue 1: Where would you like to see examples with thematic focus. In the thematic domain they belong to (e.g. GE for groundwater) explaining as well the link to environmental monitoring facilities or in data specification environmental monitoring facilities. Please provide examples you would like to be included in EF data specification.

In scope:
Description of environmental monitoring facilities are a basic element to link observations and measurements to a spatial feature. Monitoring facilities can be grouped to monitoring networks as a number of facilities belong to monitoring programs with long term initiatives (mostly induced by legislation) or can be included in specific monitoring activities. Legislation as a basic element to establish environmental monitoring facilities provides important background information for public authorities dealing with. As observations and measurements linked to an environmental monitoring facility contribute to any kind of reporting (obligatory and voluntary) a link is included in the data specification to establish a relation between environmental monitoring facilitates and reports to be delivered or provided. This is meant to optionally support e-reporting in the future.
The specification covers all kinds of environmental monitoring using fixed stations, moving equipment or remote sensing and can be applied to the thematic needs of the various domains.
Access rights and data protection on station level/observation points is a highly relevant aspect for special monitoring like in nature protection and biodiversity monitoring as a publication of the monitoring station/facility might change the observed item and therefore make the monitoring itself obsolete. Aspects related to the appropriate level of detail and sharing of data and information according to these scaling are in scope of theme environmental monitoring facilities. The correct management of access rights and data protections is out of scope for this data specification. It’s on the data provider and the implementation of right management to decide whether only aggregated information (like a description of the monitoring activity) will be provided. From TWG EF point of view there are different options to address the issue by either decreasing spatial accuracy of location (up to useless) or through a complex digital right management layer in systems.

Out of scope for data specification EF:
- Domain specific vocabularies and the appropriate structure for the domain
- Guidance on the appropriate level of detail as this is domain specific
- Examples covering thematic areas addressed by other themes of INSPIRE Annexes as domain expertise is not available in TWG EF

Open issue 2: The scope definition of EF in the INSPIRE directive gives no clear indication how far cross domain harmonisation should go and how requirements should be covered which are not explicitly mentioned in the INSPIRE thematic listing in Annex I, II and III of the directive. Please provide your view and what you expect in next version of the data specification.

2.3 Normative References


2.4 Terms and definitions

Terms and definitions necessary for understanding this document are defined in the INSPIRE Glossary\textsuperscript{13}.

In addition the following terms and definitions are used:

The definitions of Environmental Monitoring Facility (EMF) and related concepts are in detail provided in the feature catalogue. It is mentioned here in addition as this element is core to understand the data specification EF. Please be aware that an EMF does not belong to the definition taken for the thematic areas Agricultural and Aquacultural Facilities, Production and Industrial Facilities and Utility and Governmental Services. As Environmental Monitoring Facilities can be mobile they do not fit to that definition taken from a buildings/fixed installation point of view. This aspect was discussed and agreed between the thematic working groups and thematic teams are aware of. But for somebody new to the data specification EF (and others) it is essential to keep this in mind. Change of terminology was not feasible as we have to stick to the terms as they are defined by the directive.

2.5 Symbols and abbreviations

EF Theme environmental monitoring facility - used in documents and naming conventions to identify the thematic area listed in Annex III

EMA Environmental Monitoring Activity

EMF Environmental Monitoring Facilities

EMN Environmental Monitoring Network

\textsuperscript{13} The INSPIRE Glossary is available from http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY
2.6 Notation of requirements and recommendations

To make it easier to identify the mandatory requirements and the recommendations for spatial data sets in the text, they are highlighted and numbered.

**IR Requirement X** Requirements that are reflected in the Implementing Rule on interoperability of spatial data sets and services are shown using this style.

**DS Requirement X** Requirements that are not reflected in the Implementing Rule on interoperability of spatial data sets and services are shown using this style.

**Recommendation 1** Recommendations are shown using this style.

2.7 Conformance

**DS Requirement 1** Any dataset claiming conformance with this INSPIRE data specification shall pass the requirements described in the abstract test suite presented in Annex A.

3 Specification scopes

This data specification does not distinguish different specification scopes, but just considers one general scope.

**NOTE** For more information on specification scopes, see [ISO 19131:2007], clause 8 and Annex D.
4 Identification information

NOTE Since the content of this chapter was redundant with the overview description (section 2) and executive summary, it has been decided that this chapter will be removed in v3.0.

5 Data content and structure

IR Requirement 1 Spatial data sets related to the theme Environmental Monitoring Facilities shall be provided using the spatial object types and data types specified in the application schema(s) in this section.

IR Requirement 2 Each spatial object shall comply with all constraints specified for its spatial object type or data types used in values of its properties, respectively.

Recommendation 1 The reason for a void value should be provided where possible using a listed value from the VoidValueReason code list to indicate the reason for the missing value.

NOTE The application schema specifies requirements on the properties of each spatial object including its multiplicity, domain of valid values, constraints, etc. All properties have to be reported, if the relevant information is part of the data set. Most properties may be reported as “void”, if the data set does not include relevant information. See the Generic Conceptual Model [INSPIRE DS-D2.5] for more details.

5.1 Basic notions

This section explains some of the basic notions used in the INSPIRE application schemas. These explanations are based on the GCM [DS-D2.5].

5.1.1 Stereotypes

In the application schemas in this sections several stereotypes are used that have been defined as part of a UML profile for use in INSPIRE [INSPIRE DS-D2.5]. These are explained in Table 1 below.

Table 1 – Stereotypes (adapted from [INSPIRE DS-D2.5])

<table>
<thead>
<tr>
<th>Stereotype</th>
<th>Model element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>applicationSchema</td>
<td>Package</td>
<td>An INSPIRE application schema according to ISO 19109 and the Generic Conceptual Model.</td>
</tr>
<tr>
<td>featureType</td>
<td>Class</td>
<td>A spatial object type.</td>
</tr>
<tr>
<td>type</td>
<td>Class</td>
<td>A conceptual, abstract type that is not a spatial object type.</td>
</tr>
<tr>
<td>dataType</td>
<td>Class</td>
<td>A structured data type without identity.</td>
</tr>
<tr>
<td>union</td>
<td>Class</td>
<td>A structured data type without identity where exactly one of the properties of the type is present in any instance.</td>
</tr>
<tr>
<td>enumeration</td>
<td>Class</td>
<td>A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list.</td>
</tr>
<tr>
<td>codeList</td>
<td>Class</td>
<td>A flexible enumeration that uses string values for expressing a list of potential values.</td>
</tr>
<tr>
<td>placeholder</td>
<td>Class</td>
<td>A placeholder class (see definition in section 5.1.2).</td>
</tr>
<tr>
<td>voidable</td>
<td>Attribute, association role</td>
<td>A voidable attribute or association role (see definition in section 5.1.3).</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>lifeCycleInfo</td>
<td>Attribute, association role</td>
<td>If in an application schema a property is considered to be part of the life-cycle information of a spatial object type, the property shall receive this stereotype.</td>
</tr>
<tr>
<td>version</td>
<td>Association role</td>
<td>If in an application schema an association role ends at a spatial object type, this stereotype denotes that the value of the property is meant to be a specific version of the spatial object, not the spatial object in general.</td>
</tr>
</tbody>
</table>

### 5.1.2 Placeholder and candidate types

Some of the INSPIRE Annex I data specifications (which were developed previously to the current Annex II+III data specifications) refer to types that thematically belong and were expected to be fully specified in Annex II or III spatial data themes. Two kinds of such types were distinguished:

- **Placeholder types** were created as placeholders for types (typically spatial object types) that were to be specified as part of a future spatial data theme, but which was already used as a value type of an attribute or association role in this data specification.

  Placeholder types received the stereotype «placeholder» and were placed in the application schema package of the future spatial data theme where they thematically belong. For each placeholder, a definition was specified based on the requirements of the Annex I theme. The Annex II+III TWGs were required to take into account these definitions in the specification work of the Annex II or III theme.

  If necessary, the attributes or association roles in the Annex I data specification(s) that have a placeholder as a value type shall be updated if necessary.

- **Candidate types** were types (typically spatial object types) for which already a preliminary specification was given in the Annex I data specification. Candidate types did not receive a specific stereotype and were placed in the application schema package of the future spatial data theme where they thematically belong. For each candidate type, a definition and attributes and association roles were specified based on the requirements of the Annex I theme. The Annex II+III TWGs were required to take into account these specifications in the specification work of the Annex II or III theme.

  If the type could not be incorporated in the Annex II or III data specification according to its preliminary specification, it should be moved into the application schema of the Annex I theme where it had first been specified. In this case, the attributes or association roles in the Annex I data specification(s) that have the type as a value type shall be updated if necessary.

**Open issue 3:** For all Annex II+III themes for which placeholders and candidate types were specified in an Annex I data specification, it should be clearly indicated in the data specification, how the placeholder and candidate types were taken into account. If the proposed solution would require any changes to an Annex I data specification (and the corresponding section in the IR for interoperability of spatial data sets and services), this should also be clearly indicated.

A thorough investigation of the implications of the proposed changes of candidate types (in particular related to requirements of Annex I maintenance) will have to be performed for v3.0 of the data specifications.

### 5.1.3 Voidable characteristics
If a characteristic of a spatial object is not present in the spatial data set, but may be present or applicable in the real world, the property shall receive this stereotype.

If and only if a property receives this stereotype, the value of `void` may be used as a value of the property. A `void` value shall imply that no corresponding value is contained in the spatial data set maintained by the data provider or no corresponding value can be derived from existing values at reasonable costs, even though the characteristic may be present or applicable in the real world.

It is possible to qualify a value of void in the data with a reason using the VoidValueReason type. The VoidValueReason type is a code list, which includes the following pre-defined values:

- **Unpopulated**: The characteristic is not part of the dataset maintained by the data provider. However, the characteristic may exist in the real world. For example when the “elevation of the water body above the sea level” has not been included in a dataset containing lake spatial objects, then the reason for a void value of this property would be ‘Unpopulated’. The characteristic receives this value for all objects in the spatial data set.

- **Unknown**: The correct value for the specific spatial object is not known to, and not computable by the data provider. However, a correct value may exist. For example when the “elevation of the water body above the sea level” of a certain lake has not been measured, then the reason for a void value of this property would be ‘Unknown’. This value is applied on an object-by-object basis in a spatial data set.

**NOTE** It is expected that additional reasons will be identified in the future, in particular to support reasons / special values in coverage ranges.

The «voidable» stereotype does not give any information on whether or not a characteristic exists in the real world. This is expressed using the multiplicity:

- If a characteristic may or may not exist in the real world, its minimum cardinality shall be defined as 0. For example, an if an Address may or may not have a house number, the multiplicity of the corresponding property shall be 0..1.

- If at least one value for a certain characteristic exists in the real world, the minimum cardinality shall be defined as 1. For example, if an Administrative Unit always has at least one name, the multiplicity of the corresponding property shall be 1..*.

In both cases, the «voidable» stereotype can be applied. A value (the real value or void) only needs to be made available for properties that have a minimum cardinality of 1.

### 5.1.4 Code lists and Enumerations

#### 5.1.4.1 Style

All code lists and enumerations use the following modelling style:

- No initial value, but only the attribute name part, is used.

- The attribute name conforms to the rules for attributes names, i.e. is a lowerCamelCase name. Exceptions are words that consist of all uppercase letters (acronyms).

#### 5.1.4.2 Governance of code lists

Two types of code lists are defined in INSPIRE. These two types are distinguished using the tagged value “extendableByMS” in the UML data model:

- **Code lists that may not be extended by Member States**. For these code lists, the tagged value is set to “false”. They shall be managed centrally in the INSPIRE code list register, and only values from that register may be used in instance data.

- **Code lists that may be extended by Member States**. For these code lists, the tagged value is set to “true”.

---

**INSPIRE Reference: D2.8.III.7_v2.0**

**TWG-EF Data Specification on Environmental Monitoring Facilities**

**2011-06-20 Page 7**
5.2 Application schema <application schema name>

5.2.1 Description

Thematic working group *Environmental Monitoring Facilities* provides one application schema for the thematic area. The schema contains both aspects in scope for EF; at the one hand side the description of a monitoring facility and on the other hand the link to observations and measurements. The schema follows a generic approach which should enable thematic communities to use this structure across domains. The specifications and definitions provide sufficient flexibility to the thematic domains to bring their data in. Not to create a burden for thematic communities, the common elements defined in the data specification are kept to a minimum and are reduced to elements which are seen as essential for accessing environmental monitoring facilities in a common way and keep a common denominator across domains. But as intense discussions with experts from various domains showed, the requirements from the thematic domains are very different and harmonisation across themes is complex. The dimension of theme/domain specific harmonisation is not at all underestimated and stays with high priority regarding meaningful data exchange but cannot be covered by the application schema of EF. This would include agreed cross domain use of codes and shared requirements to provide information on environmental monitoring facilities. From this point of view the data specification EF should cover the requirements from specific thematic domains but as well provide an option for future developments.

The actual version 2.0 of thematic area EF covers the aspect of environmental monitoring facility description. The link to observations and measurements is included in the model provided but as well addressed by a guideline paper include correct reference here. The guideline document (DS-D2.9) on the common use of ISO 19156 Observations and Measurements (O&M) is developed by a specific working group including experts from the various INSPIRE themes (among which EF). Aspects regarding the use of O&M standard across domains and integration in INSPIRE not directly related to theme environmental monitoring facilities is covered by that guideline document.

The application schema contains 4 spatial object types. Environmental Monitoring Program, Environmental Monitoring Activity, Environmental Monitoring Network and Environmental Monitoring Facility are these 4 object types. The central spatial object type for both aspects of our scope. The narrative description focuses to explain the spatial object types as mentioned before and to explain their relations as well as for linking to observations and measurements using O&M ISO standard. For modelling reason two abstract classes are introduced to group common attributes shared between the spatial object types.

The overall idea of the model provided is that each thematic domain can decide based on their own requirements which level of detail is appropriate. The model does not imply a mandatory level of detail but gives the option to do where appropriate. The natural language description is structured starting with the spatial object type environmental monitoring facility as this spatial object type is core to understand the optional grouping.

**EnvironmentalMonitoringFacility (EMF)**

The Environmental Monitoring Facility spatial entity is the result of the information modeled in the EMF class itself but also in the 2 abstract classes mentioned above composed and has three important associations. The description of environmental monitoring facility shares elements with other spatial object types in EF model and therefore these attributes are collected in abstract classes. As all other spatial object types, an EMF has a geometry but includes for practical reasons in addition a
geometrical attribute “representative point” to facilitate the need to have a point representation in thematic context even if the initial one is different.

An Environmental Monitoring Facility can either be fix installed or mobile. As environmental monitoring facilities can be described at various levels of detail, the model provides a recursive hierarchical link between environmental monitoring facilities. This reflects the fact that a station can have various parts or a platform can host a number of sensors or measurement equipment. This cascade is modelled as an attributed association “hierarchy”. In case of mobile / removable parts of such a cascade equipment can be moved to another platform and is therefore linked to an explicit station only over a certain period of time, this association has a life time notion.

But not only link in a hierarchical approach where environmental monitoring facilities can reference other monitoring facilities is modelled. For cases where a monitoring facility is running out of operation and superseded by another one the genealogy link is modelled. This relation reflects that an environmental monitoring facility is superseded by another one. Main reason to integrate this in our model is to provide a mechanism which ensures that related observations can be interpreted as one time series and a continuum from a thematic point of view.

Figure 1: Schema of a hierarchical cascade of environmental monitoring facilities
The link “any thematic link” is model to reflect the issue that in various thematic setups a link between environmental monitoring facilities is needed to establish a relation independent from hierarchical or genealogical links. E.g. a water quantity monitoring facility is related to an upstream water quality monitoring station. The modelled link provides an option to thematic communities linking environmental monitoring facilities according to their internal specific needs.

The automated aggregation advanced processing starting from highest level of detail and constraints how to produce aggregates are in full responsibility of the thematic experts and can therefore not be part of the model of EF which has to stay in this aspect generic.
EnvironmentalMonitoringNetwork (EMN) is a spatial object type in the model which normally consists out of a number of environmental monitoring facilities. But to have one is not mandatory. This is caused by the fact that for various reason a data provider is not able or not willing to make information on the EnvironmentalMonitoringFacility level available (see Annex C.3 example Landscape monitoring in Sweden for a thematic need of restricted data availability). But it’s possible to provide information on the aggregated level of an environmental monitoring network including the option to have cascades of networks and sub networks. An environmental monitoring facility can belong to various environmental monitoring networks e.g. being part of a regional network and a national one.
An Environmental Monitoring Program (EMP) is a policy relevant description defining the target of a collection of observations and/or the deployment of Environmental Monitoring Facilities on the field. Usually an Environmental Monitoring Program has a long-term perspective over at least a few years. An Environmental Monitoring Program covers an area of interest (e.g. a region) and is based on environmental legislation. Even if more detailed information cannot be provided due to data privacy issues or thematic needs, the description of this spatial object type provides an overview and can be used for assessments and policy evaluation. So the information linked to Environmental Monitoring Program is relevant even if location of facilities is hidden. It provides a very general access point to environmental monitoring information and the most overarching view and can optional be cross domain implemented. Level of detail made available is on the thematic domain experts but not induced by the application schema.

The class AbstractMonitoringObject models all common elements shared between EMF, EMN and EMP. These attributes provide a common denominator between the core spatial object types and allow a grouping or access using the same attributes.

**Environmental Monitoring Activity (EMA)**

A fourth spatial object type is modeled within the theme environmental monitoring facilities - the Environmental Monitoring Activity. This object type expresses the need to describe environmental monitoring campaigns which are carried out with specific equipment for a specific period of time. Examples could be a tour of a vessel with monitoring equipment in the ocean or flights by an airplane hosting various sensors for airborne observations. These examples show the high relevance for mobile environmental monitoring facilities in relation to a long term perspective of environmental monitoring programs. The Environmental Monitoring Activity is modeled as a link from an EMF and EMN for specific time to Environmental Monitoring Program using the abstract class AbstractMonitoringFeature as their common element.
An essential part of the theme environmental monitoring facilities is to link to observations and measurements taken at an environmental monitoring facility. The link to the OM_Observation class reflects this direct connection which is possible from any environmental monitoring facility or environmental monitoring network. In addition, the class ObservingCapability is modelled to serve the need that a measurement regime can be described without providing the observed or measured value itself (caused e.g. by data privacy issues or because a reporting sheet does not require this). The class contains attributes to describe the operational time for a measurement regime, a process type value to distinguish between an INSPIRE_OM_process and SensorML as indication what is expected under the process relation (defined in O&M guidelines), the ResultNatureValue to express the related values are primary data, processed data or coming from simulation models and in case it is available information that the measurement regime is established to serve a specific need from a reporting obligation.

Together with the link to OM_Observation the class ObservingCapability establish a consistent link from environmental monitoring facility theme to the INSPIRE implementation of ISO FDIS 19156 Observations and Measurements. Consistency has to be assured between links from class ObservingCapability and observations. So if an observation is linked to an Environmental monitoring facility, this facility shall have an observing capability description as well. The Observing Capability has to reference to the identical Domain, Phenomenon and Process as the observation (see DS-D2.9).

**Open issue 4:** When we defined the ObservingCapability class, we realized that it may make sense to reuse the offering type from SOS. This still needs to be checked.

**Open issue 5:** A mapping must be defined for the SensorML encoding of Process (which attributes are to be stored in which sections of SensorML). This mapping is not necessary for testing purposes as the required information is provided for in the INSPIRE_OM_Process.
5.2.1.1.1. O&M Related Concepts and Attributes

The section is addressing those parts of the EF application schema which are related to the observations and measurements carried out at the facility. As mentioned in 5.1.1, ISO 19156 Geographic Information – Observations and Measurements (O&M; to be published, currently at “International Standard” stage) is to be used in INSPIRE application schemas for the provision of data on observations or measurements directly related to INSPIRE features. (Recommendation 6, chapter 9.2.6 GCM V3.3).

The INSPIRE EF Theme is one of the INSPIRE Themes making the strongest use of this standard. Thus, several O&M concepts have been included in the EF model for the present as a placeholder for future inclusion in the GCM. The decision which concepts are to be retained within the EF model and which are to be shifted to the GCM will be reached after the summer testing phase.

5.2.1.1.2. UML Overview – application schema Environmental Monitoring Facilities
Figure 8: UML class diagram: Overview of the EF application schema
5.2.1.2. Consistency between spatial data sets

5.2.1.3. Identifier management

5.2.1.4. Geometry representation

IR Requirement 3 The value domain of spatial properties used in this specification shall be restricted to the Simple Feature spatial schema as defined by EN ISO 19125-1.

NOTE The specification restricts the spatial schema to 0-, 1-, 2-, and 2.5-dimensional geometries where all curve interpolations are linear.

NOTE The topological relations of two spatial objects based on their specific geometry and topology properties can in principle be investigated by invoking the operations of the types defined in ISO 19107 (or the methods specified in EN ISO 19125-1).

5.2.1.5. Temporality representation

The application schema(s) use(s) the derived attributes "beginLifespanObject" and "endLifespanObject" to record the lifespan of a spatial object.

The attributes "beginLifespanVersion" specifies the date and time at which this version of the spatial object was inserted or changed in the spatial data set. The attribute "endLifespanVersion" specifies the date and time at which this version of the spatial object was superseded or retired in the spatial data set.

NOTE 1 The attributes specify the beginning of the lifespan of the version in the spatial data set itself, which is different from the temporal characteristics of the real-world phenomenon described by the spatial object. This lifespan information, if available, supports mainly two requirements: First, knowledge about the spatial data set content at a specific time; second, knowledge about changes to a data set in a specific time frame. The lifespan information should be as detailed as in the data set (i.e., if the lifespan information in the data set includes seconds, the seconds should be represented in data published in INSPIRE) and include time zone information.

NOTE 2 Changes to the attribute "endLifespanVersion" does not trigger a change in the attribute "beginLifespanVersion".

Recommendation 2 If life-cycle information is not maintained as part of the spatial data set, all spatial objects belonging to this data set should provide a void value with a reason of "unpopulated".
5.2.2 Feature catalogue

Table 3 - Feature catalogue metadata

<table>
<thead>
<tr>
<th>Feature catalogue name</th>
<th>INSPIRE feature catalogue Environmental Monitoring Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Environmental Monitoring Facilities</td>
</tr>
<tr>
<td>Version number</td>
<td>2.0</td>
</tr>
<tr>
<td>Version date</td>
<td>2011-06-15</td>
</tr>
<tr>
<td>Definition source</td>
<td>INSPIRE data specification Environmental Monitoring Facilities</td>
</tr>
</tbody>
</table>

Table 4 - Types defined in the feature catalogue

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
<th>Stereotypes</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>AbstractMonitoringFeature</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.1</td>
</tr>
<tr>
<td>AbstractMonitoringObject</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.2</td>
</tr>
<tr>
<td>AnyThematicLink</td>
<td>Environmental Facilities</td>
<td>Monitoring</td>
<td>5.3.1.2.1</td>
</tr>
<tr>
<td>ClassificationSchema</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.3</td>
</tr>
<tr>
<td>ClassificationUnit</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.4</td>
</tr>
<tr>
<td>EnvironmentalMonitoringActivity</td>
<td>Environmental Facilities</td>
<td>Monitoring</td>
<td>5.3.1.2.2</td>
</tr>
<tr>
<td>EnvironmentalMonitoringFacility</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.5</td>
</tr>
<tr>
<td>EnvironmentalMonitoringNetwork</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.6</td>
</tr>
<tr>
<td>EnvironmentalMonitoringProgram</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.7</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Environmental Facilities</td>
<td>Monitoring</td>
<td>5.3.1.2.3</td>
</tr>
<tr>
<td>INSPIRE_GF_PropertyType</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.8</td>
</tr>
<tr>
<td>INSPIRE_OM_Process</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.9</td>
</tr>
<tr>
<td>MeasurementRegimeValue</td>
<td>Environmental Facilities</td>
<td>Monitoring «codeList»</td>
<td>5.3.1.3.1</td>
</tr>
<tr>
<td>MediaValue</td>
<td>Environmental Facilities</td>
<td>Monitoring «codeList»</td>
<td>5.3.1.3.2</td>
</tr>
<tr>
<td>MobileValue</td>
<td>Environmental Facilities</td>
<td>Monitoring «codeList»</td>
<td>5.3.1.3.3</td>
</tr>
<tr>
<td>NetworkFacility</td>
<td>Environmental Facilities</td>
<td>Monitoring</td>
<td>5.3.1.2.4</td>
</tr>
<tr>
<td>ObservingCapability</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.10</td>
</tr>
<tr>
<td>OperationalActivityPeriod</td>
<td>Environmental Facilities</td>
<td>Monitoring «featureType»</td>
<td>5.3.1.1.11</td>
</tr>
<tr>
<td>ProcessParameter</td>
<td>Environmental Facilities</td>
<td>Monitoring «dataType»</td>
<td>5.3.1.2.5</td>
</tr>
<tr>
<td>ProcessTypeValue</td>
<td>Environmental Facilities</td>
<td>Monitoring «codeList»</td>
<td>5.3.1.3.4</td>
</tr>
<tr>
<td>ReportToLegalAct</td>
<td>Environmental Facilities</td>
<td>Monitoring «dataType»</td>
<td>5.3.1.2.6</td>
</tr>
</tbody>
</table>
5.2.2.1. Spatial object types

5.2.2.1.1. AbstractMonitoringFeature

AbstractMonitoringFeature (abstract)

<table>
<thead>
<tr>
<th>Name:</th>
<th>Abstract Monitoring Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtype of:</td>
<td>AbstractMonitoringObject</td>
</tr>
<tr>
<td>Definition:</td>
<td>An abstract base class for environmental monitoring features in the real world (Environmental Monitoring Network, Environmental Monitoring Facility)</td>
</tr>
<tr>
<td>Status:</td>
<td>Proposed</td>
</tr>
<tr>
<td>Stereotypes:</td>
<td>«featureType»</td>
</tr>
<tr>
<td>URI:</td>
<td>null</td>
</tr>
</tbody>
</table>

**Attribute: reportedTo**

| Value type: | ReportToLegalAct |
| Definition: | The Legal Act which the Abstract Monitoring Feature is reported to |
| Multiplicity: | 0..* |
| Stereotypes: | «voidable» |

**Association role: broader [the association has additional attributes - see association class Hierarchy]**

| Value type: | AbstractMonitoringFeature |
| Definition: | A link pointing to a broader definition of an Abstract Monitoring Feature. The link is pointing to the higher level in a hierarchical structure. |
| Multiplicity: | 0..1 |

**Association role: hasObservation**

| Value type: | OM.Observation |
| Definition: | The Observation(s) attached to the Abstract Monitoring Feature |
| Multiplicity: | 0..* |

**Association role: narrower [the association has additional attributes - see association class Hierarchy]**

| Value type: | AbstractMonitoringFeature |
| Definition: | A link pointing to a more detailed definition of an Abstract Monitoring Feature. The link point to the lower level in a hierarchical structure. |
| Multiplicity: | 0..* |

**Association role: observingCapability**

| Value type: | ObservingCapability |
| Definition: | A link pointing to the explicit capability of an Abstract Monitoring Feature. This provides a clean link between the observed property, the procedure used as well as the location of the measurement |
| Multiplicity: | 0..* |

**Association role: reportedTo [the association has additional attributes - see association class EnvironmentalMonitoringProgram]**

| Value type: | EnvironmentalMonitoringProgram |
| Definition: | Specific set of Abstract Monitoring Features used for a given thematic coherent concise timeframe in a specific area for a specific purpose. Usually the information collected is treated as one time step in a long term monitoring. |
**AbstractMonitoringFeature (abstract)**

| Description | For example a vessel could be equipped with a collection of Environmental Monitoring Facilities for given campaign (= Environmental Monitoring Activity) fulfilling one Environmental Monitoring Program needs. Then, after a given period this exact same vessel could be equipped with another set of Environmental Monitoring Facilities for another campaign fulfilling another Environmental Monitoring Program needs. |
| Multiplicity | 0..* |

**Constraint: Observation and ObservingCapability**

- **Natural language:** If you attach Observation(s) to an Abstract Monitoring Feature this must have an Observing Capability attached to it. The Observing Capability must reference the same Domain, Phenomenon and Process as the Observation.
- **OCL:** inv: hasObservation->notEmpty() -> observingCapability->notEmpty()

**Constraint: ObservationRequired**

- **Natural language:** If an Observation is required the Abstract Monitoring Feature should be linked to an OM_Observation
- **OCL:** inv: reportedTo.observationRequired=yes -> hasObservation->notEmpty()

5.2.2.1.2. **AbstractMonitoringObject**

**AbstractMonitoringObject (abstract)**

| Name | Abstract Monitoring Object |
| Definition | An abstract base class for environmental monitoring objects |
| Status | Proposed |
| Stereotypes | «featureType» |
| URI | null |

**Attribute: additionalDescription**

- **Value type:** CharacterString
- **Definition:** Plain text description of additional information not fitting in other attributes
- **Multiplicity:** 0..1

**Attribute: beginLifespan**

- **Value type:** DateTime
- **Definition:** Begin of the lifespan of the digital object
- **Multiplicity:** 1
- **Stereotypes:** «voidable»

**Attribute: endLifespan**

- **Value type:** DateTime
- **Definition:** End of the lifespan of the digital object
- **Multiplicity:** 0..1
- **Stereotypes:** «voidable»

**Attribute: geometry**

- **Value type:** GM_Object
- **Definition:** Geometry associated to the environmental monitoring object
- **Multiplicity:** 0..1

**Attribute: inspireId**

- **Value type:** Identifier
- **Definition:** External object identifier
- **Multiplicity:** 1

**Attribute: legalBackground**
<table>
<thead>
<tr>
<th>AbstractMonitoringObject (abstract)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> LegislationReference</td>
</tr>
<tr>
<td><strong>Definition:</strong> The legal act, in which the management and regulation of the environmental monitoring object is defined.</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..*</td>
</tr>
<tr>
<td><strong>Stereotypes:</strong> «voidable»</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> CharacterString</td>
</tr>
<tr>
<td><strong>Definition:</strong> Plain text denotation of the environmental monitoring object</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: responsibleParty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> CI_ResponsibleParty</td>
</tr>
<tr>
<td><strong>Definition:</strong> Responsible party for the environmental monitoring object</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..*</td>
</tr>
<tr>
<td><strong>Stereotypes:</strong> «voidable»</td>
</tr>
</tbody>
</table>

5.2.2.1.3. **ClassificationSchema**

**ClassificationSchema**

<table>
<thead>
<tr>
<th>Name: Classification Schema</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition:</strong> A Classification Schema is a structured domain groupings of Classification Units. The structure may be a simple flat list (code list), a hierarchy, a thesaurus or an ontology.</td>
</tr>
<tr>
<td><strong>Description:</strong> Examples of classification schema could be taxonomy, classification of chemicals, physical measurements</td>
</tr>
<tr>
<td><strong>Status:</strong> Proposed</td>
</tr>
<tr>
<td><strong>Stereotypes:</strong> «featureType»</td>
</tr>
<tr>
<td><strong>URI:</strong> null</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: inspireId</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> Identifier</td>
</tr>
<tr>
<td><strong>Definition:</strong> External object identifier</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> CharacterString</td>
</tr>
<tr>
<td><strong>Definition:</strong> Name of the Classification Schema</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: onlineResource</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value type:</strong> URI</td>
</tr>
<tr>
<td><strong>Definition:</strong> A link to an external document providing further information about the Classification Schema.</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..1</td>
</tr>
</tbody>
</table>

**Association role: unit**

<table>
<thead>
<tr>
<th>Value type: ClassificationUnit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition:</strong> Reference to an entry of a Classification Schema.</td>
</tr>
<tr>
<td><strong>Multiplicity:</strong> 0..*</td>
</tr>
</tbody>
</table>

5.2.2.1.4. **ClassificationUnit**

**ClassificationUnit**

| Name: Classification Unit |
**ClassificationUnit**

**Definition:**
A Classification Unit is a generic unit referencing to an entry of a Classification Schema. This can refer to one specific element or also to a thematic grouping, which may contain elements from different branches of a hierarchy.

**Status:** Proposed

**Stereotypes:** «featureType»

**URI:** null

**Attribute: inspireId**
- **Value type:** Identifier
- **Definition:** External object identifier
- **Multiplicity:** 1

**Attribute: name**
- **Value type:** CharacterString
- **Definition:** Name of the Classification Unit
- **Multiplicity:** 0..1

**Association role: baseProperty**
- **Value type:** INSPIRE_GF_PROPERTY
- **Definition:** An INSPIRE_GF_PROPERTY may refer to a Classification Unit for further definition of what was observed/measured (i.e. the abundance of a specific species or species group)
- **Multiplicity:** 0..*

**Association role: referringFrom**
- **Value type:** ClassificationUnit
- **Definition:** This relation is currently only sketched, it is a placeholder for complex structuring as often required in rich registries. Various roles, such as found in thesauri and ontologies (broader/narrower term, related term, disjunct term), should be extended as required per domain.
- **Multiplicity:** 0..*

**Association role: referringTo**
- **Value type:** ClassificationUnit
- **Definition:** This relation is currently only sketched, it is a placeholder for complex structuring as often required in rich registries. Various roles, such as found in thesauri and ontologies (broader/narrower term, related term, disjunct term), should be extended as required per domain.
- **Multiplicity:** 0..*

**Association role: schema**
- **Value type:** ClassificationSchema
- **Definition:** Reference to a Classification Schema.
- **Multiplicity:** 1..*

5.2.2.1.5. **EnvironmentalMonitoringFacility**

**EnvironmentalMonitoringFacility**

**Name:** Environmental Monitoring Facility

**Subtype of:** AbstractMonitoringFeature
**EnvironmentalMonitoringFacility**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value type</th>
<th>Definition</th>
<th>Multiplicity</th>
<th>Stereotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>measurementRegime</strong></td>
<td>MeasurementRegimeValue</td>
<td>Regime of the measurement</td>
<td>1</td>
<td>«voidable»</td>
</tr>
<tr>
<td><strong>mediaMonitored</strong></td>
<td>MediaValue</td>
<td>Monitored environmental medium</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td><strong>mobile</strong></td>
<td>MobileValue</td>
<td>Is the Environmental Monitoring Facility mobile during the acquisition of the observation or attached to a mobile Environmental Monitoring Facility</td>
<td>1</td>
<td>«voidable»</td>
</tr>
<tr>
<td><strong>representativePoint</strong></td>
<td>GM_Point</td>
<td>Representative location for the Environmental Monitoring Facility</td>
<td>0..1</td>
<td>«voidable»</td>
</tr>
<tr>
<td><strong>resultAcquisitionSource</strong></td>
<td>ResultAcquisitionSourceValue</td>
<td>Source of result acquisition</td>
<td>0..1</td>
<td>«voidable»</td>
</tr>
</tbody>
</table>
### EnvironmentalMonitoringFacility

**Association role: belongsTo** [the association has additional attributes - see association class NetworkFacility]

- **Value type**: EnvironmentalMonitoringNetwork
- **Definition**: A link pointing to all the Environmental Monitoring Network responsible for this Environmental Monitoring Facility
- **Multiplicity**: 0..*

**Association role: operationalActivityPeriod**

- **Value type**: OperationalActivityPeriod
- **Definition**: Lifespan of the physical object (station)
- **Multiplicity**: 1..*
- **Stereotypes**: «voidable»

**Association role: relatedTo** [the association has additional attributes - see association class AnyThematicLink]

- **Value type**: EnvironmentalMonitoringFacility
- **Definition**: Any Thematic Link to an Environmental Monitoring Facility
- **Multiplicity**: 0..*

**Association role: supersede**

- **Value type**: EnvironmentalMonitoringFacility
- **Definition**: In a genealogy, the Environmental Monitoring Facility that has been deactivated/replaced by another one
- **Multiplicity**: 0..*

**Association role: supersedeBy**

- **Value type**: EnvironmentalMonitoringFacility
- **Definition**: In a genealogy, the newly active Environmental Monitoring Facility
- **Multiplicity**: 0..*

### 5.2.2.1.6. EnvironmentalMonitoringNetwork

**EnvironmentalMonitoringNetwork**

- **Name**: Environmental Monitoring Network
- **Subtype of**: AbstractMonitoringFeature
- **Definition**: An Environmental Monitoring Network is an administrative/organisational grouping of Environmental Monitoring Facilities managed the same way for a specific purpose, targeting a specific area. Each network respects common rules aiming at ensuring coherence of the observations, especially for purposes of Environmental Monitoring Facilities, mandatory parameters selection, measurement methods and sampling regime.
- **Status**: Proposed
- **Stereotypes**: «featureType»
- **URI**: null

**Attribute: onlineResource**

- **Value type**: URI
- **Definition**: A link to an external document providing further information on the Environmental Monitoring Network.
- **Multiplicity**: 0..*
- **Stereotypes**: «voidable»

**Attribute: organisationalLevel**

- **Value type**: LegislationLevelValue
- **Definition**: Level of organisation
### EnvironmentalMonitoringNetwork

- **Multiplicity**: 1
- **Stereotypes**: «voidable»

**Association role**: contains [the association has additional attributes - see association class NetworkFacility]

- **Value type**: EnvironmentalMonitoringFacility
- **Definition**: A link pointing to all Environmental Monitoring Facilities included in this Environmental Monitoring Network
- **Multiplicity**: 0..*  

### EnvironmentalMonitoringProgram

**Name**: Environmental Monitoring Program

**Subtype of**: AbstractMonitoringObject

**Definition**: An Environmental Monitoring Program is a policy relevant document defining the target of a collection of observations and/or the deployment of Abstract Monitoring Features on the field. Usually an Environmental Monitoring Program has a long term perspective over at least a few years.

**Status**: Proposed

**Stereotypes**: «featureType»

**URI**: null

### INSPIRE_GF_PropertyType

**Name**: INSPIRE_GF_Property Type

**Definition**: An INSPIRE_GF_PropertyType from the media (or a subpart of the media) that contributes to evaluate its characteristics and/or quality and/or aptitude to some usages.

**Description**: An INSPIRE_GF_PropertyType could be elementary (i.e.: describing a ‘basic’ property) or compound (i.e.: based on elementary to calculate statistical values or categories).

**Status**: Proposed

**Stereotypes**: «featureType»

**URI**: null

#### Attribute: inspireId

- **Value type**: Identifier
- **Definition**: External object identifier
- **Multiplicity**: 1

#### Attribute: name

- **Value type**: CharacterString
- **Definition**: Name of the INSPIRE_GF_PropertyType
- **Multiplicity**: 0..1

#### Attribute: onlineResource

- **Value type**: URI
- **Definition**: A link to an external document providing further information about the INSPIRE_GF_PropertyType.
- **Multiplicity**: 0..1

#### Association role: classificationUnit

- **Value type**: ClassificationUnit
### INSPIRE_GF_PropertyType

**Definition:**
An INSPIRE_GF_PropertyType may refer to a Classification Unit for further definition of what was observed/measured (i.e. the abundance of a specific species or species group)

**Multiplicity:** 0..*

**Association role:** procedure

**Value type:** INSPIRE_OM_Process

**Definition:** INSPIRE_OM_Process could be referenced by INSPIRE_GF_PropertyType at different stages.

**Description:**
EXAMPLE 1: for chemical & physical INSPIRE_GF_PropertyTypes: sampling, conservation and transport, fractionnement, analysis

EXAMPLE 2: for environmental INSPIRE_GF_PropertyTypes: observation

EXAMPLE 3: for hydrobiological INSPIRE_GF_PropertyTypes: the global process

EXAMPLE 4: for micro-biological INSPIRE_GF_PropertyTypes: sampling, conservation and transport, determination

**Multiplicity:** 0..*

**Association role:** referringFrom

**Value type:** INSPIRE_GF_PropertyType

**Definition:** This relation is currently only sketched, it is a placeholder for complex structuring as often required in rich registries. Various roles, such as found in thesauri and ontologies (broader/narrower term, related term, disjunct term), should be extended as required per domain.

**Multiplicity:** 0..*

**Association role:** referringTo

**Value type:** INSPIRE_GF_PropertyType

**Definition:** This relation is currently only sketched, it is a placeholder for complex structuring as often required in rich registries. Various roles, such as found in thesauri and ontologies (broader/narrower term, related term, disjunct term), should be extended as required per domain.

**Multiplicity:** 0..*

5.2.2.1.9. **INSPIRE_OM_Process**

### INSPIRE_OM_Process

**Name:** INSPIRE_OM_Process

**Subtype of:** OM_Process

**Definition:** An INSPIRE_OM_Process explicitly describes the process used to reach a particular goal. (an observation or a measurement, or also how a sample was taken)

**Status:** Proposed

**Stereotypes:** «featureType»

**URI:** null

**Attribute:** inspireId

**Value type:** Identifier

**Definition:** External object identifier

**Multiplicity:** 1

**Attribute:** name
### INSPIRE_OM_Process

<table>
<thead>
<tr>
<th>Value type</th>
<th>CharacterString</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Name of the INSPIRE_OM_Process</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>0..1</td>
</tr>
</tbody>
</table>

#### Attribute: onlineResource

<table>
<thead>
<tr>
<th>Value type</th>
<th>URI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>A link to an external document providing further information about the INSPIRE_OM_Process</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>0..1</td>
</tr>
</tbody>
</table>

#### Attribute: processParameter

<table>
<thead>
<tr>
<th>Value type</th>
<th>ProcessParameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>The process parameter used in the related OM_Observation</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>0..*</td>
</tr>
</tbody>
</table>

#### Attribute: responsibleParty

<table>
<thead>
<tr>
<th>Value type</th>
<th>CI_ResponsibleParty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Responsible party for the INSPIRE_OM_Process</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>1..*</td>
</tr>
</tbody>
</table>

#### Association role: property

<table>
<thead>
<tr>
<th>Value type</th>
<th>INSPIRE_GF_PropertyType</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>INSPIRE_OM_Process could be referenced by INSPIRE_GF_PropertyType at different stages.</td>
</tr>
<tr>
<td>Description</td>
<td>EXAMPLE 1: for chemical &amp; physical INSPIRE_GF_PropertyTypes: sampling, conservation and transport, fractionnement, analysis</td>
</tr>
<tr>
<td></td>
<td>EXAMPLE 2: for environmental INSPIRE_GF_PropertyTypes: observation</td>
</tr>
<tr>
<td></td>
<td>EXAMPLE 3: for hydrobiological INSPIRE_GF_PropertyTypes: the global process</td>
</tr>
<tr>
<td></td>
<td>EXAMPLE 4: for micro-biological INSPIRE_GF_PropertyTypes: sampling, conservation and transport, determination</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>0..*</td>
</tr>
</tbody>
</table>

#### Association role: referringFrom

<table>
<thead>
<tr>
<th>Value type</th>
<th>INSPIRE_OM_Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiplicity</td>
<td>0..*</td>
</tr>
</tbody>
</table>

#### Association role: referringTo

<table>
<thead>
<tr>
<th>Value type</th>
<th>INSPIRE_OM_Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>This relation is currently only sketched, it is a placeholder for complex structuring as often required in rich registries. Various roles, such as found in thesauri and ontologies (broader/narrower term, related term, disjunct term), should be extended as required per domain.</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>0..*</td>
</tr>
</tbody>
</table>

### 5.2.2.1.10. ObservingCapability

#### ObservingCapability

<table>
<thead>
<tr>
<th>Name</th>
<th>Observing Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Explicit capability of an Abstract Monitoring Feature</td>
</tr>
<tr>
<td>Status</td>
<td>Proposed</td>
</tr>
<tr>
<td>Stereotypes</td>
<td>«featureType»</td>
</tr>
</tbody>
</table>
### ObservingCapability

<table>
<thead>
<tr>
<th>Attribute: observingTime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: TM_Object</td>
</tr>
<tr>
<td>Definition: Describes the time period that observations can be expected from this Abstract Monitoring Feature. Can be only a start time for running measurements or an interval in the case that the facility is only in operation at certain times</td>
</tr>
<tr>
<td>Multiplicity: 1</td>
</tr>
<tr>
<td>Stereotypes: «voidable»</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: processType</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: ProcessTypeValue</td>
</tr>
<tr>
<td>Definition: The type of object used for describing the process</td>
</tr>
<tr>
<td>Multiplicity: 1</td>
</tr>
<tr>
<td>Stereotypes: «voidable»</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: reportedTo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: ReportToLegalAct</td>
</tr>
<tr>
<td>Definition: If this capabilities setup was created to support data acquisition based on a legal act, the legal act should be linked here</td>
</tr>
<tr>
<td>Multiplicity: 0..*</td>
</tr>
<tr>
<td>Stereotypes: «voidable»</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute: resultNature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: ResultNatureValue</td>
</tr>
<tr>
<td>Definition: State of the provided result</td>
</tr>
<tr>
<td>Multiplicity: 1</td>
</tr>
<tr>
<td>Stereotypes: «voidable»</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Association role: featureOfInterest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: GFI_Feature</td>
</tr>
<tr>
<td>Definition: This feature is the real-world object whose properties are under observation, or is a feature intended to sample the real-world object.</td>
</tr>
<tr>
<td>Description: Parallel to the domain link on OM_Observation</td>
</tr>
<tr>
<td>Multiplicity: 0..1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Association role: observedProperty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: GF_PropertyType</td>
</tr>
<tr>
<td>Definition: The association Phenomenon links to the GF_PropertyType for which the corresponding OM_Observation:result provides an estimate of its value.</td>
</tr>
<tr>
<td>Description: Parallel to the phenomenon link on OM_Observation</td>
</tr>
<tr>
<td>Multiplicity: 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Association role: procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value type: OM_Process</td>
</tr>
<tr>
<td>Definition: Link to the Process used to generate the result. The OM_Process shall be suitable for the observed property. As a corollary, details of the observed property are constrained by the procedure used.</td>
</tr>
<tr>
<td>Description: Parallel to the ProcessUsed link on OM_Process</td>
</tr>
<tr>
<td>Multiplicity: 1</td>
</tr>
</tbody>
</table>

5.2.2.11. OperationalActivityPeriod

### OperationalActivityPeriod

| Name: Operational Activity Period |
## OperationalActivityPeriod

| Definition | Correspond to a period during which the Environmental Monitoring Facility has been used and, thus, collecting observation(s) |
| Status     | Proposed |
| Stereotypes | «featureType» |
| URI        | null |

### Attribute: `activityTime`

- **Value type**: TM_Object
- **Definition**: Lifespan of the Operational Activity Period
- **Multiplicity**: 1

## 5.2.2.2. Data types

### 5.2.2.2.1. AnyThematicLink

<table>
<thead>
<tr>
<th>AnyThematicLink (association class)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong>: Any Thematic Link</td>
</tr>
<tr>
<td><strong>Status</strong>: Proposed</td>
</tr>
<tr>
<td><strong>URI</strong>: null</td>
</tr>
</tbody>
</table>

### Attribute: `comment`

- **Value type**: CharacterString
- **Multiplicity**: 1
- **Stereotypes**: «voidable»

### 5.2.2.2.2. EnvironmentalMonitoringActivity

<table>
<thead>
<tr>
<th>EnvironmentalMonitoringActivity (association class)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong>: Environmental Monitoring Activity</td>
</tr>
<tr>
<td><strong>Definition</strong>: Specific set of Abstract Monitoring Features used for a given thematic coherent concise timeframe in a specific area for a specific purpose. Usually the information collected is treated as one time step in a long term monitoring.</td>
</tr>
<tr>
<td><strong>Description</strong>: For example a vessel could be equipped with a collection of Environmental Monitoring Facilities for given campaign (= Environmental Monitoring Activity) fulfilling one Environmental Monitoring Program needs. Then, after a given period this exact same vessel could be equipped with another set of Environmental Monitoring Facilities for another campaign fulfilling another Environmental Monitoring Program needs.</td>
</tr>
<tr>
<td><strong>Status</strong>: Proposed</td>
</tr>
<tr>
<td><strong>URI</strong>: null</td>
</tr>
</tbody>
</table>

### Attribute: `activityConditions`

- **Value type**: CharacterString
- **Definition**: Textual description of the Environmental Monitoring Activity
- **Multiplicity**: 1
- **Stereotypes**: «voidable»

### Attribute: `activityTime`

- **Value type**: TM_Object
- **Definition**: Lifespan of the Environmental Monitoring Activity
- **Multiplicity**: 1
- **Stereotypes**: «voidable»

## 5.2.2.2.3. Hierarchy

<table>
<thead>
<tr>
<th>Hierarchy (association class)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong>: Hierarchy</td>
</tr>
</tbody>
</table>
### Hierarchy (association class)

**Definition:** Lifespan of the hierarchical link between Environmental Monitoring Features  
**Status:** Proposed  
**URI:** null

<table>
<thead>
<tr>
<th>Attribute: linkingTime</th>
</tr>
</thead>
</table>
| **Value type:** TM_Object  
**Definition:** Lifespan of the link  
**Multiplicity:** 1  
**Stereotypes:** «voidable» |

### NetworkFacility (association class)

**Name:** Network Facility  
**Definition:** Lifespan of the link between Environmental Monitoring Network and Environmental Monitoring Facility  
**Status:** Proposed  
**URI:** null

<table>
<thead>
<tr>
<th>Attribute: linkingTime</th>
</tr>
</thead>
</table>
| **Value type:** TM_Object  
**Definition:** Lifespan of the link  
**Multiplicity:** 1  
**Stereotypes:** «voidable» |

### ProcessParameter

**Name:** Process Parameter  
**Definition:** The parameter used in a given observation acquisition. When referred by a given INSPIRE_OM_Process a parameter must appear in the OM_Observation.  
**Status:** Proposed  
**Stereotypes:** «dataType»  
**URI:** null

<table>
<thead>
<tr>
<th>Attribute: description</th>
</tr>
</thead>
</table>
| **Value type:** CharacterString  
**Definition:** Description of the given parameter  
**Multiplicity:** 1 |

<table>
<thead>
<tr>
<th>Attribute: onlineResource</th>
</tr>
</thead>
</table>
| **Value type:** URI  
**Definition:** A link to an external document providing further information about the process parameter.  
**Multiplicity:** 1 |

### ReportToLegalAct

**Name:** Report To Legal Act  
**Definition:** In the case that the information is used in the process of reporting triggered by an obligation or voluntary agreement, the reporting envelope should be stored here. The information is specific per submitted reporting envelope and not per obligation/agreement.  
**Description:** From INSPIRE perspective, a monitoring feature requires the provision of Observations only in the case that these have been required under a given reporting obligation or a commonly agreed voluntarily based one.
### ReportToLegalAct

<table>
<thead>
<tr>
<th>Status</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereotypes</td>
<td>«dataType»</td>
</tr>
<tr>
<td>URI</td>
<td>null</td>
</tr>
</tbody>
</table>

**Attribute: legalAct**

<table>
<thead>
<tr>
<th>Value type</th>
<th>LegislationReference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>LegalAct which is reported to</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>1</td>
</tr>
</tbody>
</table>

**Attribute: observationRequired**

<table>
<thead>
<tr>
<th>Value type</th>
<th>Boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Is an observation required?</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>1</td>
</tr>
<tr>
<td>Stereotypes</td>
<td>«voidable»</td>
</tr>
</tbody>
</table>

**Attribute: reportDate**

<table>
<thead>
<tr>
<th>Value type</th>
<th>DateTime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Time of reporting</td>
</tr>
<tr>
<td>Multiplicity</td>
<td>1</td>
</tr>
<tr>
<td>Stereotypes</td>
<td>«voidable»</td>
</tr>
</tbody>
</table>

### 5.2.2.3. Code lists

#### 5.2.2.3.1. MeasurementRegimeValue

**Name:** Measurement Regime

**Definition:** Defines categories for different types of the MeasurementRegime

**Status:** Proposed

**Governance:** May not be extended by Member States.

**URI:** 

**Value: continuous data collection**

**Definition:** Data is collected on a continuous basis. there is usually no end date, as further data is collected

**Value: demand driven data collection**

**Definition:** Data is collected on demand.

**Value: once-off data collection**

**Definition:** Data is collected only once in this configuration. no further observations in this configuration can be expected

**Value: periodic data collection**

**Definition:** Data is collected at regular intervals. No information is available at to the data collection interval.

#### 5.2.2.3.2. MediaValue

**Name:** Media

**Definition:** Defines categories for different types of Media

**Status:** Proposed

**Governance:** May not be extended by Member States.
### MediaValue

**URI:**

**Value:** air

**Value:** marine

**Value:** sediment

**Value:** soil

**Value:** waste

**Value:** water

#### 5.2.2.3.3. MobileValue

**MobileValue**

<table>
<thead>
<tr>
<th>Name:</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition:</td>
<td>Defines categories for different types of the mobility</td>
</tr>
<tr>
<td>Status:</td>
<td>Proposed</td>
</tr>
<tr>
<td>Stereotypes:</td>
<td>«codeList»</td>
</tr>
<tr>
<td>Governance:</td>
<td>May not be extended by Member States.</td>
</tr>
</tbody>
</table>

**Value: inherited**

- **Definition:** Station is mobile or fixed during the acquisition of the observation. This can be determined by navigating up the hierarchy of the Abstract Monitoring Feature via the "broader" association.

**Value: no**

- **Definition:** Station is geographically fixed during the acquisition of the observation

**Value: yes**

- **Definition:** Station is mobile during the acquisition of the observation

#### 5.2.2.3.4. ProcessTypeValue

**ProcessTypeValue**

<table>
<thead>
<tr>
<th>Name:</th>
<th>Process Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition:</td>
<td>Defines categories for different process types</td>
</tr>
<tr>
<td>Status:</td>
<td>Proposed</td>
</tr>
<tr>
<td>Stereotypes:</td>
<td>«codeList»</td>
</tr>
<tr>
<td>Governance:</td>
<td>May not be extended by Member States.</td>
</tr>
</tbody>
</table>

**Value: INSPIRE_OM_Process**

- **Definition:** Indicates that the class used for the description of methodological information in the ProcessUsed of the Observation is INSPIRE_OM_Process
### ProcessTypeValue

**Value: SensorML**

**Definition:** Indicates that the class used for the description of methodological information in the ProcessUsed of the Observation is SensorML

### 5.2.2.3.5. ResultAcquisitionSourceValue

**Name:** Result Acquisition Source

**Definition:** Defines categories for different types of the ResultAcquisitionSource

**Status:** Proposed

**Stereotypes:** «codeList»

**Governance:** May not be extended by Member States.

**URI:**

<table>
<thead>
<tr>
<th><strong>Value</strong></th>
<th><strong>Definition</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ex-situ</td>
<td>The sampling feature is a specimen taken from the ultimate FeatureOfInterest (i.e. the sampledFeature). The measurement process if performed at a different location.</td>
</tr>
<tr>
<td>in-situ</td>
<td>The sampling feature is co-located with the ultimate FeatureOfInterest (i.e. the sampledFeature). The measurement process if performed at this location.</td>
</tr>
<tr>
<td>remote-sensing</td>
<td>The sampling feature is the ultimate FeatureOfInterest (i.e. the sampledFeature). The measurement process if performed at a different location (but no sample taken).</td>
</tr>
</tbody>
</table>

### 5.2.2.3.6. ResultNatureValue

**Name:** Result Nature

**Definition:** State of the result of an observation

**Status:** Proposed

**Stereotypes:** «codeList»

**Governance:** May not be extended by Member States.

**URI:**

<table>
<thead>
<tr>
<th><strong>Value</strong></th>
<th><strong>Definition</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>primary</td>
<td>The result provided with the observation is the direct result of an estimate of a property on the featureOfInterest. No further processing has been performed. Processing may have taken place, but only in the sense of the measurement methodology itself, i.e. converting the millivolt returned from the sensor to the concentration of a substance.</td>
</tr>
<tr>
<td>processed</td>
<td>The result provided, while usually based on primary measurements, has been substantially processed. This processing can be of diverse natures, in some situations complex aggregates are provided, in other situations, the existing values are interpolated to a continuum.</td>
</tr>
<tr>
<td>simulated</td>
<td>The result provided, while usually based on primary measurements, is based on an interpretation model, and provides a simulation of past or future states of the media being analyzed. In this case, the existing values are usually extrapolated into the past or future.</td>
</tr>
</tbody>
</table>
5.2.2.4. **Imported types (informative)**

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

### 5.2.2.4.1. Boolean

<table>
<thead>
<tr>
<th>Boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Truth [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.2. CI_ResponsibleParty

<table>
<thead>
<tr>
<th>CI_ResponsibleParty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19115:2006 Metadata (Corrigendum)::Citation and responsible party information [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.3. CharacterString

<table>
<thead>
<tr>
<th>CharacterString</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Text [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.4. DateTime

<table>
<thead>
<tr>
<th>DateTime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Date and Time [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.5. GFI_Feature

<table>
<thead>
<tr>
<th>GFI_Feature (abstract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19156 Observations and Measurements::ISO FDIS 19156:2011 Observations and Measurements::General Feature Instance [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.6. GF_PropertyType

<table>
<thead>
<tr>
<th>GF_PropertyType</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19109 Application Schema::General Feature Model [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>

### 5.2.2.4.7. GM_Object

<table>
<thead>
<tr>
<th>GM_Object (abstract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package: INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19107:2003 Spatial Schema::Geometry::Geometry root [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]</td>
</tr>
</tbody>
</table>
5.2.2.4.8. **GM_Point**

**GM_Point**

| Package: | INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19107:2003 Spatial Schema:: Geometry::Geometric primitive [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

5.2.2.4.9. **Identifier**

**Identifier**

| Package: | INSPIRE Consolidated UML Model::Generic Conceptual Model::Base Types [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

**Definition:** Internal unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.

**Description:**

- **NOTE 1** External object identifiers are distinct from thematic object identifiers.
- **NOTE 2** The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same object.
- **NOTE 3** The unique identifier will not change during the life-time of a spatial object.

5.2.2.4.10. **LegislationLevelValue**

**LegislationLevelValue**

| Package: | INSPIRE Consolidated UML Model::Generic Conceptual Model::Base Types 2 [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

**Definition:** The level at which a legal act or convention has been adopted.

5.2.2.4.11. **LegislationReference**

**LegislationReference**

| Package: | INSPIRE Consolidated UML Model::Generic Conceptual Model::Base Types 2 [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

**Definition:** Information to unambiguously reference a legal act or a specific part of a legal act.

5.2.2.4.12. **OM_Observation**

**OM_Observation**

| Package: | INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19156 Observations and Measurements::ISO FDIS 19156:2011 Observations and Measurements::Observation schema::observation [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

5.2.2.4.13. **OM_Process**

**OM_Process (abstract)**

| Package: | INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19156 Observations and Measurements::ISO FDIS 19156:2011 Observations and Measurements::Observation schema::observation [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM] |

5.2.2.4.14. **TM_Object**

**TM_Object**
6 Reference systems

6.1 Coordinate reference systems

6.1.1 Datum

IR Requirement 4 For the coordinate reference systems used for making available the INSPIRE spatial data sets, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, and the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well established and described relationship between both systems, according to EN ISO 19111.

6.1.2 Coordinate reference systems

IR Requirement 5 INSPIRE spatial data sets shall be made available using one of the three-dimensional, two-dimensional or compound coordinate reference systems specified in the list below.

Other coordinate reference systems than those listed below may only be used for regions outside of continental Europe. The geodetic codes and parameters for these coordinate reference systems shall be documented, and an identifier shall be created, according to EN ISO 19111 and ISO 19127.

1. Three-dimensional Coordinate Reference Systems
   - Three-dimensional Cartesian coordinates
   - Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height), using the parameters of the GRS80 ellipsoid
2. Two-dimensional Coordinate Reference Systems
   - Two-dimensional geodetic coordinates, using the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Lambert Azimuthal Equal Area projection and the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Lambert Conformal Conic projection and the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Transverse Mercator projection and the parameters of the GRS80 ellipsoid

3. Compound Coordinate Reference Systems
   - For the horizontal component of the compound coordinate reference system, one of the two-dimensional coordinate reference systems specified above shall be used
   - For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope
   - Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS. The geodetic codes and parameters for these vertical reference systems shall be documented and an identifier shall be created, according to EN ISO 19111 and ISO 19127
   - For the vertical component measuring the depth of the sea floor, where there is an appreciable tidal range, the Lowest Astronomical Tide shall be used as reference surface. In marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 m, the depth of the sea floor shall be referenced to the Mean Sea Level
   - For the vertical component measuring depths above the sea floor in the free ocean, barometric pressure shall be used
   - For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere shall be used

6.1.3 Display

**IR Requirement 6** For the display of the INSPIRE spatial data sets with the View Service specified in D003152/02 Draft Commission Regulation implementing Directive 2007/2/EC of the European Parliament and of the Council as regards Network Services, at least the two dimensional geodetic coordinate system shall be made available.

6.1.4 Identifiers for coordinate reference systems

**IR Requirement 7** For referring to the non-compound coordinate reference systems listed in this Section, the identifiers listed below shall be used.

For referring to a compound coordinate reference system, an identifier composed of the identifier of the horizontal component, followed by a slash (/), followed by the identifier of the vertical component, shall be used.

- ETRS89-XYZ for Cartesian coordinates in ETRS89
- ETRS89-GRS80h for three-dimensional geodetic coordinates in ETRS89 on the GRS80 ellipsoid
- ETRS89-GRS80 for two-dimensional geodetic coordinates in ETRS89 on the GRS80
- EVRS for height in EVRS
- LAT for depth of the sea floor, where there is an appreciable tidal range
- MSL for depth of the sea floor, in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200m
- ISA for pressure coordinate in the free atmosphere
- PFO for Pressure coordinate in the free ocean
- ETRS89-LAEA for ETRS89 coordinates projected into plane coordinates by the Lambert Azimuthal Equal Area projection
6.2 Temporal reference system

**IR Requirement 8** The Gregorian Calendar shall be used for as a reference system for date values, and the Universal Time Coordinated (UTC) or the local time including the time zone as an offset from UTC shall be used as a reference system for time values.

6.3 Theme-specific requirements and recommendations on reference systems

The data specification EF does not specify any specific requirements or recommendations on reference systems. This is due to the fact that the model provided follow a generic approach which can be potentially integrated in models of various domains. Specific requirements and recommendations are caused by specific thematic needs and therefore belong fully to the environmental thematic domains including parts or full model of data specification EF.

7 Data quality

This chapter includes a description of data quality elements and sub-elements as well as the associated data quality measures (section 7.1). The selected data quality measures should be used to evaluate quality of data sets for a specific data quality element / sub-element. The evaluation can be performed at the level of spatial object, spatial object type, dataset or dataset series.

The results of the evaluation are then reported at the spatial object type or dataset level in metadata utilising the same data quality elements and measures (see chapter 8).

**NOTE** The selection of appropriate data quality measures represents the first step towards the harmonisation of documenting data quality.

In addition, for some of the data quality elements described in section 7.1, minimum data quality requirements or recommendations may be defined. These are described in the section 1.2.

**Recommendation 1** If data quality information is required at spatial object level then it should be modelled in the data model as an attribute of a relevant spatial object type.

Data quality elements which could be related to an environmental monitoring facility are not defined. In many cases there are detailed quality requirements related to the result of an observation or measurement. But these quality criteria should be the thematic domain community level as for specific needs these requirements can differ between the various domains to fit for their use. Taking this into account, a definition of quality criteria across domain in data specification EF is not provided. But see for result related quality aspects the guidelines of O&M use (DS-D2.9)

According to this approach there is as well no minimum data quality requirement.

7.1 Data quality elements and measures

No data quality elements for quantitative evaluation are defined for this theme.
7.2 Minimum data quality requirements and recommendations

No minimum data quality requirements are defined.

No minimum data quality recommendations are defined.

8 Dataset-level metadata

Metadata can be reported for each individual spatial object (spatial object-level metadata) or once for a complete dataset or dataset series (dataset-level metadata). Spatial object-level metadata is fully described in the application schema (section 5). If data quality elements are used at spatial object level, the documentation shall refer to the appropriate definition in section 7. This section only specifies dataset-level metadata elements.

For some dataset-level metadata elements, in particular on data quality and maintenance, a more specific scope can be specified. This allows the definition of metadata at sub-dataset level, e.g. separately for each spatial object type. When using ISO 19115/19139 to encode the metadata, the following rules should be followed:

- The scope element (of type DQ_Scope) of the DQ_DataQuality subtype should be used to encode the scope.
- Only the following values should be used for the level element of DQ_Scope: Series, Dataset, featureType.
- If the level is featureType the levelDescription/MDScopeDescription/features element (of type Set<GF_FeatureType>) shall be used to list the feature type names.

NOTE The value featureType is used to denote spatial object type.

Mandatory or conditional metadata elements are specified in Section 8.1. Optional metadata elements are specified in Section 8. The tables describing the metadata elements contain the following information:

- The first column provides a reference to a more detailed description.
- The second column specifies the name of the metadata element.
- The third column specifies the multiplicity.
- The fourth column specifies the condition, under which the given element becomes mandatory (only for Table 2 and Table 3).

8.1 Common metadata elements
metadata elements required by Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata) for spatial datasets and spatial dataset series (Table 2) as well as the metadata elements specified in Table 3.

Table 2 – Metadata for spatial datasets and spatial dataset series specified in Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata)

<table>
<thead>
<tr>
<th>Metadata Regulation Section</th>
<th>Metadata element</th>
<th>Multiplicity</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Resource title</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Resource abstract</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Resource type</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Resource locator</td>
<td>0..*</td>
<td>Mandatory if a URL is available to obtain more information on the resource, and/or access related services.</td>
</tr>
<tr>
<td>1.5</td>
<td>Unique resource identifier</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>Resource language</td>
<td>0..*</td>
<td>Mandatory if the resource includes textual information.</td>
</tr>
<tr>
<td>2.1</td>
<td>Topic category</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Keyword</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Geographic bounding box</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Temporal reference</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Lineage</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>Spatial resolution</td>
<td>0..*</td>
<td>Mandatory for data sets and data set series if an equivalent scale or a resolution distance can be specified.</td>
</tr>
<tr>
<td>7</td>
<td>Conformity</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td>Conditions for access and use</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>8.2</td>
<td>Limitations on public access</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Responsible organisation</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>10.1</td>
<td>Metadata point of contact</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>10.2</td>
<td>Metadata date</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10.3</td>
<td>Metadata language</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 – Mandatory and conditional common metadata elements
<table>
<thead>
<tr>
<th>Metadata element</th>
<th>Multiplicity</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1.1 Coordinate Reference System</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8.1.2 Temporal Reference System</td>
<td>0..*</td>
<td>Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.</td>
</tr>
<tr>
<td>8.1.3 Encoding</td>
<td>1..*</td>
<td></td>
</tr>
<tr>
<td>8.1.4 Character Encoding</td>
<td>0..*</td>
<td>Mandatory, if an encoding is used that is not based on UTF-8.</td>
</tr>
<tr>
<td>8.1.5 Data Quality – Logical Consistency – Topological Consistency</td>
<td>0..*</td>
<td>Mandatory, if the data set includes types from the Generic Network Model and does not assure centreline topology (connectivity of centrelines) for the network.</td>
</tr>
</tbody>
</table>

### 8.1.1 Coordinate Reference System

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>Coordinate Reference System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Description of the coordinate reference system used in the dataset.</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td>13. referenceSystemInfo</td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td>referenceSystemInfo</td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>mandatory</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>1</td>
</tr>
<tr>
<td>Data type(and ISO 19115 no.)</td>
<td>189. MD_CRS</td>
</tr>
</tbody>
</table>

**Domain**

Either the referenceSystemIdentifier (RS_Identifier) or the projection (RS_Identifier), ellipsoid (RS_Identifier) and datum (RS_Identifier) properties shall be provided.

**NOTE** More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.

**Example**

referenceSystemIdentifier:
- code: ETRS_89
- codeSpace: INSPIRE RS registry
### Example XML encoding

```xml
<gmd:referenceSystemInfo>
  <gmd:MD_ReferenceSystem>
    <gmd:referenceSystemIdentifier>
      <gmd:RS_Identifier>
        <gmd:code>
          <gco:CharacterString>ETRS89</gco:CharacterString>
        </gmd:code>
        <gmd:codeSpace>
          <gco:CharacterString>INSPIRE RS registry</gco:CharacterString>
        </gmd:codeSpace>
      </gmd:RS_Identifier>
    </gmd:referenceSystemIdentifier>
  </gmd:MD_ReferenceSystem>
</gmd:referenceSystemInfo>
```

### Comments

#### 8.1.2 Temporal Reference System

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>Temporal Reference System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Description of the temporal reference systems used in the dataset.</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td>13. referenceSystemInfo</td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td>referenceSystemInfo</td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>0..*</td>
</tr>
<tr>
<td>Data type(and ISO 19115 no.)</td>
<td>186. MD_ReferenceSystem</td>
</tr>
</tbody>
</table>

#### Domain

No specific type is defined in ISO 19115 for temporal reference systems. Thus, the generic MD_ReferenceSystem element and its reference SystemIdentifier (RS_Identifier) property shall be provided.

**NOTE** More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.

#### Implementing instructions

- referenceSystemIdentifier:
  - code: GregorianCalendar
  - codeSpace: INSPIRE RS registry
### Example XML encoding

```xml
<gmd:referenceSystemInfo>
  <gmd:MD_ReferenceSystem>
    <gmd:referenceSystemIdentifier>
      <gmd:RS_Identifier>
        <gmd:code>
          <gco:CharacterString>GregorianCalendar</gco:CharacterString>
        </gmd:code>
        <gmd:codeSpace>
          <gco:CharacterString>INSPIRE RS registry</gco:CharacterString>
        </gmd:codeSpace>
      </gmd:RS_Identifier>
    </gmd:referenceSystemIdentifier>
  </gmd:MD_ReferenceSystem>
</gmd:referenceSystemInfo>
```

### Comments

8.1.3 Encoding

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td>271. distributionFormat</td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td>distributionInfo/MD_Distribution/distributionFormat</td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>mandatory</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>1</td>
</tr>
<tr>
<td>Data type (and ISO 19115 no.)</td>
<td>284. MD_Format</td>
</tr>
<tr>
<td>Domain</td>
<td>See B.2.10.4. The property values (name, version, specification) specified in section 9 shall be used to document the default and alternative encodings.</td>
</tr>
<tr>
<td>Implementing instructions</td>
<td></td>
</tr>
</tbody>
</table>

**Example**

```
example: Environmental Monitoring Facilities GML application schema
version: version 2.0, GML, version 3.2.1
```

```xml
<gmd:MD_Format>
  <gmd:name>
    <gco:CharacterString>Environmental Monitoring Facilities GML application schema</gco:CharacterString>
  </gmd:name>
  <gmd:version>
    <gco:CharacterString>2.0, GML, version 3.2.1</gco:CharacterString>
  </gmd:version>
  <gmd:specification>
  </gmd:specification>
</gmd:MD_Format>
```
8.1.4 Character Encoding

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>Character Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>The character encoding used in the data set.</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td></td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td></td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>Mandatory, if an encoding is used that is not based on UTF-8.</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>0..*</td>
</tr>
<tr>
<td>Data type (and ISO 19115 no.)</td>
<td></td>
</tr>
<tr>
<td>Domain</td>
<td></td>
</tr>
<tr>
<td>Implementing instructions</td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
</tr>
</tbody>
</table>

8.1.5 Data Quality – Logical Consistency – Topological Consistency

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>Data Quality – Logical Consistency – Topological Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Correctness of the explicitly encoded topological characteristics of the dataset as described by the scope</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td>18. dataQualityInfo</td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td>dataQualityInfo</td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>Mandatory, if the data set includes types from the Generic Network Model and does not assure centreline topology (connectivity of centrelines) for the network.</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>0..*</td>
</tr>
<tr>
<td>Data type (and ISO 19115 no.)</td>
<td>115. DQ_TopologicalConsistency</td>
</tr>
<tr>
<td>Domain</td>
<td>Lines 100-107 from ISO 19115</td>
</tr>
<tr>
<td>Implementing instructions</td>
<td>This metadata should be filled, at least, with these elements:</td>
</tr>
<tr>
<td></td>
<td>- valueUnit: UnitOfMeasure</td>
</tr>
<tr>
<td></td>
<td>- value: Record</td>
</tr>
<tr>
<td>Example</td>
<td></td>
</tr>
<tr>
<td>Example XML encoding</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td>See clauses on topological consistency in section 7 for detailed information. This metadata element is mandatory if connectivity is not assured for network centrelines in the dataset. In this case the Connectivity tolerance parameter – as described in section 7 – must be provided in order to ensure automatic and unambiguous creation of centreline topology in post-process.</td>
</tr>
</tbody>
</table>

8.2 Metadata elements for reporting data quality
**Recommendation 2** For reporting the results of the data quality evaluation quantitatively, the data quality elements and measures defined in chapter 7 should be used.

The scope for reporting may be different from the scope for evaluating data quality (see section 7). If data quality is reported at the data set or spatial object type level, the results are usually derived or aggregated.

<table>
<thead>
<tr>
<th>Metadata element name</th>
<th>See chapter 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>See chapter 7</td>
</tr>
<tr>
<td>ISO 19115 number and name</td>
<td>80. report</td>
</tr>
<tr>
<td>ISO/TS 19139 path</td>
<td>dataQualityInfo/*/report</td>
</tr>
<tr>
<td>INSPIRE obligation / condition</td>
<td>optional</td>
</tr>
<tr>
<td>INSPIRE multiplicity</td>
<td>0..*</td>
</tr>
<tr>
<td>Data type (and ISO 19115 no.)</td>
<td>Corresponding DQ_xxx element from ISO 19115, e.g. 109. DQ_CompletenessCommission</td>
</tr>
</tbody>
</table>

**Domain**

<table>
<thead>
<tr>
<th>Lines 100-107 from ISO 19115</th>
</tr>
</thead>
<tbody>
<tr>
<td>100. nameOfMeasure : CharacterString [0..*]</td>
</tr>
<tr>
<td>101. measureIdentification : MD_Identifier [0..1]</td>
</tr>
<tr>
<td>102. measureDescription : CharacterString [0..1]</td>
</tr>
<tr>
<td>103. evaluationMethodType : DQ_EvaluationMethodTypeCode [0..1]</td>
</tr>
<tr>
<td>104. evaluationMethodDescription : CharacterString [0..1]</td>
</tr>
<tr>
<td>105. evaluationProcedure : CI_Citation [0..1]</td>
</tr>
<tr>
<td>106. dateTime : DateTime [0..*]</td>
</tr>
<tr>
<td>107. result : DQ_Result [1..2]</td>
</tr>
</tbody>
</table>

**Implementing instructions**

**Recommendation 3** For each DQ result included in the metadata, at least the following properties should be provided:

100. nameOfMeasure

NOTE This should be the name as defined in Chapter 7.

103. evaluationMethodType

104. evaluationMethodDescription

NOTE If the reported data quality results are derived or aggregated (i.e. the scope levels for evaluation and reporting are different), the derivation or aggregation should also be specified using this property.

106. dateTime

NOTE This should be data or range of dates on which the data quality measure was applied.

107. result

NOTE This should be of type DQ_QuantitativeResult

**Example**

**Example XML encoding**

**Comments** See Chapter 7 for detailed information on the individual data quality elements and measures to be used.

---

**Open issue 6:** In the ongoing revision of ISO 19115 and development of new ISO 19157 standard (Geographic Information – Data quality), a new element is introduced (DQ_DescriptiveResult). This element enables to describe and report qualitative results of the data quality evaluation and could be...
used instead of DQ_QuantitativeResult. Once the new (version of the) standards are approved, these
guidelines will be revisited and be updated if necessary.

Open issue 7: For reporting compliance with minimum data quality requirements and
recommendations specified in section 7, the INSPIRE conformity metadata element should be used.
However, since this issue is part of the larger discussion on the Abstract Test Suite and the definition
of conformance classes for the data specification, detailed instructions on how to provide metadata on
compliance with minimum data quality requirements and recommendations will only be provided for
v3.0.

### 8.3 Theme-specific metadata elements

No mandatory theme-specific metadata elements are defined for this theme.

No optional theme-specific metadata elements are defined for this theme.

Except the metadata elements inherited from the generic conceptual model (using data types from
GCM) there are no additional theme specific metadata from EF perspective. Monitoring facilities are to
be integrated in a thematic context and should share additional metadata elements with the domain
they belong to. As this is by nature not covered by data specification EF no theme specific metadata
are defined. The basic description of metadata elements as specified in Regulation 1205/2008/EC
metadata) are sufficient for theme EF.

### 8.4 Guidelines on using metadata elements defined in Regulation 1205/2008/EC

#### 8.4.1 Conformity

The **Conformity** metadata element defined in Regulation 1205/2008/EC allows to report the
conformance with the Implementing Rule for interoperability of spatial data sets and services or
another specification. The degree of conformity of the dataset can be **Conformant** (if the dataset is fully
conformant with the cited specification), **Not Conformant** (if the dataset does not conform to the cited
specification) or **Not evaluated** (if the conformance has not been evaluated).

<table>
<thead>
<tr>
<th>Recommendation 4</th>
</tr>
</thead>
</table>
| The Conformity metadata element should be used to report conceptual
consistency with this INSPIRE data specification. The value of Conformant
should be used for the Degree element only if the dataset passes all the
requirements described in the abstract test suite presented in Annex A. The
Specification element should be given as follows:
- title: “INSPIRE Data Specification on <Theme Name> – Draft Guidelines”
- date:
  - dateType: publication
  - date: 2011-06-20 |
Open issue 8: Conformance testing is still an open issue under discussion.

Instructions on conformance testing and a common abstract test suite (including detailed instructions on how to test specific requirements) will be added at a later stage.

This may also lead to an update of the recommendations on how to fill the conformity metadata element.

8.4.2 Lineage

Recommendation 5 Following the ISO 19113 Quality principles, if a data provider has a procedure for quality validation of their spatial data sets then the data quality elements listed in the Chapters 7 and 8 should be used. If not, the Lineage metadata element (defined in Regulation 1205/2008/EC) should be used to describe the overall quality of a spatial data set.

According to Regulation 1205/2008/EC, lineage “is a statement on process history and/or overall quality of the spatial data set. Where appropriate it may include a statement whether the data set has been validated or quality assured, whether it is the official version (if multiple versions exist), and whether it has legal validity. The value domain of this metadata element is free text”.

The Metadata Technical Guidelines based on EN ISO 19115 and EN ISO 19119 specify that the statement sub-element of LI_Lineage (EN ISO 19115) should be used to implement the lineage metadata element.

Recommendation 6 To describe the transformation steps and related source data, it is recommended to use the following sub-elements of LI_Lineage:
- For the description of the transformation process of the local to the common INSPIRE data structures, the LI_ProcessStep sub-element should be used.
- For the description of the source data the LI_Source sub-element should be used.

NOTE 1 This recommendation is based on the conclusions of the INSPIRE Data Quality Working Group to avoid overloading of the overall lineage statement element with information on the transformation steps and related source data.

NOTE 2 In order to improve the interoperability, domain templates and instructions for filling these free text elements (descriptions) may be specified in an Annex of this data specification.

Open issue 9: The suggested use of the LI_Lineage sub-elements needs to be discussed as part of the maintenance of the INSPIRE metadata Technical Guidelines.

8.4.3 Temporal reference

According to Regulation 1205/2008/EC, at least one of the following temporal reference metadata elements shall be provided: temporal extent, date of publication, date of last revision, date of creation. If feasible, the date of the last revision of a spatial data set should be reported using the Date of last revision metadata element.
9 Delivery

9.1 Delivery medium

<table>
<thead>
<tr>
<th>DS Requirement 2</th>
<th>Data conformant to this INSPIRE data specification shall be made available through an INSPIRE network service.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS Requirement 3</td>
<td>All information that is required by a calling application to be able to retrieve the data through the used network service shall be made available in accordance with the requirements defined in the Implementing Rules on Network Services.</td>
</tr>
</tbody>
</table>

EXAMPLE 1 Through the Get Spatial Objects function, a download service can either download a pre-defined data set or predefined part of a data set (non-direct access download service), or give direct access to the spatial objects contained in the data set, and download selections of spatial objects based upon a query (direct access download service). To execute such a request, some of the following information might be required:
- the list of spatial object types and/or predefined data sets that are offered by the download service (to be provided through the Get Download Service Metadata operation),
- and the query capabilities section advertising the types of predicates that may be used to form a query expression (to be provided through the Get Download Service Metadata operation, where applicable),
- a description of spatial object types offered by a download service instance (to be provided through the Describe Spatial Object Types operation).

EXAMPLE 2 Through the Transform function, a transformation service carries out data content transformations from native data forms to the INSPIRE-compliant form and vice versa. If this operation is directly called by an application to transform source data (e.g. obtained through a download service) that is not yet conformant with this data specification, the following parameters are required:
- Input data (mandatory). The data set to be transformed.
- Source model (mandatory, if cannot be determined from the input data). The model in which the input data is provided.
- Target model (mandatory). The model in which the results are expected.
- Model mapping (mandatory, unless a default exists). Detailed description of how the transformation is to be carried out.

9.2 Encodings

For delivery medium and encodings no specification will be provided by data specification EF. Delivery medium is close related to specific thematic needs and should be defined by the domain experts. The various encodings which are used specifically for information related to observation and measurements don’t fit as well into the data specification of EF. Specific encodings should be listed in their INSPIRE relevant context but definitely not in data specification EF. The variety of theme specific encodings will be also confronted to the fact that this is not up to EF annex to list all encodings used by any thematic community (outside INSPIRE thematic focus).

10 Data Capture
Data specification EF addresses various level of detail which can be provided using the proposed model. But as the model follows a generic cross domain approach data capture rules cannot be defined.
For thematic communities including the data model EF in their specification this might be different as from the point of view of thematic community there might be rules which level of detail is required for a specific use.
On the generic level of EF data specification this is excluded.

11 Portrayal

This clause defines the rules for layers and styles to be used for portrayal of the spatial object types defined for this theme.

In section 0, the types of layers are defined that are to be used for the portrayal of the spatial object types defined in this specification. A view service may offer several layers of the same type, one for each dataset that it offers on a specific topic.

Section Error! Reference source not found. specifies the styles that shall be supported by INSPIRE view services for each of these layer types.

In section Error! Reference source not found., further styles can be specified that represent examples of styles typically used in a thematic domain. It is recommended that also these styles should be supported by INSPIRE view services, where applicable.

Where XML fragments are used in these sections, the following namespace prefixes apply:
- sld="http://www.opengis.net/sld" (WMS/SLD 1.1)
- se="http://www.opengis.net/se" (SE 1.1)
- ogc="http://www.opengis.net/ogc" (FE 1.1)

IR Requirement 10  If an INSPIRE view services supports the portrayal of data related to the theme Environmental Monitoring Facilities, it shall provide layers of the types specified in this section.

DS Requirement 4  If an INSPIRE view network service supports the portrayal of spatial data sets corresponding to the spatial data theme Environmental Monitoring Facilities, it shall support the styles specified in section Error! Reference source not found.. If no user-defined style is specified in a portrayal request for a specific layer to an INSPIRE view service, the default style specified in section Error! Reference source not found. for that layer shall be used.

Recommendation 7  In addition to the styles defined in section Error! Reference source not found., it is recommended that, where applicable, INSPIRE view services also support the styles defined in section Error! Reference source not found..

TWG EF does not provide portrayal rules or standard styles. The graphical representation using symbols and colour is specific per thematic domain. In some communities portrayal rules are specified in high detail (e.g. geology). The portrayal of environmental monitoring facilities has to be embedded in the thematic context.
If in future an agreed portrayal would be needed across domains for environmental monitoring facilities (e.g. an environmental monitoring facility view service) it can be added but should not be defined ahead of real requirements in the actual data specification process.

**Open issue 10:** As TWG EF don't see requirements for a view service for Environmental Monitoring Facilities in the generic approach they are modeled we envisage an open issue to define portrayal rule or layer concept - as this belongs to thematic implementation of the generic model.
Bibliography


[DS-2.9] INSPIRE DS-D2.9, Guidelines for the use of Observations & Measurements and Sensor Web Enablement-related standards in INSPIRE Annex II and III data specification development


Annex A  
(normative)

Abstract Test Suite

Any dataset conforming to this INSPIRE data specification shall meet all requirements specified in this document.

Open issue 11: Conformance testing is still an open issue under discussion.

Instructions on conformance testing and a common abstract test suite (including detailed instructions on how to test specific requirements) will be added at a later stage.
Annex B
(informative)

Use case description

In the actual version of the data specification there is no fully formalised use case included. This is due to the fact that the drafting of use cases for theme Environmental Monitoring Facilities proved as highly complex. As there is no "abstract" environmental monitoring, all concrete use cases have to be covered by thematic areas and description should be provided from a thematic point of view. In practice information on environmental monitoring facilities is used in thematic context. Access is either through spatial objects defined by other thematic areas (e.g. a river segment, a protected site) or through an environmental medium in focus (like air, freshwater, marine). Therefore we tried to set up a number of questions related to environmental monitoring facilities from different expert perspectives represented in our working group. The questions/examples could be used as an input for discussion and clarification with other thematic working groups and as optional parts in use cases provided by them. So we decided to include in Annex B examples of use instead.

B.1 Examples of use

TWG EF used the following structure to formalise the descriptions:

**Title:** to be used as a reference for discussions
**Question:** One or more questions a user raises
**User:**
**Other data sources required:** Sources out of scope for TWG EF needed to answer the question(s)
**Requirements to EF:** What is expected/needed to be delivered by theme EF
**Response to user:** Answer to the question(s)

The following “examples of use” are included as input or discussion and potential link to other thematic working groups as they reflect the contribution of information covered by theme EF contributes to a broader picture and are closely linked into the thematic domains:

<table>
<thead>
<tr>
<th>Title</th>
<th>Env. theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hungarian Aluminium Plant Accident</td>
<td>Water, hazards, risk, health</td>
</tr>
<tr>
<td>Publicly funded EFs related to air quality</td>
<td>Air quality</td>
</tr>
<tr>
<td>Safe Camping</td>
<td>Protected sites, nature protection, health</td>
</tr>
<tr>
<td>Animal with Transponder</td>
<td>Species distribution, migration monitoring</td>
</tr>
<tr>
<td>Where has Ambrosia been sighted</td>
<td>Species distribution</td>
</tr>
<tr>
<td>Where is the most current data on soil quality available</td>
<td>soil</td>
</tr>
<tr>
<td>Information on particulate matter monitoring in Austria</td>
<td>Air qual., emission, health</td>
</tr>
<tr>
<td>Habitat availability and quality for a specific species</td>
<td>Nature protection, biodiversity</td>
</tr>
<tr>
<td>What information is available related to the oceans in relation to climate change monitoring and the Marine Strategy Framework Directive</td>
<td>Marine, climate change</td>
</tr>
<tr>
<td>Impact of spread of some species on forest habitats</td>
<td>Species distribution</td>
</tr>
</tbody>
</table>
### B.1.1 Hungarian Aluminium Plant Accident

Questions:
1. *When will the arsenic be propagated to my position on the Danube? (This question requires hydro modelling on the fly – not sure it is covered by INSPIRE)*
2. *How far has the arsenic travelled to date*
3. *What is the affected area*
4. *Which cities will be impacted*

User: Interested

Other data sources required:
- Meteo data
- Topographic data
- Land cover
- Soil

Requirement to EF:
- Identify Water Stations delivering quantity and chemical analysis
- Send measurements concerning water

1. *Where are the stations following the media (river-surface water) with the type of monitoring (quality or chemical)*
2. *Does station A have monitored arsenic for a given time period*
3. *Which station has an Arsenic concentration over a given threshold (like an alert system)?*

Response to User:
1. Tomorrow at noon
2. Presently the arsenic poisoning has reached the XXX border
3. Polygon showing the current extent
4. Budapest...

### B.1.2 Publicly funded EFs related to air quality

**Question:** What publicly funded activities related to air quality are available across Europe?

**User:** politician

**Other data sources required:**
- Funding information (how much spent on station, monitoring activity)
- Air quality management plans related to these stations

**Requirements to EF:**
- Filter on funding type of facilities
- Filter on thematic area of facilities
- What is measured by these facilities
- Location of facilities (coordinates, administrative area)
- Current funding sources for facility
- How long has facility been in operation? (start/stop times)
- Costs of facility (probably not in EF but external budget plans)

**Response to user:**
• List with information on what air quality monitoring facilities measuring what sorts of data (+ further station description) exist based on public funding
• map with locations of publicly funded air quality monitoring facilities

B.1.3 Safe Camping

Question: I’d like to go camping with my small children this weekend at camping site X. Is this safe?

User: general public, citizen

Other data sources required:
• protected areas
• camping sites
• hydrometry
• meteorological conditions: risk for safety
• conditions related to health like pollen concentration, blooming of specific species...

Requirements to EF:
• location of meteo facilities
• water level: if the camp is close to a river or sea...

Response to user:
• yes, everything is ok, or no
• optional reasons to be careful might be given like it may flood, high allergen levels, be careful wild living wolfs, …

B.1.4 Animal with Transponder

Question:
1. Where is the current position of the animal(s) with the tracking equipment?
2. Where were the animal with the tracking equipment during last year?
3. Can we detect a migration pattern for the observed animal(s)?

User: Zoology experts, NGOs, public

Other data sources required:
• no other data required

Requirements to EF:
• Real time location of animal(s)
• Time stamp on the observation feature

Response to user:
1. Map with the point of the current position of the animal.
2. Map with the points of the occurrence of the animal during last year, indicating direction of migration.

Additional requirements:
• data privacy (exclusive access to actual information if an endangered species is observed or bias from public/broad access is expected (animals might change where they go if people are around)

B.1.5 Where has Ambrosia been sighted

Question: 1. Where has Ambrosia (highly allergenic invasive species: http://en.wikipedia.org/wiki/Ragweed ) been sighted within my country, who has made that observation?
2. How has the distribution of Ambrosia changed within my country over the last years?
User: governmental official (all levels from national to local), citizen

Other data sources required:
- aggregated level of species distribution
- link to local and European legislation

Requirements to EF:
- list datasets containing reference to this species
- return occurrence data
- observer (person, instrument, facility)
- link to monitoring programme/ activity

Response to user:
- locations where Ambrosia has been sighted/reported
- locations where Ambrosia has been sighted/reported per year; graphical representation of spread

Additional explanation:
Two ways to look at this use case:
- Look for data falling under the Species distribution theme

or...
- Look for Environmental Monitoring facilities in my Country that hold biodiversity data (implicit link of geographical names/areas and the facilities).
- Report on owner, wider monitoring activities, life-cycle information, list of web services, catalogue services associated with these facilities.
- Query those Environmental Monitoring facilities for data on occurrences of Ragweed.

Implications: standardised application schema, standardised reporting of species occurrence data + associated with the monitoring facility.

or
- look for occurrence data on ragweed within my country. As the individual observations are also features, the occurrences may be queried just like stations. When occurrences have been found these can then be backtracked to the facility there were found in (or in the case of something like countryside survey the facility would be the whole country area, with a link to the survey campaign).

Comment: To be discussed with thematic working group on Species Distributions.

B.1.6 Where is the most current data on soil quality available?

Question: Where is the most current data on soil quality available?

User: planner, interested citizen (pollution aspects)

Other data sources required:
- catalogue where soil quality data are listed
- geographical context for orientation
- search engine for spatial data (area, location, surrounding)
- terminology on soil quality (what parameters are important, what parameters and what numbers are indicative for soil quality...)

Requirements to EF:
- search criteria for soil quality data
- search criteria for time dimension - most current observation/measurement
- search criteria for the area of interest
• search criteria on responsible party for sampling

Response to user:
• *In the area of interest soil sampling points, permanent monitoring stations are displayed on actual topographical background information. Detailed information on the soil quality/indicative parameters is available per station.*
• *Restricted view: Map of soil quality in classes from good to bad is delivered to user; EF are integrated as point layer to visualise data the classification is based on. Per station attribute of sampling time is available and visualised (colour code for specific time spans, 1980-1990,...)*

Comment: to be discussed with thematic working group soil!

**B.1.7 Information on particulate matter monitoring in Austria**

*Question:* What percentage of Austrian Air Quality stations monitor PM (particular matter)?

*User:* interested public, NGOs, politicians

*Other data sources required:*
• Description on types of PM
• Description of effects of PM
• History of PM Monitoring methodology
• Health thresholds for PM

*Requirements to EF:*
• filter on thematic area of facilities (i.e. Air)
• filter on pollutants measured by facilities (i.e. PM)
• location of facilities (coordinates, administrative area)
• pollutants measured by facilities
• how long has facility been in operation? (start/stop times)

*Response to user:*
• number of percentage (54%)
• map with locations of air quality monitoring facilities monitoring PM and which one (PM10, PM20, PM 5), since when, financed by

**B.1.8 Habitat availability and quality for a specific species**

*Question:* In order to classify species according to strict red-listing criteria, the extent, connectivity and quality of habitat for that particular species is a prerequisite.

*User:* Biodiversity experts assigned by national authorities to undertake red-list evaluation of species potentially threatened in national territory

*Other data sources required:*
• Trend data for species distribution and population numbers (recent and historical)
• Species life history information and data on the magnitude of “natural” population fluctuations.
• Previous red-list committee evaluation output.

*Requirements to EF:*
• Systematic monitoring of habitat and/ or species requires a permanent or semi-permanent station net where remote sensing or field-based data is gathered in a relevant time frame is a prerequisite for the evaluation of red list category for each species under evaluation.
• Data on habitat availability is either presence/absence (1/0) or aggregation of individual pixels into extent of occurrence.
• Data on habitat quality is typically plant species composition or structural aspects such as volume of coarse woody debris in forest habitats.
• Data for species is either presence/absence (1/0) or population numbers.
• Occurrence data available with filter on specific species

Response to user:
Delivery of monitoring data that will allow to draw conclusions on the environmental condition by sound statistical approach, i.e. that habitat quantity have diminished by 20% in 10-year period in a specific region/nation

B.1.9 What information is available related to the oceans in relation to climate change monitoring and the Marine Strategy Framework Directive?

Question: What data is available from marine environmental monitoring stations that can aid understanding on the conditions of the marine environment in terms of climate change and good environmental status of the seas and oceans in relation to the Marine Strategy Framework Directive?


Other data sources required:
• Orthoimagery (Annex II) - Aerial photography of the coastline and satellite orthoimagery of ocean conditions such as temperature, salinity, chlorophyll etc.
• Oceanographic geographical features (Annex III) - observational data such as sea surface temperature and salinity
• Sea regions (Annex III) - Seas and saline water bodies divided into regions and sub-regions with common characteristics.

Requirements to EF:
• Systematic monitoring of the seas and oceans through facilities that collect parameters such as sea temperature, salinity, chlorophyll, biota, and contaminants in the marine environment.
• The following search criteria are relevant:
  - What data is available?
  - Where is data available i.e. user defined area of interest and/or ‘Sea regions’ defined area of interest?

Response to user:
Discovery, view, download and transformation of marine environmental monitoring facilities data that will allow scientists and decision makers understand the marine environment in terms of ‘good environmental status’ and climate change trends such as increased temperature or marine acidification.

B.1.10 Impact of spread of some species on forest habitats

Question: What is the impact of the bark beetle on the forests in specific area?

User: Forestry experts, NGOs, politicians, public

Other data sources required:
• Administrative units
• Forests (for better response forest habitats should be used)
• interpolation of spread for bark beetle and potential forest destruction

Requirements to EF:
• location of the facilities
• measurements done on the facilities
• filter on thematic area of facilities (i.e. Forest)
• filter on pollutants measured by facilities (i.e. PM)
• monitoring/survey on bark beetle occurrence
Response to user:
  Map with graphic representation of the quantitative occurrence of the bark beetle in the forests in the specific area, or map with potential destruction of the forest by the bark beetle interpolated from the observation by the environmental monitoring facilities in the specific area.

B.1.11 Reporting Requirements WFD

Questions:
1. What are the EF concerned by this specific EU required EF network/program
2. Where are the EF
3. What is the EF instrumentation
4. Give me the EF detection threshold/calibration used

User: EEA, EuroStat, JRC, DGENV, Member States

Other data sources required:
- Link to referential datasets already reported within this reporting: e.g.: this water quality monitoring station is linked to this Water Framework Directive lake water body.

Requirements to EF:
- be compatible with the reporting sheet concerned by the given requirement.
- allow filter on programs reported to
- provide data on instrumentation (includes methodology, threshold, calibration, ...)
- provide measurement data
- ideally provide aggregated measurement data if stored in same system as base data

Response to user:
1. List of EF id
2. List of all EF with basic attributes
3. List of EF instrumentation & methodological information
4. Quality info: detection threshold/calibration used

B.1.12 Reporting Requirements CAFE

Questions:
1. What are the EF concerned by this specific EU required EF network/program
2. Where are the EF
3. What is the EF instrumentation
4. Give me the EF detection threshold/calibration used
5. Give me the EF data (measurements, filter possible?)
6. Give me aggregates of the EF data (i.e. yearly means, percentiles, number of exceedances) (may be out of scope, but in scope of CAFE reporting, and no different to model than base data so no worries!)

User: EEA, EuroStat, JRC, DGENV, Member States

Other data sources required:
- Link to referential datasets already reported within this reporting: e.g.: this monitoring facility was established due to the following exceedances in the past years.

Requirements to EF:
- Be compatible with the reporting sheet concerned by the given requirement.
- allow filter on programs reported to
- provide data on instrumentation (includes methodology, threshold, calibration, ...)
- provide measurement data
- ideally provide aggregated measurement data if stored in same system as base data

Response to user:
1. List of EF id
2. List of all EF with basic attributes
3. List of EF instrumentation & methodological information
4. Quality info: detection threshold/calibration used
5. Measurement data
6. Aggregated measurement data

B.1.13 There is an environmental oil spill incident at sea. Agencies need access to data to best manage the risk in terms of natural hazards and industrial accidents

Question:
1. Where are stationary monitoring facilities next to the location of the accident
2. What monitoring programs cover information to evaluate the impact of the accident
3. Do we have time series of relevant information to judge hazard effect

Users: Government agencies such as Coastguard, environmental protection and monitoring, transport and the general public. EC and agencies such as the EEA.

Other data sources required:
- coastline,
- temperature profile,
- bathymetry,
- transport routes etc.

Requirement to EF:
- Data on marine water quality pre and post incident at sea to compare the hazard effect of the spill or accident for the defined area
- data on available environmental monitoring facilities for the defined area which could be used for data acquisition (in addition to usual scheme)

Response to User:
- List of relevant EF datasets within catchment of the incident.
- List of EF attributes, instrumentation and methodologies used, quality information and measured relevant parameters ie. water quality parameters.
Annex C
(informative)

Examples

These examples aim to explain the different part of the EF model including the link to sampling and direct observations. The hierarchical structure offers the option to describe down to the appropriate level of detail while the associate option provides the possibility to group EF in different ways. Connection point from all thematic areas is from EF point of view the monitoring facility (could be the environmental monitoring network). In cases where this to thematic communities seems inappropriate, the proposed O&M part could be integrated as well directly into the thematic model. What will be lost will be the common elements for all environmental monitoring facilities shared from thematic areas.

C.1 Monitoring of water quantity in rivers

For various purposes the quantity of water passing a specific location in a river is monitored. Monitoring can range from highly frequent water level observations (water height, river flow) done at fixed locations and using various equipment to singular/randomly taken measures at different locations.

Depending on the question/problem, the measurements/observations/information is used to provide/produce information. The actual problem is defining what is “usable” for the actual questions. E.g. only measurements taken in a specific frequency can be taken into account. For location with a higher frequency averages are used; measurements taken at a lower frequency cannot be used.

Thus, the dataset produced/exchanged is created out of various sources and depends on a common structure how location, frequency and methodology are documented. Direct access to initial raw measurements is not core and in many cases even misleading as the result values cannot be used directly for the specific purpose required.

The EF model tries to provide an approach to exchange aggregated information the same way as primary measurement results. The common approach is to provide the location resp. an area of validity of a value and the information needed to include it into further processing or use it for decision support and so on.

The model provides a recursive structure to allow the provision of the correct information at the appropriate level of detail/accuracy while keeping consistency between result values and descriptive attributes. The same attributes are used to describe various levels of aggregation within one thematic domain so the user of the exchanged information has all information needed.

# Example of how water quantity monitoring is modeled in the French Water Information System (Sandre’s data models):
- Hydrometric site: geographical site (watercourse link) on which river flow measurements are considered to be homogeneous and comparable. Usually for cartographic needs its representative point is used.
Apart from general information (administrative, hydrological localization, …), measurements can be attached to an hydrometric site.

On an hydrometric site many types of equipment allowing the measurement of one or many hydrometric parameters are being deployed: hydrometric stations.

- Hydrometric station: equipment deployed on a hydrometric site to observe and measure a given hydrometric parameter (water height, river flow). An hydrometric station pertains to only one site.

The hydrometric station carries its own description information. It is also attached to ancillary information such as gaging curves, correction curves the local vertical datum used, certain historical thresholds (floods, …).

Each hydrometric station is fitted with hydrometric sensor(s).

- Hydrometric sensor:
  The hydrometric sensor (the five vertical gages in the above image) is the equipment that realizes the actual physical measurement. It could be a spirit level, an ultrasonic sensor, a human being with a mobile equipment.
  An hydrometric sensor pertains to only one hydrometric station.
  It carries descriptive information on the equipment used to measure water height or river flow.
  It is also attached to the actual measurements.

- Mapping with EF data model:
From EF point of view, each of these 3 concepts Hydrometric site, Hydrometric station and Hydrometric sensor are modeled as EnvironmentalMonitoringFacilities (EMF).

Exchanging these datasets with another country using the EMF concept will solve part of the semantic barrier as the terminology used (site, station, sensor) is not bound to be the same.

Example of a hydrometric sensor, an observation realized by the sensor and the station to which the sensor belongs in the INSPIRE EF context. A summary diagram is available at the end of the example, it will ease non XML readers understanding.

- **EMF** (hydrometric sensor: O12525100101):
  - inspireID: could be in the following form ‘urn:fr:Sandre:Referentiels:sa_hyd:2.1:Capteur:O12525100101’
  - representativePoint: GM_Point (X/Y/SRS of the representative point)
  - mediaMonitored: water
  - measurementRegime: Continuous Data Collection
  - responsibleParty: DREAL Midi-Pyrénées
  - mobile: No
  - resultAcquisitionSource: in-situ

- **EMF** (hydrometric station: O125251001):
  - inspireID: could be in the following form ‘urn:fr:Sandre:Referentiels:sa_hyd:2.1:Station:O125251001’
  - representativePoint: GM_Point (X/Y/SRS of the representative point)
  - mediaMonitored: water
  - measurementRegime: Continuous Data Collection
  - responsibleParty: DREAL Midi-Pyrénées
  - mobile: No
  - resultAcquisitionSource: in-situ

- **Inspire_OM_Process**: 

Figure 1: Modelling ‘hydrometric’ Environmental Monitoring Facility in TWG-EF data model (extract from complete model for easier reading only)
- inspireID: ..... reference to Sandre’s code list n°507, entry code n°0 could be in the following form ‘urn:fr:Sandre:Referentiels:sa_nsa:1.0:507:0’ (urn version of http://services.sandre.eaufrance.fr/References/1.3.0/jeuDonnees.php?recherche=507&function=getXMLNsa&v=3.1#0)
- name : ‘Measure : the value has been effectively measured’ (in contrast to ‘Interpolation’ or ‘Reconstitution’)
- onlineResource : URI to the Sandre’s nomenclature mentioned above. Could be in the following form :
  http://services.sandre.eaufrance.fr/References/1.3.0/jeuDonnees.php?recherche=507&function=getXMLNsa&v=3.1,
- processParameter : reference to the ‘sampling rate’ process parameter

- Observation
The attributes below involve classes defined in the OM_Specification.
To ease the understanding of the implication of such classes, XML Snippets are provided.

- phenomenonTime
<!-- describes the period of record of the time series -->
<om:phenomenonTime>
  <gml:TimePeriod gml:id="ts_period">
    <gml:beginPosition>2011-05-20T00:00:01</gml:beginPosition>
    <gml:endPosition>2011-05-20T23:45:00</gml:endPosition>
  </gml:TimePeriod>
</om:phenomenonTime>

- resultTime
<!-- result time describes the time the result was available, here it is the last point in the time series -->
<om:resultTime>
  <gml:TimeInstant gml:id="eor">
    <gml:timePosition>2011-05-20T23:45:00</gml:timePosition>
  </gml:TimeInstant>
</om:resultTime>

- result
<!-- The time series data using WaterML2.0 (an O&M profile for water quantity data exchange) -->
<om:result>
  <wml2:TimeSeries gml:id="ts_1">
    <!-- Describes the time range of the result time series -->
    <cv:domainExtent>
      <gml:TimePeriod>
        <gml:beginPosition>2011-05-20T00:00:01</gml:beginPosition>
        <gml:endPosition>2011-05-20T23:45:00</gml:endPosition>
      </gml:TimePeriod>
    </cv:domainExtent>
    <!-- Range is the parameter space: i.e. water height-->
    <cv:rangeType xlink:href="http://sandre.eaufrance.fr/referentiels/sa_nsa/1.0/509/H" xlink:title="Hauteur"/>
    <cv:element>
      <wml2:TimeValuePair>
        <cv:geometry>2011-05-20T00:15:00</cv:geometry>
        <swe:Quantity>
          <swe:uom xlink:href="urn:ogc:def:uom:UCUM::mm"/>
          <swe:value>400</swe:value>
        </swe:Quantity>
      </wml2:TimeValuePair>
    </cv:element>
  </wml2:TimeSeries>
</om:result>
<wml2:TimeValuePair>
  <cv:geometry>2011-05-20T00:30:00</cv:geometry>
  <swe:Quantity>
    <swe:uom xlink:href="urn:ogc:def:uom:UCUM::mm"/>
    <swe:value>400</swe:value>
  </swe:Quantity>
</wml2:TimeValuePair>

<!-- Snip the time serie continues to 2011-05-20T23:45:00 -->
</cv:element>
<!-- Daily discharge values are calculated as the average across the preceeding interval -->
</wml2:TimeSeries>
</om:result>

- associations
  - featureOfInterest <!-- Link to the monitoring point. -->

- observedProperty
  <!-- The INSPIRE_GF_PropertyType defines that the parameter is actually water height! -->
    - inspireID: ... reference to Sandre's code list n°509, entry code 'H' could be in the following form 'urn:fr:Sandre:Referentiels:sa_nsa:1.0:509:H' (urn version of http://services.sandre.eaufrance.fr/References/1.3.0/jeuDonnees.php?recherche=509&function=getXmlNsa&v=3.1#H)
      - name: Water Height
    - onlineResource:
      http://services.sandre.eaufrance.fr/References/1.3.0/jeuDonnees.php?recherche=509&function=getXmlNsa&v=3.1

- procedure
  - points to the Inspire_OM_Process described above.
Figure 2 - Summary diagram of the station/sensor/observation example
# Link between EMFs from different themes.
Water quantity and water quality monitoring network are not set up in order to answer to the same needs. Then with every water quality EMF man won’t find any water quality EMF.

In some cases it can be useful to know which water quantity EMF can be associated with which water quality EMF; at least to have an information about the river flow at the water quality EMF level (a correction coefficient can be applied). This association of EMFs is allowed by the anyThematicLink association available at the EMF concept level.

# The Environmental Monitoring Network (EMN)
The EMF which results are described above is part of the French national hydrometric network.

Example of this network in the INSPIRE EF context:
- **EMN**:
  - inspireID : could be in the following form 'urn:fr:Sandre:Referentiels:sa_dc:2.2:DispositifCollecte:0000000027'
  - name : Réseau d'hydrométrie national
  - geometry : should be the aggregation of the INSPIRE Administrative Units polygons representing France
  - responsibleParty : French Ministry of Environment (SCHAPI department)
  - beginLifeSpan : 1971-01-01
  - onlineResource : http://sandre.eaufrance.fr/referentiel/disceau/code/0000000027
  - organisationalLevel : 'national'

This network pertains to several national Monitoring Programs
- **Environmental Monitoring Program**:
  - inspireID : 'urn:fr:Sandre:Referentiels:xxxx:1'
  - name : prévision des crues -> (flood forecast)
  - geometry : should be the aggregation of the INSPIRE Administrative Units polygons representing France
  - responsibleParty : French Ministry of Environment etc...

- **Environmental Monitoring Program**:
  - inspireID : 'urn:fr:Sandre:Referentiels:xxxx:2'
Other ‘hydrometric’ EMN exist in France. For example the one with the inspireID ‘urn:fr:Sandre:Referentiels:sa_dc:2.2:DispositifCollecte:0400000035.’ This EMN geometry is restricted to the ‘Loire’ River Basin (thus its organisationalLevel is ‘sub-national’).
It’s a subnetwork of the precedent one (0000000027) with whom it shares some EFs and Environmental Monitoring Program.
It is also linked to other Environmental Monitoring Programs like one on the management of two dams/reservoirs.

C.2 Example groundwater monitoring

For groundwater monitoring, physical and chemical parameters are observed/measured. Access to groundwater bodies is provided by bore holes from drilling activities. For the monitoring aspect, drilling and borehole - including their detailed description - is given as it is a precursor process.

From legal point of view, groundwater reporting for Water Framework Directive (WFD) is an European framework which requires that information (see UC07, D2.8II/III.4 Data specification on Geology, examples of use AQ-05). Taking the descriptions from the Annex of D2.8II/III.4 Data specification on Geology, we can exclude from our view groundwater bodies and set them as given. The focus in this example is on wells as groundwater monitoring facilities and their relation to observations and the data specification geology.
Figure 1: Schematic view on a groundwater body and observation wells

Figure 2a: Schematic view on wells distributed over various GWB and belonging to different monitoring networks. E.g. the red dots represent national monitoring wells and the blue ones additional regional monitoring wells.
So the schematic view shows that a network of wells can deliver information for more than one groundwater body while a groundwater body might be observed by wells from various monitoring networks.

The following clip of the UML model illustrates what model part will cover the information related to an Environmental Monitoring Network.

![UML diagram of Environmental Monitoring Network](image)

Figure 2b: An Environmental Monitoring Network integrates all attributes from the abstract classes and can have an hierarchical structure; so sub-networks are possible.

The monitoring program is introduced as a part of our model to reflect the need to describe a political/organisational setup of environmental monitoring. In our example it would be the European Groundwater Monitoring Program established to feed the requirements of the WFD. In national context the monitoring program could be a national or regional one. The description of the Environmental Monitoring Program would contain the description and the legal context in general terms. See as well the example from Swedish landscape monitoring program covering different perspective towards Environmental Monitoring Program. Figure 3 illustrates how the description of an Environmental Monitoring Program is formalised in the UML model.

![UML diagram of Environmental Monitoring Program](image)

Figure 3: Environmental Monitoring Program
An *environmental monitoring activity* can include wells (monitoring facilities) independent from their relation to networks or the natural object they observe (groundwater body). But it is possible as well to include monitoring networks in an activity. So an activity forms a temporary collection of monitoring facilities for a specific time and a specific purpose. In the schema in figure 4a the area for the monitoring activity is triggered by an accident and specific action has to be taken regarding groundwater monitoring. In our example the issue would be to detect spread of pollutants after the accident and would involve all wells within certain distance to the location of the accident. Mostly it is for a relatively short period of time (opposite to a network). In some thematic areas it could be labelled as a sampling campaign or a specific observation exercise/campaign.

Figure 4a: Schematic view on monitoring activity; in the example triggered by an accident with potential groundwater impact.
If we look closer to a single well, various cases can be relevant. First what genealogy can provide. The genealogy link between monitoring facilities is able to express that one facility is substituted by another one – but the timeseries of continuous observation can be kept. In practise that would happen if e.g. the top pipe of a simple observation well (for measuring water level = pressure in water body) is ruined by a agricultural machine and had to be replaced (whole installation) or the filter part of the pipe is blocked and has to be replaced.

Inside a well there are several options to have different equipment for different observation or sampling purpose. All of these installations can be defined as an environmental monitoring facility at a more detailed hierarchical level. That’s what the hierarchical relation between environmental monitoring facilities should be used for. In our example one well has one geological profile. As well the outer and inner pipes of a well are common elements. But, as shown in figure 5, the sensors or pumps installed are used for different observation purpose and can have their own lifecycle and can be added or removed without changing the “higher” hierarchical level of information. So all installation/equipment is targeted to the same GWB/aquifer (the FeatureOfInterest) but has his distinct observing capabilities, method and procedures. Results can be assigned to the most detailed level and through the hierarchical (or genealogical) recursive link of environmental monitoring facilities aggregated at any time – if from thematic point of view this is valid.
As observation capabilities can be linked to any Environmental Monitoring Facility, the part where the description is covered what a sensor is meant for and so on contain descriptive elements what can be done here. The model provides the option to express observing capabilities independent from the hierarchical level of the environmental monitoring facility or environmental monitoring network. So in our example observing capabilities can be linked but do not have to be to the network of groundwater
wells, a single well as hosting a number of sensors and equipment and to a specific sensor. Thematic needs can be expressed but have to be handled carefully to be clear where observing capabilities belong to.

**Figure 5c:** UML representation of the observing capability. So any Environmental Monitoring Facility can have one or more Observing Capabilities independent from hierarchical structures.

Focus in the example provided is on the logic of various instances one could create using the environmental monitoring facility model. For more detailed description from thematic point of view “groundwater” please see as well the use case UC07 in Annex B of data specification theme geology and Annex C of the same data specification (DS-D2.8.III.4)

### C.3 Landscape monitoring in Sweden

Landscape monitoring programs are typically set up with an aim to describe and quantify the status and trend of biodiversity, or more precisely those landscape structures that make up the prerequisites for important aspects of biodiversity. To optimize monitoring efforts and data quality, the sampling strategy will be either a random sample or a fixed grid setup with randomized starting point. The grid may be further stratified in order to enhance coverage of less common biotopes or landscape types. In such monitoring programs, the data analysis will always take place on the aggregated level, whereas data from the individual monitoring plot becomes meaningful only after pooling of data from all plots within the wider program context. This means that the logical georeference for the data set will be the whole area (biogeographical or administrative) covered by the monitoring network, rather than the individual plots. There are also special cases where the exact location of the permanent data collection plot has to be kept hidden/secret. This is because the rationale of the monitoring program demands that the individual monitoring plots should face the same chance of landuse changes (or permanency of landuse practises) as any other part of the territory. If landowners or landusers of any category were to make decisions on landuse based on the knowledge that plots are being monitored for existing landscape and biodiversity qualities there would be a real risk of bias in such monitoring programs. One example in Europe is the Swedish National Inventory of Landscapes (NILS) which
covers all parts of the country by a fixed grid of more than 600 5x5 km landscape squares where infrared aerial photo interpretation is applied in combination with systematic field measurements in a systematic subset of plots within the squares. By rotation, the squares are revisited every 5 years, starting from 2003. The focus is mainly on landscape changes relevant for biodiversity and the program is designed to provide a scientifically sound baseline for biodiversity monitoring and evaluation in Sweden. As an extension of the NILS program, the ongoing LIFE project Monitoring of Terrestrial Habitats (MOTH) is set to strengthen NILS capacity to contribute to the evaluation of conservation status of species and habitats of European concern. In this context, the original Swedish national Inventory of Forests (in operation since 1923) has been partially redesigned with a stronger biodiversity focus in order to support and complement the new NILS program. All of these nationwide landscape monitoring programs are based on the same rationale - that landuse on individual sites must not be influenced by knowledge about the location of the plots. The results of the landscape monitoring programs – if successful – have a strong potential to influence national policies in economically important policy areas such as agriculture and forestry. Thus it is essential that the permanent plots (“Environmental Monitoring Facilities”) must remain an exclusive knowledge of the monitoring staff only.

References:
www.slu.se/en/collaborative-centres-and-projects/swedish-national-forest-inventory/

The following parts of the example should illustrate information which is available and communicated related to the landscape monitoring program NILS in Sweden.

**Overall description of the monitoring program NILS**
NILS follows the biological diversity by monitoring the landscape with random sampling in 631 permanent sample plots, systematically distributed in Sweden.
The design of the NILS programme.

NILS’ random sampling design makes it possible to collect objective data with the highest precision possible, which is a requirement in order to be able to convey reliable information on national and regional levels.

The composition and structure of the landscape are important elements in NILS and in order to be able to investigate them properly, it is necessary for the random sampling to cover large parts of the landscape. By compromising between need and cost, NILS has chosen landscape squares (5x5 km) for general descriptions with a central kilometer square (1x1 km) for more comprehensive measurements.

In order to carry out the estimates of e.g. landscape structure index, the area of the ground cover and frequency of indicator species, NILS has been designed in the following way:

**Strata divisions**
Sweden has been divided into ten geographical strata. The divisions provide basis for concentrated random sampling in certain areas, e.g. cultivated land and the alpine region.

**Aerial Photo Interpretation**
NILS uses aerial photo interpretation in order to describe the composition of the landscape as cost-effective as possible. Comprehensive and detailed interpretations are done in the kilometer square (1x1 km). A method of how to interpret the landscape square (5x5 km) is under development.

**Field Inventory**
The field inventory is a follow-up to the aerial photo interpretation and adds information that can not be obtained from the aerial photos, for instance species level information. Both comprehensive inventory of the ground cover and land use, as well as detailed description of the vegetation is performed in systematically placed sample plots within the kilometer square. The line intersect inventory, which is performed between the circular plots, provides good estimates of length and quality of linear elements in the landscape (such as roads, hedges and ditches).

**Further detailed information**

**Data collection**
Data are collected by two different methods: aerial photo interpretation and field inventory.

**Aerial photo interpretation (see difference to overview)**
The composition and structural changes in the landscape are large scale events that are hard to detect from the ground, but that can easily be interpreted from infrared aerial photos. A general interpretation and digitizing is made of the NILS plots. Many different types of landscapes are
registered in order to give a general picture of the structure and composition of the landscape. Within a kilometer square (1x1 km), a more detailed interpretation with digital readings of landscape elements and biotopes is made. Interpretation and analysis of historical aerial pictures and maps makes it possible to follow the historical development.


Field inventory (see difference to overview)
Field inventory crews document the central 1 km x 1 km squares. The field inventories are performed to supplement the aerial photo interpretation, but also to specifically monitor objects, structures and species that cannot be detected or interpreted from the aerial images. About ten two-person crews take part in the fieldwork, which is performed between May and September.


And even more detailed information on field inventory

Field inventory
Field inventory takes place in fixed sample plots and lines within every NILS kilometer square (1x1 km). Each NILS square is inventoried every fifth year.

Aerial photo interpretation and field inventory are closely related since the sample plots are inventoried in the field and the locations of point and line objects are decided in relation to the aerial photo interpreted areas and objects. The sample plots' sizes correspond in large part to the smallest map unit in the aerial photo interpretation.

The field inventory uses, as often as possible, the same variables and definitions that are used in the aerial photo interpretation. In the field, however, a large number of variables that can not be detected in aerial photos are also registered.

The field inventory information is collected in a fixed grid pattern of permanent sample plots and in line objects encountered during line inventory.

The sample plots form a basis for estimating quantity, condition and change of types of landscape covering the area. From these a representative random sampling of the entire land area of Sweden is received.