

Common Database on Designated Areas (CDDA) in conformity with the INSPIRE data specifications

Step-3: Transform the CDDA data sets based on the matching tables into GML (Geography Markup Language)

GML – Proof of concept

Prepared by / compiled by:
Organisation:
Tracasa

EEA project manager:
Darja Lihteneger

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1 Overview

1.1 Normative references

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007¹

Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services² and the amendments

INSPIRE DS-D2.5, Generic Conceptual Model, v3.4rc3³

INSPIRE DS-D2.8.I.9, Data Specification on Protected Sites - Guidelines, v3.1⁴

INSPIRE DS-D2.8.I.9, Data Specification on Protected Sites – Technical Guidelines, v3.1⁵

INSPIRE DS-D2.7, Guidelines for the encoding of spatial data, v3.3rc3⁶

1.2 General definitions

Terms and definitions necessary for understanding this document are defined in the INSPIRE Glossary <http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY/items>. In addition, the following terms and definitions are used:

Protected Site: The INSPIRE Directive defines a Protected Site as an area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

Protected Sites and Protected Areas are synonymous.

According to the International Union for the Conservation of Nature (IUCN), a Protected Site is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Protected Area: A clearly defined geographical space is recognised, dedicated and managed through legal or other effective means in order to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Definitions and details are basing on IUCN publication: "Guidelines for applying Protected Area Management Categories"⁷.

Designated Areas: The definition of a "designated area" within the Common Database on Designated Areas (CDDA) is very similar to the protected area definition by IUCN. The "designation types" are grouped according to 3 categories, which clearly reflect the IUCN note above by also identifying designation types in other sectors "or other effective means".

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF>

² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2010R1089:20110225:EN:PDF>

³ http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.5_v3.4rc3.pdf

⁴ http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_PS_v3.1.pdf

⁵ http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_PS_v3.2.pdf

⁶ http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.7_v3.3rc3.pdf

⁷ <http://data.iucn.org/dbtw-wpd/edocs/PAPS-016.pdf>

As some of the designation types do not refer to the creation of individual site networks, the definition of the CDDA also includes "area covering" designations such as the protection of the complete distribution of certain habitats. This is an addition to the IUCN "protected area" definition.

CDDA: The CDDA is a European inventory of nationally designated areas. It holds information about protected areas and the national legislative instruments, which directly or indirectly create protected areas⁸.

Eionet: It is a partnership network of the European Environment Agency (EEA) and its member and cooperating countries. It consists of the EEA itself, six European Topic Centres (ETCs) and a network of around 1000 experts from 39 countries in over 350 national environment agencies and other bodies dealing with environmental information. These are the National Focal Points (NFPs) and the National Reference Centres (NRCs). Definition based on Eionet website⁹.

Harmonisation: This means the ability of data to be compatible and implies the adoption of common rules in application schemas, co-ordinate reference systems, classification systems, identifier management, etc. from different points of view. Definition based on NatureSDI^{plus} project publications¹⁰.

Interoperability: It gives possibility for spatial data sets to be combined, and for services to interact, without repetitive manual intervention; in such a way that the result is coherent and the added value of the data sets and services is enhanced [INSPIRE Directive]. Definition based on the INSPIRE Glossary¹¹.

1.3 Symbols and abbreviations

<i>Acronym</i>	<i>Description</i>
CDDA	Common Database on Designated Areas
CRS	coordinate reference system
DM	data model
DS	data specifications
EC	European Commission
EEA	European Environment Agency
EPSG	European Petroleum Survey Group
ETC/BD	European Topic Centre on Biological Diversity
ETL	Extract - Transform – Load
GCM	Generic Conceptual Model
GIS	Geographic Information System
GML	Geography Markup Language
HALE	HUMBOLDT Alignment Editor
INSPIRE	Infrastructure for Spatial Information in Europe; Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
INSPIRE MIG	INSPIRE Maintenance and Implementation Group

⁸ <http://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-8>

⁹ <http://www.eionet.europa.eu/>

¹⁰ <http://www.nature-sdi.eu/>

¹¹ <https://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY/items>

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INSPIRE PS	INSPIRE Protected sites theme
IR	Implementing Rules (a.k.a Commission Regulation)
IUCN	International Union for the Conservation of Nature
JRC	Joint Research Centre
MT	matching table
MS	Member State
MD	metadata
OGC	Open Geospatial Consortium
PS	Protected sites
TG	Technical Guidelines (a.k.a Data/interoperability specification)
UML	Unified Modelling Language
UNEP-WCMC	United Nations Environment Programme – World Conservation Monitoring Centre United
WDPA	World Database on Protected Areas

1.4 Notations

In order to make easier to identify the agreements and the recommendations for the right GML encoding, they are highlighted using the following characteristics.

Recommendation no.

Recommendations are shown using this style

Agreement no.

Agreements are shown using this style

Open issue no.

Open issues are shown using this style

2 Scope

2.1 Scope of the project

The scope of the global project is summarised in order to keep always present the main pursued objectives.

The CDDA is an established Eionet priority data flow. It is related to the INSPIRE Protected sites (INSPIRE PS) spatial data theme by its purpose and content. By demonstrating how to provide the CDDA European data sets in conformity with the INSPIRE Protected sites data specification and Implementing Rules, the European Environment Agency (EEA) may:

- provide useful guidelines to the EEA/Eionet members and help them with the INSPIRE implementation in this particular topic;
- suggest improvements to the management of the unique identifiers within the CDDA data sets;
- improve the documentation of the CDDA data model, including the spatial component and
- provide the complete line of INSPIRE conformant components (metadata, services and data sets) for every release of this data flow.

2.1.1 Objectives

Main objectives of this project are to set-up and test the process and provide the CDDA data sets in conformity with the INSPIRE Protected sites data specification.

Based on the INSPIRE Protected sites guidelines published in 2010, the project, initially, referred to both application schemas Simple and Full application schema. During the project progress, the updated INSPIRE Protected sites¹² guidelines was published on 17.04.2014 which include the Simple application schema only, while the extended Full application schema has been removed and transferred to the future work within the INSPIRE Maintenance and Implementation Group (MIG). Therefore, the INSPIRE PS Full application schema is not available currently and it won't be used in this project. The project scope and description are updated to reflect this fact.

The main objectives of the project are the following:

- To develop the process (define, test and document the workflow) for providing the CDDA data sets (European database) in conformity with the INSPIRE Protected sites data specifications (Implementing Rules and Technical Guidelines) by verifying the mapping against the INSPIRE PS Simple application schema;
- To provide the CDDA data sets in conformity with the INSPIRE Protected sites;

¹² http://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_PS_v3.2.pdf

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- To draft proposals for the updates of the CDDA data flow, if necessary;
- To draft proposals for the implementation or updates of relevant INSPIRE data specifications (with regard to the outcomes of the CDDA in conformity with INSPIRE project), if applicable (to be later provided to the INSPIRE MIG).

At the same time, the gathered information during this project about the relevant software tools will be used to set-up the appropriate workflow and software tools in the EEA. It will build the internal capacity which will allow further re-use and design of the similar processes and transformation rules for other spatial data sets in the EEA that will be provided in conformity with INSPIRE.

Following this, specific objectives for the “Step-2: Evaluate conformity of the CDDA data sets with INSPIRE PS Simple application schema” are established:

- To define the Mapping Rules between the CDDA information and the INSPIRE PS specifications.
 - create matching table with all explanations
 - identify and document the gaps and problems and propose and document the solutions for them.
- Proof of concept of transformation with test data transformation into GML format. Document the main aspects.

2.1.2 Expected outcomes

- A defined workflow for making CDDA data sets in conformity with INSPIRE data specifications;
- Documented transformation rules for mapping between the data models of the CDDA and INSPIRE Protected sites;
- CDDA data sets in conformity with INSPIRE Protected sites and in the appropriate encoding (example of data formats: GML, others);
- Examples of the national CDDA data sets provided in conformity with the INSPIRE Protected sites are based on the same transformation rules (up to 3 countries’ examples): documented mapping and provided data sets in the appropriate encoding.
- Demonstration or guidelines for the software tools are used in this process, and it is especially for mapping and storing the transformation rules for future re-use (deployment of the software tools in the EEA if possible).

2.1.3 Project overview

The project has two parts:

1. The first part has the highest priority and is related to the activities of the CDDA in conformity with the INSPIRE PS Simple application schema and
2. The second part is related to the activities of the CDDA in conformity with the INSPIRE PS Full application schema.

The second part is postponed until the INSPIRE PS Full application schema is updated by INSPIRE MIG. Therefore, this second part is no longer included in this project. The focus of the project is on the first part.

The complete project is organised into six steps:

- Step-1: Initial study and evaluation of the process;
- Step-2: Evaluate conformity of the CDDA data sets with INSPIRE PS Simple application schema;
- Step-3: Transform the CDDA data sets based on the matching tables into Geography Markup Language (GML);
- Step-4: Run and document the compliance tests;
- Step-5: Document the complete process.

2.2 Scope of the report

This report presents the initial work on the proof of concept of transforming the data from the CDDA European data sets into GML, following the mapping rules which are defined in the report “Step-3: Transform the CDDA data sets based on the matching tables into Geography Markup Language (GML)”.

This report is organised in several chapters with the objective to guide the reader to a practical knowledge about how a INSPIRE compliant GML file has to be encoded. Transformation rules allow moving from the conceptual model (UML data model and mapping rules) to the physical model. The use of specific transformation tools will allow putting mapping rules in place, creating as a result of this process a GML file, which is the format, recommended for the purpose of data interchange between systems in INSPIRE. Mapping rules are described extensively in the Report D2.2-TechnicalReport_MappingRules¹³ of the project.

- The first chapter provides a general overview about related normatives, general definitions and notation used in the document for underline specific aspects.
- The second chapter gives the explanations of the global project, main goals and expected outcomes, describing as well the organisation of this report.
- The third chapter describes widely all the attributes encoding after a deep software tools analysis. Every INSPIRE Protected sites attribute has the explanations on how to perform the transformation process with agreements and recommendations. Examples come from the mapping rules adopted in previous work of the project.
- The fourth chapter describes how to work with voidable values applying the mapping rules. Studies done have found that in some cases there is no information available from the CDDA

¹³ <http://taskman.eionet.europa.eu/issues/19342>

¹⁰ CDDA in conformity with INSPIRE. Step-3: Transform the CDDA data sets based on the matching tables into GML (Geography Markup Language). Proof of concept

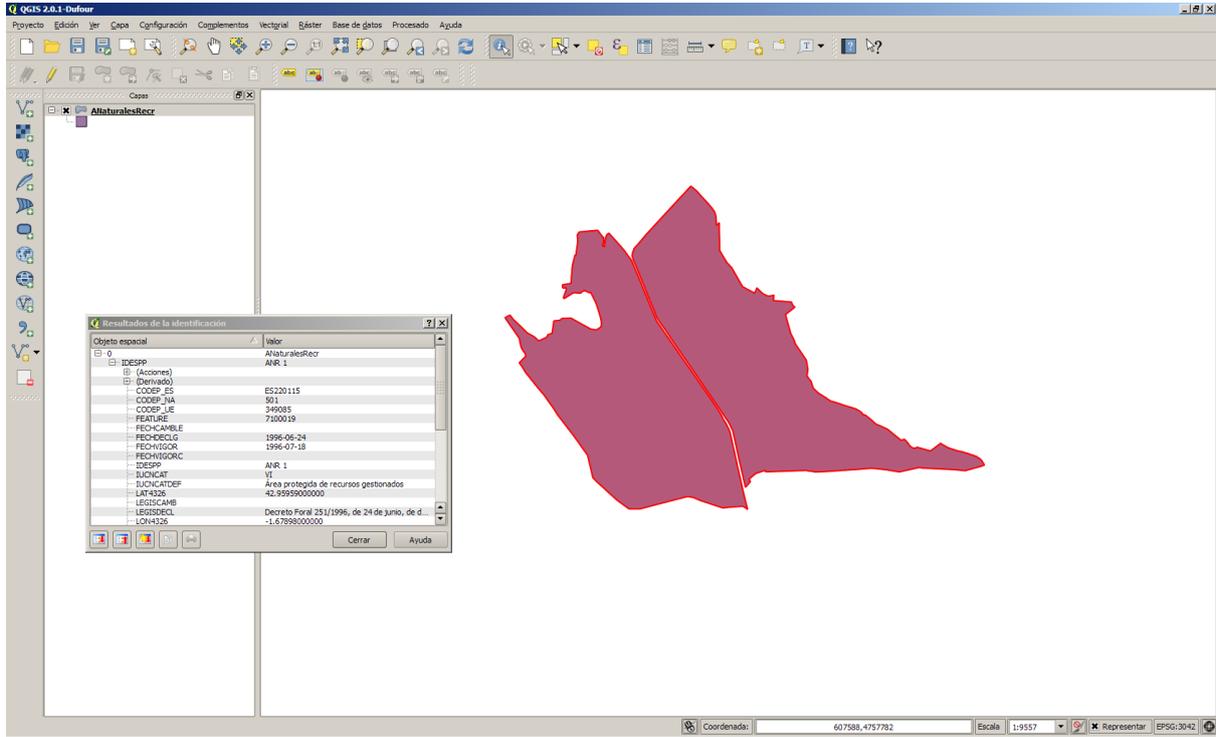
and this should be encoded in the right way to fulfil the INSPIRE PS data specifications and also the ISO specifications.

- The fifth chapter describes two issues that have been analysed during the previous studies of the project. The size of the physical geographical file is an important aspect to take into account in order to avoid problems working with software tools in different parts of the process. Also, visualising the GML result obtained after transformation process has to be the first validation issue to ensure the data quality. An example of how to do this point it is also included in this chapter.
- The sixth chapter is the place where open issues that appear in project have been managed. These open issues are needed to obtain the final GML file and to ensure its final quality. During the work done some of them have been closed finding solutions while others still need to be solved. At this moment few of them are still waiting a solution but it depends of future INSPIRE implementations.
- Although is out of the scope in this step, some validation aspect has been evaluated and are described in chapter seven. What is showed here it is a first approach to the Validation issue which will follow in future reports.
- Annex 1 contains a real example of GML encoding for one “site” with the complete attributes.

3 GML Description

3.1 Attribute: geometry (INSPIRE PS)

Figure 3.1: The multi-surface geometry defining the boundary of the Protected Site.



Geometry encoding

Description on two approaches of GML encoding it was followed at the beginning:

- Using MultiSurface
- Using Polygon (like in GeoConverter and HALE)

After analysing this issue with some experts, the final conclusion is to encode the multipolygons with gmd: MultiSurface. Also previous tests show the need to encode plane and multi polygons in the same way with the final goal of displaying it in a viewer. It has to be into account that all the CDDA datasets will contain a combination of plane polygons and multipolygons. Latest improvements in HALE transformation tool show that this default encoding using gmd: MultiSurface for all the spatial objects in a dataset it is possible.

Also another geometry issue has been analysed during this project step. In the CDDA spatial information points and polygons can be found. To create polygons from points is a work that is not part of this project.

Agreement 1.

For the prototype only polygons will be used.

Agreement 2.

For all spatial objects gmd:MultiSurface has to be used in the GML encoding.

```
<ps:geometry>
  <gml:MultiSurface gml:id="MultiSurface_1" srsName="urn:ogc:def:crs:EPSG::4258">
    <gml:surfaceMember>
      <gml:Polygon gml:id="ZonePolygon_1" srsDimension="2" >
        <gml:exterior>
          <gml:LinearRing>
            <gml:posList>2.96426248808386 -1.6830767239679427 42.96402250203678 -
1.68284165381832</gml:posList>
          </gml:LinearRing>
        </gml:exterior>
      </gml:Polygon>
    </gml:surfaceMember>
    <gml:surfaceMember>
      <gml:Polygon gml:id="ZonePolygon_2" srsDimension="2">
        <gml:exterior>
          <gml:LinearRing>
            <gml:posList>42.96465225760745 -1.6779829722252757 42.96436146432868 -
1.677965300350789</gml:posList>
          </gml:LinearRing>
        </gml:exterior>
      </gml:Polygon>
    </gml:surfaceMember>
  </gml:MultiSurface>
</ps:geometry>
```

CRS encoding:

Two different options for CRS encoding have been identified, EPSG:4258 or urn:ogc:def:crs:EPSG::4258. Both are right and refer to ETRS89; nevertheless EPSG:4258 is ETRS89 in XY-order, while urn:ogc:def:crs:epsg::4258 is YX-order. The last one represents the coordinates order defined by the EPSG and the encoding of OGC for this CRS.

Agreement 3.

To use srsName="urn:ogc:def:crs:EPSG::4258".

Another approach analysed the possibility of including in the srsName element a reference to an identifier in a registry. For example: *http://www.opengis.net/def/crs/EPSSG/0/4258*. Following the INSPIRE PS requirements:

- IR requirement (IR Requirement Annex II, Section 1.5 Coordinate Reference System Identifiers) which defines: “Only identifiers contained in a common register shall be used for referring to the coordinate reference systems listed in this Section.”
In addition, it is proposed: These Technical Guidelines propose to use the http URIs provided by the Open Geospatial Consortium as coordinate reference system identifiers.
- TG requirement 2: The identifiers listed in Table 3 shall be used for referring to the coordinate reference systems used in a data set.

At this moment it was not possible to go in this way. For the objective of the current project the encoding of the srsName it will be done using the OGC code.

3.2 Attribute: inspireID (INSPIRE PS)

Definition: External object identifier of the protected site.

According INSPIRE Technical Guidelines for Protected Sites, only two attributes are mandatory for reporting the unique identifier inspireId: localId and namespace.

```
<ps:inspireID>  
  <base:Identifier>  
    <base:localId>895</base:localId>  
    <base:namespace>EU.EUROPA.ENVIRONMENT.PS.CDDA.ESP.ESP</base:namespace>  
  </base:Identifier>  
</ps:inspireID>
```

```
<ps:inspireID>  
  <base:Identifier>  
    <base:localId>895</base:localId>  
    <base:namespace>EU.EUROPA.ENVIRONMENT.PS.CDDA.NOR.SJM</base:namespace>  
  </base:Identifier>  
</ps:inspireID>
```

Agreement 4.

Direct link between SITE_CODE (CDDA) and INSPIRE localId

Use a code composed by a fixed pattern + country code - PARENT_ISO (CDDA) + extraregions-ISO3 (CDDA) as following:

EU.EUROPA.ENVIRONMENT.PS.CDDA. < PARENT_ISO >.< ISO3>

Validation:

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Validation processes against INSPIRE PS XSD schema show errors if the attributes localId and/or namespaces are not present.

All the values are available for this attribute. This is the minimum condition. Therefore, no voidable values exist.

3.3 Attribute: legalFoundationDate (INSPIRE PS)

Definition: The date when the protected site was legally created. This is the date when the real world object was created, not the date that its representation in an information system was created.

```
<ps:legalFoundationDate>1974-01-01T00:00:00+01:00</ps:legalFoundationDate>
```

Agreement 5.

To transfer “Year” (CDDA) into date of 1st January of that year and time as 00:00:00+01:00.
Brussels, Standard time zone: UTC/GMT +1 hours.

yyyy → yyyy-01-01T00:00:00+01:00

Validation:

Validation processes against INSPIRE PS XSD schema shows errors if the format for the attribute is not DateTime.

3.4 Attribute: legalFoundationDocument (INSPIRE PS)

Definition: A URL or text citation referencing the legal act that created the Protected Site

```
<ps:legalFoundationDocument xsi:nil="true" nilReason="unpopulated" />
```

Agreement 6.

The attribute will remain always as <voidable>.

Validation:

Validation processes using the encoding showed above against INSPIRE PS XSD schema shows NO errors. Therefore this would be a right way to leave it as voidable. However, more in depth analysis is provided in chapter 7.1.

3.4.1 Attribute title

Following INSPIRE PS data specifications, it is the information that identifies the legal document designating the site.

CDDA contains two fields *Law* and *Lawreference* from the table “*Designations*”; however it can not be mapped into this element. The main reason is that the meaning of *Law* and *Lawreference* in CDDA is different from the meaning of legal foundation document in INSPIRE PS data specifications; the first is at designation level, not site specific, while INSPIRE requires information specific from the site.

```
<gmd:title>
  <gco:CharacterString>Ley 42/2007; Ley 5/2005 de Illes Balears; Decreto legislativo 1/2000 de
  Canarias</gco:CharacterString>
</gmd:title>
```

Recommendation 1.

When the element is available at data provider level, it could be mapped to INSPIRE PS by following the attribute “title” characteristics.

3.4.2 Attribute date

It is the date related to legal document. It can be defined if it makes reference to Law creation, reviewing or publication.

CDDA does not have any field including this information, so the first conclusion is that it can not be mapped directly. The pursuit of this information through searching in the specific regulations seems difficult and should be made by data provider who better knows the information. The encoding is out of the scope of this document, however, some recommendations and examples are provided in case data provider could retrieve such information.

```
<gmd:date>
  <gmd:CI_Date>
    <gmd:date>
      <gco:Date>2007</gco:Date>
    </gmd:date>
    <gmd:dateType>
      <gmd:CI_DateTypeCode
codeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_DateTypeCode"
codeListValue="creation">creation</gmd:CI_DateTypeCode>
      </gmd:dateType>
    </gmd:CI_Date>
  </gmd:date>
```

Recommendation 2.

When the element is available at data provider level, it could be mapped to INSPIRE PS by following the attribute “date” characteristics.

3.5 Attribute: siteDesignation (INSPIRE PS)

Definition: The designation type (DesignationType) is composed of three elements: designationScheme, designation and percentageUnderDesignation.

3.5.1 Attribute designationScheme

Definition: The scheme from which the designation code comes.

According to INSPIRE PS Simple – CDDA extended schema, Several Designation Schemes can be used for reporting CDDA information:

- natura2000
- emeraldNetwork
- ramsar
- UNESCOWorldHeritage
- IUCN
- BiosphereReserve
- nationalMonumentsRecord
- nationalDesignationTypeCategory
- nationalDesignationTypeCode.

The proposal in this project was to create new extended code list INSPIRE designationSchemeValue, which include all INSPIRE codes and two extended codes: nationalDesignationTypeCategory and nationalDesignationTypeCode. Then, for all the selected schemas it is possible to reference to this new code list:

<http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue>

3.5.2 Attribute designation

Definition: The actual Site designation.

It is the actual site designation. More than one designation schema can be used for designating the site. Each designation schema will usually use more detailed classification of the designations, for example in a form of the code lists.

In the wake of the previous proposal, in this project the following links were created to the code lists nationalDesignationTypeCategoryValue and nationalDesignationTypeCodeValue:

<http://dd.eionet.europa.eu/vocabulary/cdda/designations>

<http://dd.eionet.europa.eu/vocabulary/cdda/designationtypecategory>

For the links to the INSPIRE non extended code list values, the direct reference to INSPIRE code list could be used.

3.5.3 Attribute *percentageUnderDesignation*

It is the percentage of the site that falls under the designation. Information is not explicitly required in the CDDA data set, but it is implicit based on the CDDA definition that only the sites with 100% area under designation are included in the CDDA; this is correct for National designation type category and National designation type code.

However, for IUCN categories it can not be assured that the site is 100% covered by the IUCN category. Data type Percentage is defined in INSPIRE PS, version 3.2 as: A percentage value, being an integer between 0 and 100 inclusive. Based on the definition of the attribute *percentageUnderDesignation* (INSPIRE PS), for the purpose of this project it is proposed to use the value -1 to indicate that percentage of site under IUCN is not available.

```
<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme codeSpace="
http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue
">nationalDesignationTypeCode</ps:designationScheme>
    <ps:designation
codeSpace="http://dd.eionet.europa.eu/vocabulary/cdda/designations">ES08</ps:designation>
      <ps:percentageUnderDesignation>100</ps:percentageUnderDesignation>
    </ps:DesignationType>
  </ps:siteDesignation>

<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme codeSpace="
http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue
">nationalDesignationTypeCategory</ps:designationScheme>
    <ps:designation
codeSpace="http://dd.eionet.europa.eu/vocabulary/cdda/designationtypecategory">A</ps:designation
>
      <ps:percentageUnderDesignation>100</ps:percentageUnderDesignation>
    </ps:DesignationType>
  </ps:siteDesignation>

<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme codeSpace="
http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue
">IUCN</ps:designationScheme>
    <ps:designation
codeSpace="http://inspire.ec.europa.eu/codelist/IUCNDesignationValue">nationalPark</ps:designati
on>
      <ps:percentageUnderDesignation>-1</ps:percentageUnderDesignation>
    </ps:DesignationType>
  </ps:siteDesignation>
```

Agreement 7.

To provide at least information about three designation schemas:

- IUCN
CDDA - Table “*sites*” - field IUCNCAT. The mapping between INSPIRE code list and EEA Data Dictionary vocabulary is needed.
- nationalDesignationTypeCategory:
CDDA - Table “*designation*” – field National Designation type category.
- nationalDesignationTypeCode
CDDA - Table “*designation*” – field National Designation type code.

Agreement 8.

Values for the “percentageUnderDesignation” attribute are fixed:

- IUCN: -1
- National Designation Type Category: 100%
- National Designation Type Code: 100%

Validation:

Validation processes against INSPIRE PS XSD schema shows NO errors even when the three schemas (IUCN, NationalDesignationTypeCategory and NationalDesignationTypeCode) are included. The Multiplicity: 1..* of the “siteDesignation” attribute allows this.

3.6 Attribute: siteName (INSPIRE PS)

Definition: It is the name of the protected site.

```
<ps:siteName>
  <gn:GeographicalName>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Timanfaya</gn:text>
        <gn:script nilReason="unpopulated" xsi:nil="true"/>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>
```

Recommendation 3.

Following INSPIRE recommendations, the simplest use of data type GeographicalName could be used for the names by other INSPIRE application schemas; for instance INSPIRE PS Simple application schema. Only the attribute text is mandatory for providing the CDDA information according to the INSPIRE PS simple application schema.

However, for proper validation is necessary to apply the complete data type GeographicalName.

http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_GN_v3.0.1.pdf

Validation:

Validation processes against INSPIRE PS XSD schema shows errors if the data type Geographical Name is not complete. It is fixed with the following encoding:

```
<ps:siteName>
  <gn:GeographicalName>
    <gn:language xsi:nil="true" nilReason="unpopulated"/>
    <gn:nativeness xsi:nil="true" nilReason="unpopulated"/>
    <gn:nameStatus xsi:nil="true" nilReason="unpopulated"/>
    <gn:sourceOfName xsi:nil="true" nilReason="unpopulated"/>
    <gn:pronunciation xsi:nil="true" nilReason="unpopulated"/>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Playa del Matorral</gn:text>
        <gn:script nilReason="unpopulated" xsi:nil="true"/>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>
```

3.7 Attribute: siteProtectionClassification (INSPIRE PS)

The classification of the protected site is based on the purpose for protection. According to INSPIRE PS data specifications, the site protection classification follows an enumeration list of values.

```
<ps:siteProtectionClassification>natureConservation</ps:siteProtectionClassification>
```

Agreement 9.

To use always “natureConservation” for CDDA reporting.

Validation:

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Validation processes against INSPIRE PS XSD schema show errors if at least one of the values from the enumeration list is not present.

Description: cvc-enumeration-valid: Value " is not facet-valid with respect to enumeration '[natureConservation, archaeological, cultural, ecological, landscape, environment, geological]'. It must be a value from the enumeration.

3.8 Attribute: ID (GML encoding)

The only requirement for this element is that must be unique, following the GML encoding rules.

Geoconverter example:

```
<ps:ProtectedSite gml:id="I72">  
  <ps:geometry>  
    <gml:Polygon srsDimension="2" srsName="EPSG:04258" gml:id="p1">
```

HALE example:

```
<ps:ProtectedSite gml:id="ProtectedSite_id_b513411d-3f2c-4eb1-b431-3f3d87d2e521">  
  <ps:geometry>  
    <gml:Polygon gml:id="_f090db9a-269f-4285-9e32-7ee449d7f005" srsName="EPSG:4326">
```

Agreement 10.

To define the element as unique value.

Transformation tools ensure the right encoding of this element.

4 Voidable stereotype

4.1 Attribute: legalFoundationDate (INSPIRE PS)

Following the agreements reached in the report D2.2-TechnicalReport_MappingRules on the voidable stereotypes, only some of the input information from CDDA has no value for the official date, therefore the nilReason must be unknown.

```
<ps:legalFoundationDate nilReason="unknown" xsi:nil="true" />
```

4.2 Attribute: legalFoundationDocument (INSPIRE PS)

The mapping rules (see D2.2-TechnicalReport_MappingRules) show that no mapping appears between the European CDDA data sets and the INSPIRE PS attribute legalFoundationDocument. Therefore, the information on void reason will be assigned to this INSPIRE PS attribute. The agreement is to use unpopulated for the nilReason.

```
<ps:legalFoundationDocument xsi:nil="true" nilReason="unpopulated" />
```

Validation processes using the encoding showed above against INSPIRE PS XSD schema shows NO errors. Therefore this would be a right way to leave it as voidable. However, more in depth analysis is provided in chapter 7.1.

However, in case the minimum CI_Citation attributes should be completed, the reason would follow the ISO specifications:

```
<ps:legalFoundationDocument>  
  <gmd:CI_Citation>  
    <gmd:title gco:nilReason="missing"/>  
    <gmd:date gco:nilReason="missing"/>  
  </gmd:CI_Citation>  
</ps:legalFoundationDocument>
```

4.3 Attribute: siteDesignation (INSPIRE PS)

According the NationalDesignationTypeCode schema, no empty values have been found in the CDDA information.

According the NationalDesignationTypeCategory and IUCN schemas, empty values could be found in the CDDA information. In these cases, logical conditions could be designed and the corresponding encoding could be obtained for the empty values. Following the agreements reached in the report D2.2-TechnicalReport_MappingRules on the voidable stereotypes, only some of the input information from CDDA has no value for Category and IUCN values, therefore the nilReason must be unknown.

```

<ps:siteDesignation nilReason="unknown">
  <ps:DesignationType>
    <ps:designationScheme>IUCN</ps:designationScheme>
    <ps:designation/>
  </ps:DesignationType>
</ps:siteDesignation>

<ps:siteDesignation nilReason="unknown">
  <ps:DesignationType>
<ps:designationScheme>nationalDesignationTypeCategory</ps:designationScheme>
    <ps:designation/>
  </ps:DesignationType>
</ps:siteDesignation>

```

4.4 Attribute: siteName (INSPIRE PS)

Following the agreements reached in the report D2.2-TechnicalReport_MappingRules on the voidable stereotypes, only some of the input information from CDDA has no value for the official Site name, therefore the nilReason must be unknown. For the rest of attributes of the data type GeographicalName the default value must be "Unpopulated" because for the objective of this project it is not necessary to fill them.

```

<ps:siteName>
  <gn:GeographicalName>
    <gn:language xsi:nil="true" nilReason="unpopulated"/>
    <gn:nativeness xsi:nil="true" nilReason="unpopulated"/>
    <gn:nameStatus xsi:nil="true" nilReason="unpopulated"/>
    <gn:sourceOfName xsi:nil="true" nilReason="unpopulated"/>
    <gn:pronunciation xsi:nil="true" nilReason="unpopulated"/>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Playa del Matorral</gn:text>
        <gn:script nilReason="unpopulated" xsi:nil="true"/>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>

```

5 GML issues

This chapter describes two issues that have been analysed during the previous studies of the project.

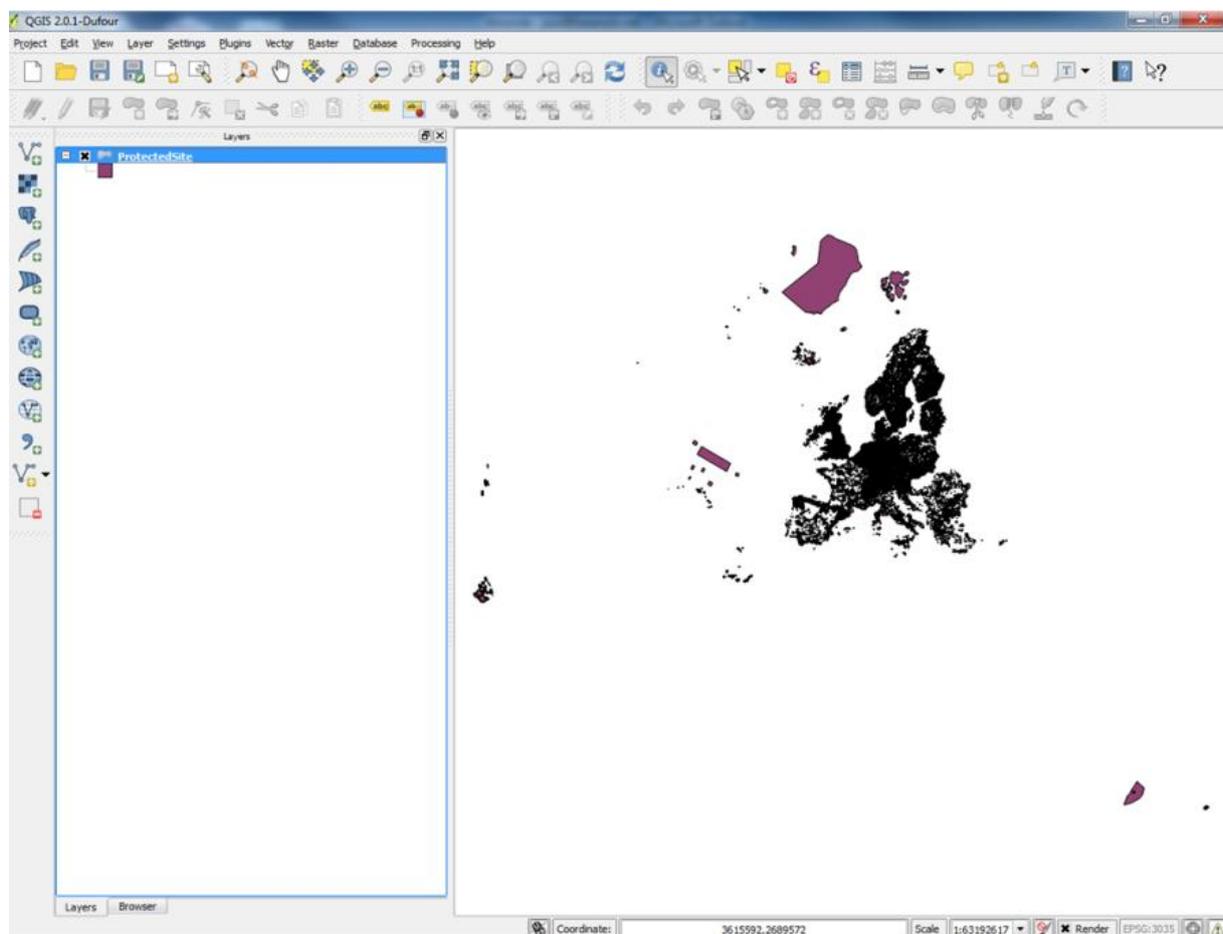
5.1 GML size

The size of the physical geographical file is an important aspect to take into account in order to avoid problems working with software tools in different parts of the process. CDDA information including the 35 countries (Eionet members) information generates one output GML file with more than 2 GB size. Even some software tools can not perform this transformation process. Large files are difficult to manage in different applications as viewers, validation tools, etc.

Agreement 11.

To split the CDDA information by country in order to obtain manageable GML files.

Figure 5.1 CDDA information



5.2 Displaying

The first aspect that can be validated to ensure the data quality is the visualization of the GML obtained after a transformation process. The correct displaying of the polygons ensures that the agreement 1 “For the prototype only polygons will be used” has been followed.

Also it is important to check the CRS. Using a reference vector or raster data it is a good solution.

Agreement 12.

The first assessment of the data transformation process is the proper visualisation of the GML file within the appropriate software tool.

Figure 5.2: GML file from Spain visualised in QGIS

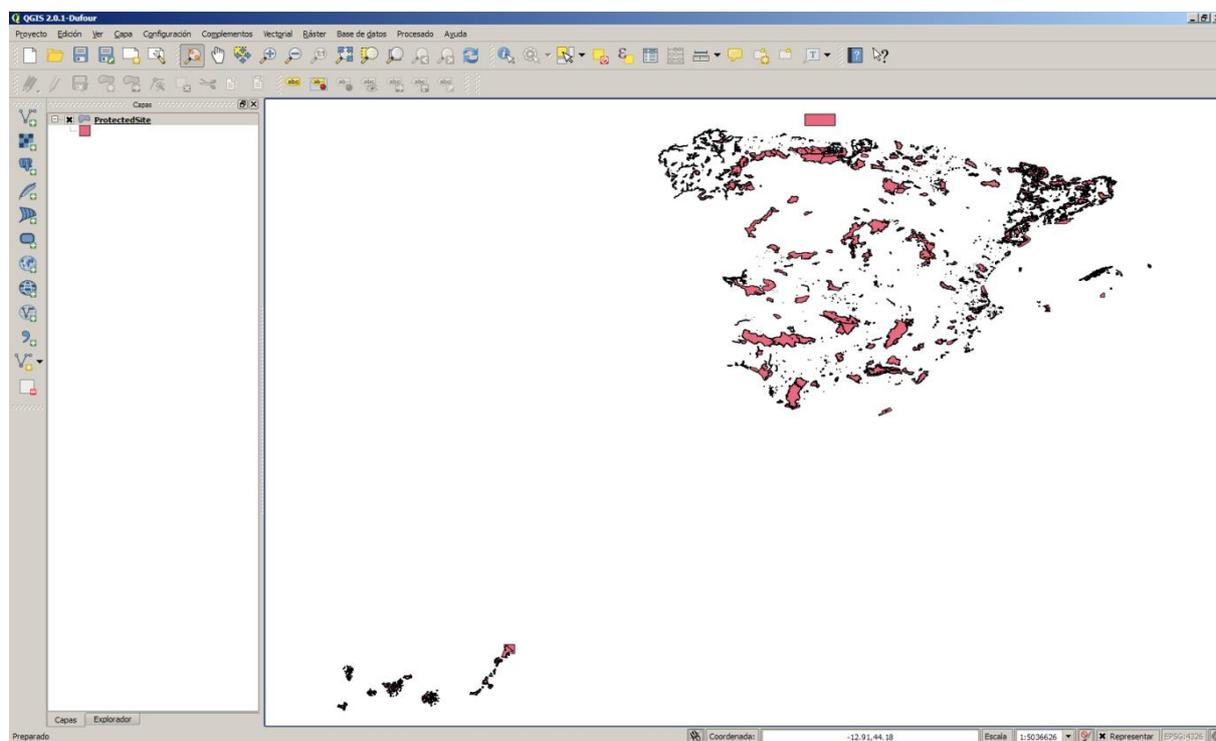
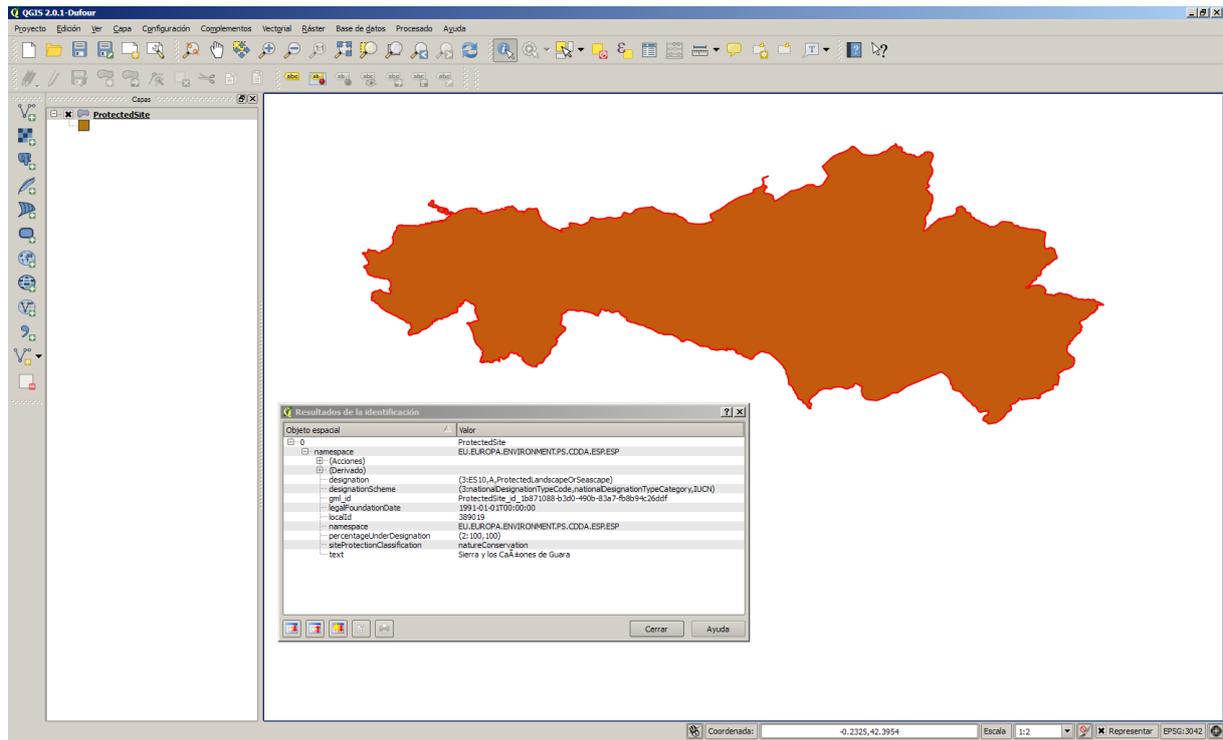


Figure 5.3 GML file of one site from Spain visualized in QGIS



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6 Open issues

In this chapter, there is a list of the open issues in the project discovered so far. These issues need to be solved to get the final GML file and to ensure its final quality. They do not depend on the project itself, but they include several questions that have been formulated directly for the INSPIRE community and cannot be solved at project level, but at INSPIRE MIG level.

Some other open issues have been analysed in this chapter and some of them have been solved finding the solution. The different concerns are related to the GML encoding and also some other aspects connected to the INSPIRE PS data model. Now only the issues related with INSPIRE are still open.

Open issue 1.

ps:percentageUnderDesignation under ps:siteDesignation.

Here are listed some of the doubts. These have been sent as feedback to INSPIRE MIG.

- ps:percentageUnderDesignation is of type Percentage, however this data type does not exist in ISO or in the INSPIRE GCM. It is defined within the updated INSPIRE Protected sites Technical Guidelines, published on 17.04.2014, but as a type (page 23) and data type (page 20).

Now it is possible to find a definition: “A percentage value, being an integer between 0 and 100 inclusive.”

- Once the UML is transformed into the XSD, attribute percentageUnderDesignation ends up being defined as type anyURI, not Percentage (as it is in the UML data model).
- A number is needed to represent the percentage. No doubts appear now with latest version of INSPIRE Protected sites Technical Guidelines, published on 17.04.2014. to use a range 0..100.
- There’s a bit contradiction between the multiplicity of the attribute percentageUnderDesignation and its definition. Definition states that “The percentage of the site that falls under the designation. This is used in particular for the IUCN categorisation. If a value is not provided for this attribute, it is assumed to be 100%”

Question: How the information that the percentage under designation is unknown should be provided?

- Value -1 is used in the current project to indicate that the percentage is not known or available. This is not an elegant solution but it would avoid misinterpretation when the percentage is not provided because this value is not known or available and it could be interpreted wrongly as 100% based on the definition of the attribute.

Open issue 2.

Code lists: it seems that has been a shift of paradigm between INSPIRE Directive Annex I & Annex II&III data specifications. In Annex I, elements that reference code lists are defined as gml:CodeType; in Annex III they're defined as gml:ReferenceType. For Annex III it's clear that the entire entry is provided within the xlink; for Annex I is a bit unclear what goes into the codeSpace attribute and what goes into the element itself.

Question: Is the following encoding correct:

```
<ps:designationScheme codeSpace="
http://inspire.ec.europa.eu/codelist/DesignationSchemeValue/">IUCN</ps:designationScheme>
```

Question: Are there any plans to align the code list elements between Annex I & Annex II&III data specifications in the future?

The last information from JRC indicates that the new versions of INSPIRE Annex 1 themes are going to be created including this issue. They ask for our feedbacks. The scope is to be backwards compatible with data sets that have already been transformed according to the old schemas. I.e. even if you used the old schemas in your project the data should still validate against the new schemas as well.

Open issue 3.

ProtectedSitesFull: While the PS-Simple schema is available together with the other Annex I schemas, the full schema is now under drafts.

Question: When the INSPIRE PS Full application schema will be available?

Question: There seems to be quite a difference between the UML and XSD for ProtectedSitesFull; what's status and outlook for this?

Open issue 4.

ps:inspireID vs. ef:inspireId: It has been noticed that in XSD of Annex III is written Id with a small "d", in XSD for Protected sites and other Annex I it's ID with a large "D".

Question: What is the reason for this and if/when will this attribute be harmonized through all INSPIRE data specifications and data models?

7 Validation approach

The software tool *HALE - The HUMBOLDT Alignment Editor* has been used to evaluate how the mapping and the final encoding obtained impact the final GML result. Although, it is out of the scope in this step of the project, the results have been validated using *Oxygen XML Editor v15 by SyncRo Soft SRL* and *W3C XML Schema (XSD) Validation online*, against the INSPIRE PS XSD schema.

The schematron and the PS schematron (the version extended has been prepared by Katharina Schleidt from ETC/BD) have been also used as a proof of concept. Nevertheless, this document presents only the results obtained working with XSD schema as the complete validation will be carried out during the next step of the project.

This validation approach describes some issues that need to be analysed and solved prior to the next step, in order to get the final and right GML result.

The process has been duplicated using *Geoconverter* tool and the results are quite similar than using HALE.

7.1 Attribute: legalFoundationDocument (INSPIRE PS)

The objective would be to leave the attribute, voidable at high level:

```
<ps:legalFoundationDocument xsi:nil="true" nilReason="unpopulated" />
```

However, the tools used for the encoding doesn't provide directly the possibility to encode in this way. For example, the best way to get this encoding using HALE tool is not mapping the attribute at all; then the result obtained would be:

```
<ps:legalFoundationDocument xsi:nil="true"/>
```

There is no information about the nilReason, but the validation process using Oxygen software against INSPIRE PS XSD schema shows NO errors. Even if the nilReason="unpopulated" is added manually in the GML result, the validation process shows NO errors.

However, if the attribute is filled using the nilReason option assigning a default value, the result obtained is completely different:

```
<ps:legalFoundationDocument nilReason="missing">  
  <gmd:CI_Citation/>  
</ps:legalFoundationDocument>
```

The validation of these lines using Oxygen software against INSPIRE PS XSD schema shows in this case some errors:

*"The content of element 'gmd:CI_Citation' is not complete.
One of '{\"http://www.isotc211.org/2005/gmd\":'title'}' is expected."*

To avoid errors related to *gmd:CI_Citation* during the validation, the information about Title and Date must be included. In this case the reason for voidable element must follow ISO specifications:

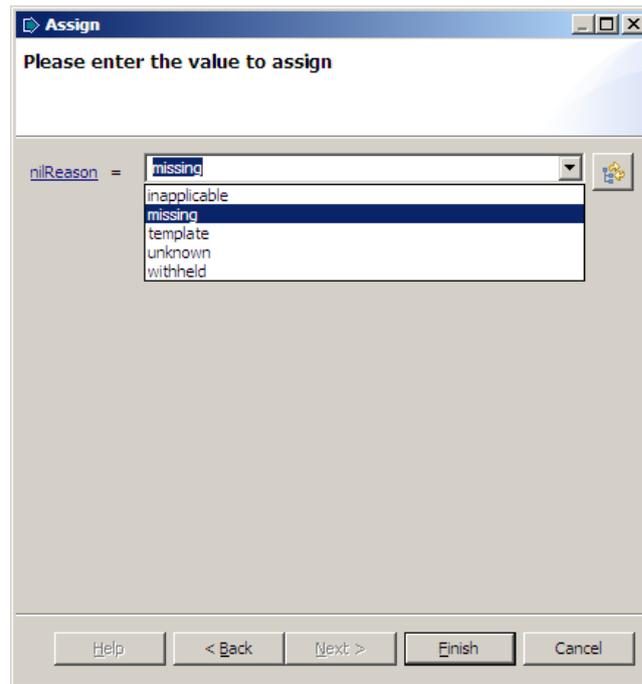
```
<ps:legalFoundationDocument>  
  <gmd:CI_Citation>
```

```

    <gmd:title gco:nilReason="missing"></gmd:title>
    <gmd:date gco:nilReason="missing"></gmd:date>
  </gmd:CI_Citation>
</ps:legalFoundationDocument>

```

Note: only ISO voidable values for nilReason have been found in HALE, but it is possible to type-in directly the INSPIRE values. More information about this issue can be found in <http://taskman.eionet.europa.eu/issues/18249>



7.2 Attribute: siteDesignation (INSPIRE PS)

The three elements of this attribute are analysed: designationScheme, designation and percentageUnderDesignation.

When all the information is available and the 3 attributes are filled, no problems appear. But if some information is missed, the next errors emerge:

7.2.1 Attribute designation

When a spatial object has no information in the designation attribute, one way to proceed with the software tool is to leave the value empty, and then it is correctly validated:

```

<ps:designation
codeSpace="http://inspire.ec.europa.eu/codelist/IUCNDesignationValue/"></ps:designation>

```

Filling manually the encoding with `xsi:nil="true"` and/or `nilReason="unknown"`, the validation process using Oxygen software against INSPIRE PS XSD schema shows errors:

“cvc-elt.3.1: Attribute 'http://www.w3.org/2001/XMLSchema-instance,nil' must not appear on element 'ps:designation', because the {nillable} property of 'ps:designation' is false.”

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Using the logical conditions it is possible to separate between value and no value and have a result like this:

```
<ps:siteDesignation nilReason="unknown">
  <ps:DesignationType>
    <ps:designationScheme>IUCN</ps:designationScheme>
    <ps:designation/>
  </ps:DesignationType>
</ps:siteDesignation>
```

And this is validated.

7.2.2 Attribute *percentageUnderDesignation*

Analysing the validation for IUCN designations, several solutions could be considered.

The first approach is to leave the attribute without mapping, and it doesn't appear in the final GML result.

```
<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme
codeSpace="http://inspire.ec.europa.eu/codelist/DesignationSchemeValue/">IUCN</ps:designationScheme>
    <ps:designation
codeSpace="http://inspire.ec.europa.eu/codelist/IUCNDesignationValue/">nationalPark</ps:designation>
  </ps:DesignationType>
</ps:siteDesignation>
```

The validation process using Oxygen software against INSPIRE PS XSD schema shows NO errors.

However, the proposal is to map IUCN designation using the -1 to avoid misinterpretation with the INSPIRE PS definition of this attribute

When the attribute is filled with -1 for all the spatial objects, the validation process using Oxygen software against INSPIRE PS XSD schema also shows NO errors:

```
<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme
codeSpace="http://inspire.ec.europa.eu/codelist/DesignationSchemeValue/">IUCN</ps:designationScheme>
    <ps:designation
codeSpace="http://inspire.ec.europa.eu/codelist/IUCNDesignationValue/"></ps:designation>
    <ps:percentageUnderDesignation>-1</ps:percentageUnderDesignation>
  </ps:DesignationType>
</ps:siteDesignation>
```

Finally, if the attribute is encoded manually with `xsi:nil="true"` and/or `nilReason="unknown"` validation process using Oxygen software against INSPIRE PS XSD schema shows errors:

“cvc-elt.3.1: Attribute 'http://www.w3.org/2001/XMLSchema-instance,nil' must not appear on element 'ps:percentageUnderDesignation', because the {nillable} property of 'ps:percentageUnderDesignation' is false.”

A more in depth analysis on the software tools, shows that logical conditions could be designed and different encoding could be obtained for normal values and for empty values.

7.3 Attribute: siteName (INSPIRE PS)

Although we only fill the spelling attribute (text), the result shows all the attributes for the GeographicalName data type. And even filled with `xsi:nil="true"`.

```
<ps:siteName>
  <gn:GeographicalName>
    <gn:language xsi:nil="true"/>
    <gn:nativeness xsi:nil="true"/>
    <gn:nameStatus xsi:nil="true"/>
    <gn:sourceOfName xsi:nil="true"/>
    <gn:pronunciation xsi:nil="true"/>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Playa del Matorral</gn:text>
        <gn:script nilReason="missing" xsi:nil="true"></gn:script>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>
```

If we remove some attributes to show the simplest use of the data type GeographicalName, the validation process shows some errors:

```
<ps:siteName>
  <gn:GeographicalName>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Playa del Matorral</gn:text>
        <gn:script nilReason="missing" xsi:nil="true"></gn:script>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>
```

cvc-complex-type.2.4.a: Invalid content was found starting with element '{"urn:x-inspire:specification:gmlas:GeographicalNames:3.0":spelling}'. One of '{"urn:x-inspire:specification:gmlas:GeographicalNames:3.0":language}' is expected.

It is also possible to fill all attributes with the `nilReason="unpopulated"`

```
<ps:siteName>
  <gn:GeographicalName>
    <gn:language nilReason="unpopulated" xsi:nil="true"></gn:language>
    <gn:nativeness nilReason="unpopulated" xsi:nil="true"></gn:nativeness>
    <gn:nameStatus nilReason="unpopulated" xsi:nil="true"></gn:nameStatus>
```

```
<gn:sourceOfName nilReason="unpopulated" xsi:nil="true"></gn:sourceOfName>
<gn:pronunciation nilReason="unpopulated">
  <gn:PronunciationOfName/>
</gn:pronunciation>
<gn:spelling>
  <gn:SpellingOfName>
    <gn:text>Timanfaya</gn:text>
    <gn:script nilReason="unpopulated" xsi:nil="true"></gn:script>
  </gn:SpellingOfName>
</gn:spelling>
</gn:GeographicalName>
</ps:siteName>
```

And this also has been validated.

Annex 1 GML EXAMPLE

```
<gml:featureMember>
  <ps:ProtectedSite gml:id="ProtectedSite_id_d67f5cc1-1174-4407-b399-2098259049fd">
    <ps:geometry>
      <gml:MultiSurface gml:id="_5e42f835-b23d-409c-b42a-6d00db5861f2"
srsName="urn:ogc:def:crs:EPSG::4258">
        <gml:surfaceMember>
          <gml:Polygon gml:id="_10089c17-0bdc-48a9-8617-e18bb7f840d5">
            <gml:exterior>
              <gml:LinearRing>
                <gml:posList>42.96426248808386 -1.6830767239679427 42.96402250203678 -
1.68284165381832 </gml:posList>
              </gml:LinearRing>
            </gml:exterior>
          </gml:Polygon>
        </gml:surfaceMember>
        <gml:surfaceMember>
          <gml:Polygon gml:id="_115bf448-502f-4a46-b536-b608d66ca7d2">
            <gml:exterior>
              <gml:LinearRing>
                <gml:posList>42.96465225760745 -1.6779829722252757 42.96436146432868 -
1.677965300350789 </gml:posList>
              </gml:LinearRing>
            </gml:exterior>
          </gml:Polygon>
        </gml:surfaceMember>
      </gml:MultiSurface>
    </ps:geometry>

    <ps:inspireID>
      <base:Identifier>
        <base:localId>895</base:localId>
      </base:Identifier>
    </ps:inspireID>

    <ps:legalFoundationDate>1974-01-01T00:00:00+01:00</ps:legalFoundationDate>

    <ps:legalFoundationDocument>
      <gmd:CI_Citation>
        <gmd:title gco:nilReason="missing"></gmd:title>
        <gmd:date gco:nilReason="missing"></gmd:date>
      </gmd:CI_Citation>
    </ps:legalFoundationDocument>
```

```

<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme codeSpace="
http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue
">nationalDesignationTypeCode</ps:designationScheme>
    <ps:designation
codeSpace="http://dd.eionet.europa.eu/vocabulary/cdda/designations">ES08</ps:designation>
    <ps:percentageUnderDesignation>100</ps:percentageUnderDesignation>
  </ps:DesignationType>
</ps:siteDesignation>
<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme
codeSpace="http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue">IUCN</ps:desi
gnationScheme>
    <ps:designation
codeSpace="http://inspire.ec.europa.eu/codelist/IUCNDesignationValue">nationalPark</ps:designati
on>
    <ps:percentageUnderDesignation>-1</ps:percentageUnderDesignation>
  </ps:DesignationType>
</ps:siteDesignation>
<ps:siteDesignation>
  <ps:DesignationType>
    <ps:designationScheme
codeSpace="http://dd.eionet.europa.eu/vocabulary/inspire/DesignationSchemeValue">nationalDesign
ationTypeCategory</ps:designationScheme>
    <ps:designation
codeSpace="http://dd.eionet.europa.eu/vocabulary/cdda/designationtypecategory">A</ps:designation
>
    <ps:percentageUnderDesignation>100</ps:percentageUnderDesignation>
  </ps:DesignationType>
</ps:siteDesignation>

<ps:siteName>
  <gn:GeographicalName>
    <gn:language nilReason="unpopulated" xsi:nil="true"></gn:language>
    <gn:nativeness nilReason="unpopulated" xsi:nil="true"></gn:nativeness>
    <gn:nameStatus nilReason="unpopulated" xsi:nil="true"></gn:nameStatus>
    <gn:sourceOfName nilReason="unpopulated" xsi:nil="true"></gn:sourceOfName>
    <gn:pronunciation>
      <gn:PronunciationOfName>
        <gn:pronunciationSoundLink nilReason="unpopulated"
xsi:nil="true"></gn:pronunciationSoundLink>
        <gn:pronunciationIPA nilReason="unpopulated" xsi:nil="true"></gn:pronunciationIPA>
      </gn:PronunciationOfName>
    </gn:pronunciation>
    <gn:spelling>
      <gn:SpellingOfName>
        <gn:text>Bosque de Orgi</gn:text>
        <gn:script nilReason="unpopulated" xsi:nil="true"></gn:script>
      </gn:SpellingOfName>
    </gn:spelling>
  </gn:GeographicalName>
</ps:siteName>

```

```
<ps:siteProtectionClassification>natureConservation</ps:siteProtectionClassification>  
</ps:ProtectedSite>  
</gml:featureMember>
```