INSPIRE
Infrastructure for Spatial Information in Europe

Drafting Team "Data Specifications" Definition of Annex Themes and Scope

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Foreword

INSPIRE is a Directive proposed by the European Commission in July 2004 setting the legal framework for the establishment and operation of an Infrastructure for Spatial Information in the European Community. The purpose of such infrastructure is to support the formulation, implementation, monitoring activities and evaluation of Community policies and activities that may have a direct or indirect impact on the environment at various levels of public authority, European, national and local.

INSPIRE should be based on the infrastructures for spatial information that are created and maintained by the Member States. The components of those infrastructures include: metadata, spatial data themes (as described in Annexes I, II, III of the Directive), spatial data services; network services and technologies; agreements on data and service sharing, access and use; coordination and monitoring mechanisms, processes and procedures.

The guiding principles of INSPIRE are that the infrastructures for spatial information in the Member States should be designed to ensure that spatial data are stored, made available and maintained at the most appropriate level; that it is possible to combine spatial data and services from different sources across the Community in a consistent way and share them between several users and applications; that it is possible for spatial data collected at one level of public authority to be shared between all the different levels of public authorities; that spatial data and services are made available under conditions that do not restrict their extensive use; that it is easy to discover available spatial data, to evaluate their fitness for purpose and to know the conditions applicable to their use.

The text of the INSPIRE Directive is available from the INSPIRE web site (http://www.ec-gis.org/inspire). The Directive identifies what needs to be achieved, and Member States have two years from the date of adoption to bring into force national legislation, regulations, and administrative procedures that define how the agreed objectives will be met taking into account the specific situation of each Member State. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas. Implementing Rules are adopted as Commission Decisions, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed by representatives of the Member States and European Parliament[1]. The committee is chaired by a representative of the Commission (this is known as the Comitology procedure). The committee will be established within three months from the entry in force of the Directive.

The IR will be shaped in their legal structure and form by the Commission legal services on the basis of technical documents prepared by especially convened Drafting Teams, for each of the main components of INSPIRE: metadata, data specifications, network services, data and service sharing, and monitoring procedures.

This document represents a contribution of the Data Specification Drafting Team, and is open for the review process described in section “Purpose of the document”.

This deliverable identifies definitions and scope of INSPIRE spatial data themes, taking the feasibility and relevance for community policy into account. It is based on existing reference material, especially INSPIRE position papers, summarising the results in a single document.

The deliverable shall help to outline the individual spatial data themes, which will be described in more detail by Data Specifications later in the INSPIRE working programme. These Data Specifications will provide a detailed definition of data content by means of application schema and feature catalogue. Furthermore the Data Specifications will specify requirements to data quality, data consistency, reference systems and metadata. The theme description, scopes and examples in this deliverable D2.3 may serve as a starting point for the development of the Data Specifications.

[1] The implementing rules are formally adopted through the comitology procedure that has been amended by Council Decision of 17 July 2006 (2006/512/EC). Under the new regulation, the Parliament and the Council are on equal footing for all comitology procedures related to co-decision acts. As a consequence, all measures must be ratified by all three institutions to come into force.

This document is not a draft Implementing Rule, but is targeted to help in the process of developing Data Specifications that will become Implementing Rules.

Purpose of the document

This document contains the proposal of the Drafting Team "Data Specifications" for description and scope of INSPIRE spatial data themes. A preliminary version of this document (version 1) has already been revised in the light of comments from the INSPIRE Consolidation team.

It should be noted that the document - at this stage – draws mainly from the experience of the experts in the Drafting Team “Data Specifications”. For that reason, the descriptions of individual spatial data themes have been established at different level of detail. The usage examples, the outline of data content, the list of potential reference documents and the suggested contributors to further specification work are not yet aligned with the European Commission needs analysis, and the wider User Community in general.

This deliverable of the Drafting Team “Data Specifications” is an intermediate document between the theme definitions in the Directive and the Draft Implementing Rules. It is considered a starting point for the development of Data Specifications. It shall stimulate SDICs and LMOs to participate in the process, by commenting on this document and providing additional use cases and expertise to the development of harmonised data specifications to support INSPIRE.

This draft (version 2.0) is published in the INSPIRE restricted web site for SDICs and LMOs review. Only registered SDICs and LMOs are invited to make comments, through their contact person and using the convenient spreadsheet. The individuals concerned have been notified of the procedure to comment on this draft. The period to provide comments is set at 8 weeks from the day of publication, i.e. 6 July 2007 17:00 CET.

The comments from SDICs and LMOs on the description and scope of themes will be taken into account by the Drafting Team “Data Specifications”, for the development of an overview description of each theme with approx. 250 words per theme. This description together with the name of the theme and its definition (from the Directive) will be managed in the Feature Concept Dictionary. The overview description, together with the collection of comments from SDICs and LMOs categorised per theme, will be forwarded to the Thematic Working Groups that develop the Data Specifications for the individual spatial data themes from autumn 2007 on.

It is important to note that this document is not a draft Implementing Rule, but a document that is targeted to support the process of developing Data Specifications that will eventually become Implementing Rules. There will be one Implementing Rule (IR) for each theme. A IR may contain one or several data specifications (according to different level of details or vector – raster for the same one).

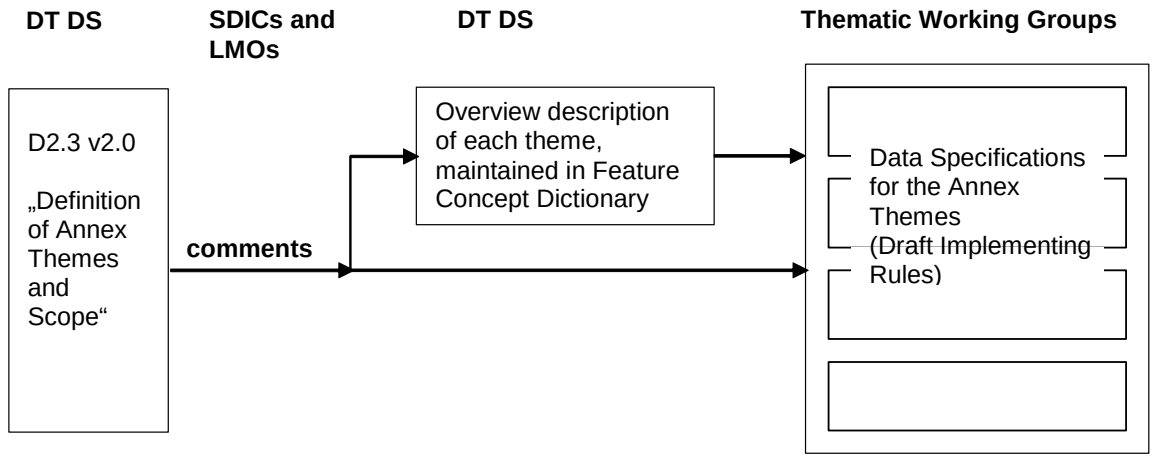

Figure 1 – Further steps from D2.3 v2.0

1 Scope

This deliverable identifies definitions and scope of INSPIRE spatial data themes, taking the feasibility and relevance for community policy into account. It is based on existing reference material, especially INSPIRE position papers, and the results are summarised this single document.

For each spatial data themes (as described in Annexes I, II, III of the Directive), the document provides:

- **Definition** – as given in the Annexes I, II, III of the Directive.
- **Description** – explains the spatial data theme in more detail
- **Scope, Use examples** - prominent usage examples and reference to Community policies. The user requirements should address not only reporting requirements on the Commission level, but also the ones related to the formulation, implementation, monitoring and evaluation of policies at the European, national and cross border level.
- **Important feature types and attributes** – this is a non-exhaustive list of the most prominent feature types and attributes. Note: this is not yet an attempt to define content requirements.
- **Overlaps and links with other themes -** known overlap with and/or dependencies from other spatial data themes
- **Reference material** - List of the reference documents that are considered relevant to the theme.
- **Suggested contributors to future specification work** – SDICs and/or LMOs that are considered to be important contributors in the drafting process. The list is not exhaustive.

This deliverable is accompanied by one document **Survey of initiatives relevant to INSPIRE data specifications** that have been prepared by the Consolidation Team. This document includes the classification of Reference Materials submitted for INSPIRE Data Specifications, a preliminary analysis on SDICs and LMOs registered and potential distribution by Themes and a review of organisations regarding the Article 7(1) of the INSPIRE Directive
An analysis of spatial data and information requirements stemming from the environmental legislation of the EU is in progress and it will be added to this document in due time.

2 Terms and abbreviations

2.1 Terms

The terms in this sub-clause are taken from the "Glossary of Generic Geographic Information Terms in Europe" that specifies the terminology used in the INSPIRE Implementing Rule documents.

(1) application data
data in support of user requirements

(2) data harmonisation
providing access to **spatial data** through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of **data product specifications**

NOTE This includes agreements about coordinate reference systems, classification systems, application schemas, etc.

(3) data product specification
detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to and used by another party [ISO/FDIS 19131 Geographic Information – Data Product Specification]

(4) dataset
identifiable collection of data [ISO 19115:2005, Geographic information — Metadata]

(5) exonym
name used in a specific language for a **spatial object** situated outside the area where that language is spoken, and differing in its form from the name used in an official or well-established language of that area where the **spatial object** is located [UNGEGN Glossary of Terminology - modified]

(6) feature
abstraction of real world phenomena [ISO 19101:2005, Geographic information — Reference model]

NOTE The term "(geographic) feature" as used in the ISO 19100 series of International Standards and in this document is synonymous with **spatial object** as used in this document. Unfortunately "spatial object" is also used in the ISO 19100 series of International Standards, however with a different meaning: a spatial object in the ISO 19100 series is a spatial geometry or topology.

(7) feature catalogue
catalogue(s) containing definitions and descriptions of the **spatial object types**, their attributes and associated components occurring in one or more **spatial data sets**, together with any operations that may be applied [ISO 19110:2006, Geographic information — Methodology for feature cataloguing – modified]

(8) feature concept dictionary
dictionary containing definitions and descriptions of feature concepts and feature-related concepts [ISO/CD 19126 Geographic Information – Feature concept dictionary and registers]

(9) gazetteer
directory of instances of a class or classes of features containing some information regarding position [EN ISO 19112:2005, Geographic information — Spatial referencing by geographic identifiers]

NOTE A gazetteer can be considered as a geographical index or dictionary.

(10) geographic identifier
spatial reference in the form of a label or code that identifies a location [EN ISO 19112:2005, Geographic information — Spatial referencing by geographic identifiers]

EXAMPLE 1 Place names: Paris, Rhine, Mont Blanc

EXAMPLE 2 Postal codes: 53115, 01009, SW1, IV19 1PZ

(11) INSPIRE data specification
data product specification for a **theme** adopted as an implementing rule

(12) interoperability
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]

(13) metadata
information describing **spatial data sets** and spatial data services and making it possible to discover, inventory and use them [INSPIRE Directive]

NOTE A more general definition provided by ISO 19115 is "data about data"

(14) object
*in this document used synonymous with **spatial object***

(15) object referencing
method of referencing **application data** to existing **reference data** describing their location to ensure spatial consistency across the **spatial objects** associated in this way

(16) reference data
spatial objects that are used to provide location information in **object referencing**

NOTE Typical reference data are topographic or cadastral data.

(17) spatial data
data with a direct or indirect reference to a specific location or geographic area [INSPIRE Directive]

NOTE The use of the word “spatial” in INSPIRE is unfortunate as in the everyday language its meaning goes beyond the meaning of “geographic” – which is considered by the Drafting Team as the intended scope – and includes subjects such as medical images, molecules, or other planets to name a few. However, since the term is used as a synonym for geographic in the draft Directive, this document uses the term “spatial data” as a synonym for the term “geographic information” used by the ISO 19100 series of International Standards.

(18) spatial data set
identifiable collection of spatial data [INSPIRE Directive]

(19) spatial object
abstract representation of a real-world phenomenon related to a specific location or geographical area [INSPIRE Directive]

NOTE It should be noted that the term has a different meaning in the ISO 19100 series. It is also synonymous with "(geographic) feature" as used in the ISO 19100 series.

(20) spatial object type
classification of **spatial object**s

EXAMPLE Cadastral parcel, road segment or river basin are all examples of potential spatial object types.

NOTE In the conceptual schema language UML a spatial object type will be described by a class with stereotype <<FeatureType>>.

(21) spatial reference systems

system for identifying position in the real world, which does not necessarily use coordinates [EN ISO 19112:2005, Geographic information — Spatial referencing by geographic identifiers - modified]

EXAMPLE Geographic coordinates describing positions on the Earth surface (coordinate reference system), linear measurements along a river centreline from the intersection of a bridge (linear reference system), postal codes identifying the extent of postal zones (gazetteer).

(22) theme
grouping of **spatial data** according to Annex I, II and III of the INSPIRE Directive

2.2 Acronyms and abbreviations

AFE	Atlas Florae Europaeae
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe
CAP	Common Agricultural Policy
CBD	UN Convention on Biological Diversity
CBD	Central business district
CEN	European Committee for Standardisation
CGMS	Crop Growth Monitoring System
CGRS	Common European Chorological Grid Reference System
CORINE	Coordination of Information on the Environment
CRS	Information and Service for European Coordinate Reference Systems
DEM	Digital Elevation Model
DG ENV	Directorate-general Environment
DG INFSO	Directorate-general Information Society
DG TREN	Directorate-general Transport and Energy
DIGEST	Digital Geographic Information Exchange Standard: NATO Standardization Agreement (STANAG) 7074
DMEER	Digital Map of European Ecological Regions
DT DS	INSPIRE Drafting Team Data Specifications
EAP	Environmental Action Programme
ECCP	European Climate Change programme
ECMWF	European Centre for Medium-range Weather Forecasting
ECOMET	Economic Interest Grouping of the National Meteorological Services of the European Economic Area
EEA	European Environment Agency
EEAC	European Environmental Advisory Councils
EIA	Environmental Impact Assessments
EIONET	European Environment Information and Observation Network
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
ENVASSO	Environmental Assessment of Soil for Monitoring
EPER	European Pollutant Emission Register
ESBN	European Soil Bureau Network
ETRS	European Terrestrial Reference System
ETRS89	European Terrestrial Reference System 89
EULIS	European Land Information Service
EUNIS	European Nature Information System
EUREF	IAG Subcommision for the European Reference Frame
EuroGOOS	Association of Agencies to further the goals of GOOS (Global Ocean Observing System, IOC)
EUROSTAT	Statistical Office of the European Communities
EUSIS	European Soil Information System
EUVN	European Vertical Reference Network /
EVRS	European Vertical Reference System
FACC	Feature and Attribute Coding Catalog (DIGEST)
GBIF	Global Biodiversity Information Facility.
GEOLAND	Integrated GMES project on land Cover and Vegetation
GEOSS	Global Earth Observation System of Systems

GIS	Geographic Information System
GISCO	Geographic Information System of the Commission
GMES	Global Monitoring for Environment and Security
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTOS	Global Terrestrial Observing System
HALO	Harmonised coordination of Atmosphere, Land and Ocean integrated projects of the GMES backbone
HELCOM	Helsinki Commission > Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area
IAG	International Association of Geodesy
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICZM	Integrated Coastal Zone Management
ID	Identifier
IGN	Institut Géographique National / Instituto Geográfico Nacional
INSPIRE	Infrastructure for Spatial Information in Europe
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange (of IOC)
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification
ISO	International Organization for Standardization
JRC	Joint Research Centre
LAU	Local Administrative Units
LBS	Location Based Services
LCCS	Landcover Classification System
LMO	Legally Mandated Organisation
LRTAP	UN/ECE Convention on Long-Range Transboundary Air Pollution
LUCAS	Land Use/Cover Area Frame Statistical Survey
MERSEA	Marine Environment and Security for the European Area (GMES project)
MEUSIS	Multiscale European Soil Information System
MGRS	Military Grid Reference System
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne
NMCA	National Mapping and Cadastral Agencies
NUTS	Nomenclature of Territorial Units for Statistics (EUROSTAT)
NWP	Numerical Weather Prediction
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo-Paris-Convention)
PCC	Permanent Committee on Cadastre in the European Union
PSU	Primary Sampling Unit
PTRDB	Pedotransfer Rules Database
Ramsar	The Convention on Wetlands, signed in Ramsar, Iran
RISE	Reference Information Specifications for Europe
SDIC	Spatial Data Interest Community
SDIGER	A cross-border inter-administration Spatial Data Infrastructure to support WFD information access for Adour-Garonne and Ebro River basins
SEA	Strategic Environmental Assessment
SERIEE	Système Européen pour le Rassemblement des Informations Economiques sur l'Environnement / European System for the collection of economic information on the environment
SGDBE	Soil Geographical Database of Europe
SMU	Soil Mapping Units
SSU	Secondary Sampling Unit
STU	Soil Typological Units
UELN	United European Levelling Network
UN	United Nations
UN-ECE	United Nations Economic Commission for Europe
UN-ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme

UNFCCC	UN Convention on Climate Change
UNGEGN	United Nations Group of Experts on Geographical Names
UTM	Universal Transverse Mercator
WFD	Water Framework Directive
WGS	World Geodetic System
WMO	World Meteorological Organization (at the UN)
WPLA	Working Party on Land Administration, operating under the auspices of the UN-ECE Committee on Human Settlements.
WRB	World Reference Base for Soil Resources

3 History of INSPIRE Data Specification

This chapter provides an overview on reports and assessments that are relevant to the definition of INSPIRE thematic content. These were used as the main source material for this document.

The thematic content of the European Spatial Data Infrastructure, with special reference to the text to be used in the INSPIRE Directive, has been discussed on INSPIRE expert meetings since 2002 and has been in focus in several of the assessments and reports being produced in the preparations for INSPIRE. It is relevant that the reader is aware of these documents and their input into the work in developing the Implementing Rules for INSPIRE from October 2005 onwards. The two position papers (referenced below) from 2002 have the most detailed description of data themes, but later developments have changed priority and theme definitions somewhat.

INSPIRE position paper: Reference data: Oct 2002.
In the initial phase of INSPIRE there were discussions among a broad group of participants about what a European Spatial Data Infrastructure was to contain. There was support to include a broad set of reference data, but there were different views to which detail. Work was lead by EUROSTAT, who edited the report.

See report:

(INSPIRE RDM, 2002) INSPIRE position paper: Reference Data. October 2002
URL: http://www.ec-gis.org/inspire/reports/position_papers/inspire_rdm_pp_v4_3_en.pdf

INSPIRE position paper: Environmental and thematic data: Oct 2002.
Simultaneously to the work on reference data a working group dealt with the need for other kinds of thematic data. There were discussions regarding the necessity and convenience of a division between reference and thematic data. The work was organised by EEA (European Environment Agency) which relied on material from the topic centres and EIONET concerning an assessment of data needs. The report describes needs in thematic data policies, both for reporting and implementation at the local level. It contains the description of a thematic categorisation system and descriptions of each of the data themes. Furthermore the report provides some examples on implementation/quality obligations and suggests a phased implementation. Examples of data sets within each of the data themes can be found in the appendix.
See report:

(INSPIRE ETC, 2002) INSPIRE position paper: Environmental thematic user needs by: INSPIRE Environmental Thematic Coordination Group. Editor: Arvid Lillethun. 10 Oct. 2002
URL: http://www.ec-gis.org/inspire/reports/position_papers/inspire_etc_pp_v2_3_en.pdf

INSPIRE IMS: Implementation Strategy Issues - Data requirements. Apr 2003.
The INSPIRE Expert Group was interested to establish a common document regarding data content of the infrastructure and an outline of possible obligations to be set forward in a directive. A working group with a broad representation discussed this topic and then developed the report. This concluded that there should be a treatment of a large set of spatial data in many different themes.
See report:

(INSPIRE IMS, 2003) Implementation Strategy Issues - Data Requirements by: INSPIRE Implementation Strategy Group, subgroup data requirements, Editor: Arvid Lillethun, 28 April 2003

INSPIRE public consultation, Phase II, May 2003.
An Internet consultation was undertaken by the European Commission in 2003. It included questions on which issues should be addressed by INSPIRE. The material published included the data specifications and implementation examples as found in the INSPIRE IMS document referred to above. There were 17 themes with additional sub-themes. The tables include details on scale, important attributes etc.

See appendix in :

(INSPIRE Consultation, 2003) Consultation Paper on a forthcoming EU Legal Initiative on Spatial Information for Community Policy-making and Implementation.
URL: http://www.ec-gis.org/inspire/reports/INSPIRE-InternetConsultationPhaseII.pdf

INSPIRE scoping paper, April 2004
In response to the consultation and also to the objective of linking the INSPIRE directive more directly to the EU environmental policies, a scoping paper was then developed. Here several topics/themes that earlier on had been included were omitted . The paper comes up with different categories of data in different annexes. Each theme is briefly described.

See report:

(INSPIRE Scoping, 2004) INSPIRE Scoping paper.
By: Task Force Scoping. Editor: C. Steenmans. 24 March 2004.
URL: http://www.ec-gis.org/inspire/reports/inspire_scoping24mar04.pdf

Proposal INSPIRE framework directive
Material from the previous documents where processed internally in the European Commission. This process resulted in the Appendix I-III descriptions found in the Directive, being adjusted through Parliament/Council processes.

Original proposal, *presented by the Commission:*

(INSPIRE, 2004) Proposal for a directive of the European Parliament and the Council establishing an infrastructure for spatial information in the Community (INSPIRE) COM(2004) 516, Brussels, July 2004

*'**Parliament' version**, texts adopted by European Parliament at first reading on 7 June 2005:*

(INSPIRE, 2005 Parliament)

*'**Council' version**, political agreement reached at the Council meeting on 24 June 2005:*

(INSPIRE, 2005 Council) Proposal for a directive of the European Parliament and the Council establishing an infrastructure for spatial information in the Community (INSPIRE) – political agreement
Council of the European Union, 10553/05, Brussels, 29 June 2005

'*Conciliation' version, ioint text approved by the Conciliation Committee:*

(INSPIRE, 2007) Directive of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) , PE-CONS 3685/06, Brussels, 16 January 2007

4 Structure of spatial data

The INSPIRE directive is using terms such as data set and data theme. Themes are grouped in different annexes. This chapter clarifies issues related to terms, concepts and the structure of data specifications.

The early documents in the INSPIRE refer to reference data and thematic data. **Reference data** is a series of dataset that everybody involved with geographic information uses to reference his/her own data as part of their work. It provides a common link between applications and thereby provides a mechanism for the sharing of knowledge and information amongst people. It is used as a common base to which thematic data may be referenced. (INSPIRE RDM, 2002)

Reference data must fulfil three functional requirements:

- provide an unambiguous location for a user's information
- enable merging of data from various sources
- provide a context to allow others to better understanding the information that is being presented

The RDM position paper (INSPIRE RDM, 2002) identified seven components of reference data:

1. Geodetic reference data
2. Units of administration
3. Units of property rights (parcels, buildings)
4. Addresses
5. Selected topographic themes (hydrography, transport, height)
6. Orthoimagery
7. Geographical names

The reference data was expected to be mainly produced or organised by the National Mapping and Cadastral Agencies. Most other parts of the data for INSPIRE was expected to be primarily used and produced by the environmental sector, although some derive from other sectors e.g. roads. Many of the data components containing multi-purpose data have been termed core thematic data.

The user needs in the environmental sector were elaborated under the guidance of EEA. The ETC position paper (INSPIRE ETC, 2002) describes the user needs and defines possible environmental data components to be defined in the INSPIRE legislation.

The discussion after the release of the position papers revealed difficulties in distinguishing reference data from thematic data (since any spatial object can be referenced by another). There is considerable overlap, for instance in hydrography. As a consequence, the next proposals for the **grouping of themes** were no longer based on the role of the data in the infrastructure and the producing organisation. Instead, the themes were grouped according to common characteristics in data content.

The INSPIRE IMS data requirement paper (INSPIRE IMS, 2003) prepared by the INSPIRE Implementation Strategy Working Group, proposes a hierarchical structure. Ideally, the structure of spatial data would reflect the high-level categorisation of real world spatial objects that are logically related. However, the process of organising or modelling the real world objects is a long term process and should be treated as separate projects within different working groups under INSPIRE. Therefore, a pragmatic approach has been adopted by categorising data into:

- **Spatial data themes**: High level thematic categories
- **Spatial data components**: sub-categories. A spatial data component comprises a group of spatial data with similar characteristics irrespective of scale
- **Spatial data sets**: lowest level of this conceptual framework, spatial data sets contain real data with defined content and accuracy/scale.

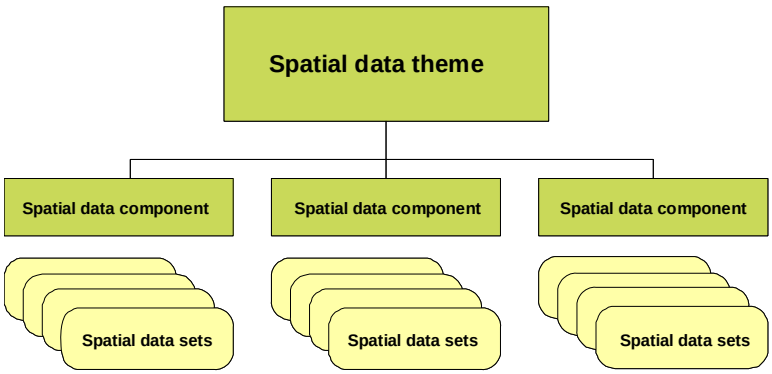

Figure 1: hierarchical structure to group spatial data. (INSPIRE IMS, 2003)

The actual data sets can be identified under each of the spatial data components. Each data set (data set specification) is only placed within one of the spatial data components.

Both the INSPIRE position paper on environmental user needs (INSPIRE ETC, 2002) and the INSPIRE IMS data requirement paper (INSPIRE IMS, 2003) contain a thematic hierarchy or grouping of themes. The ETC paper had 20 main data themes and the IMS had 17 data themes. The IMS paper built on definitions also referred to in Reference data and Metadata position paper (INSPIRE RDM, 2002) and the ETC paper. Other thematic structures were considered, such as the thematic structure found in ISO 19115 Metadata (topic category), but this thematic structure was not found to be relevant for grouping environmental/thematic and reference geographical data given priority in the INSPIRE drafting process. The spatial data themes and their spatial data components (sub-themes) as defined by the IMS group are described in Table 1.

The list of themes that we find in the current Annexes of the proposal for a directive is based on the structure in the IMS paper. Some themes which had been discussed in the drafting process where left out, others were merged into other themes. Later, in the processes in the European Parliament and the European Council, titles and definitions of some of the themes were changed, other themes were again included. When defining the content of each theme referred to in the INSPIRE annexes it is therefore essential to consider the earlier documents and processes.

In the INSPIRE scoping paper from 2004 (INSPIRE Scoping, 2004) the thematic structuring was left out, and a rough structure of appendixes were introduced. The grouping of themes in **Annex I, Annex II and Annex III** represent a grouping for addressing different actions concerning harmonisation, dissemination and other actions formulated in the directive. Different time schedules are linked to the data in the three annexes I, II and III. There is no thematic hierarchy in the INSPIRE directive, however each theme represent a cluster/collection of different data sets. The existing structure and content of the Annex I, II and III are described in Table 2.

In order to understand the relationship between the different themes, it could be of help to group them thematically in a kind of hierarchy. This may also be relevant in the preparations before the detailed description of themes are carried out, including data modelling of each thematic area.

Table 1: INSPIRE IMS spatial data themes and their spatial data components (sub-themes). The wide range of themes covered represent the broad needs for fulfilling expected actions for sustainable development and the multi-purpose needs for eGovernment actions.

1. Geographical location
- 1.1 Geographical reference systems
- 1.2 Geographical names
- 1.3 Geographical grids

2. Administrative units
- 2.1 Official administrative units
- 2.2 Government management zones
- 2.3 Blocks, census and statistical districts
- 2.4 Civil security units
- 2.5 Environment management & reporting units
- 2.6 Postal codes/regions

3. Properties, buildings and addresses
- 3.1 Properties
- 3.2 Buildings
- 3.3 Addresses

4. Elevation
- 4.1 Terrestrial elevation
- 4.2 Bathymetry
- 4.3 Coastline

5. Geo-physical environment
- 5.1 Soil
- 5.2 Bedrock geology
- 5.3 Geo-morphology

6. Land surface
- 6.1 Land cover
- 6.2 Orthophoto-images

7. Transport
- 7.1 Transport networks
- 7.2 Transport services

8. Utilities and facilities
- 8.1 Transmission lines and pipelines
- 8.2 Environmental protection facilities
- 8.3 Production facilities, industry
- 8.4 Agricultural facilities
- 8.5 Trade and service facilities

9. Society and population
- 9.1 Urban and rural settlement
- 9.2 Population distribution-demography
- 9.3 Human health and safety
- 9.4 Cultural heritage
- 9.5 Natural amenities

10. Area regulation
- 10.1 Land use plans
- 10.2 Protected sites
- 10.3 Area restriction/regulation zones

11. Air and climate
- 11.1 Air and atmospheric conditions
- 11.2 Meteorological spatial features
- 11.3 Climate zones

12. Water bodies/Hydrography
- 12.1 Surface water bodies/ Hydrography networks
- 12.2 Water catchments
- 12.3 Groundwater bodies/aquifers

13. Ocean and seas
- 13.1 Oceanographic spatial features
- 13.2 Sea regions

14. Biota/biodiversity
- 14.1 Bio-geographical regions
- 14.2 Vegetation
- 14.3 Habitats and biotopes
- 14.4 Species distribution
- 14.5 Landscape diversity

15. Natural resource
- 15.1 Ecosystem resources
- 15.2 Water resources
- 15.3 Agricultural land and soil resources
- 15.4 Forest resources
- 15.5 Fishery resources
- 15.6 Geological resources
- 15.7 Renewable energy resources

16. Natural and technological risks
- 16.1 Natural risk vulnerability zones
- 16.2 Technological risk vulnerability zones
- 16.3 Technological accidents and natural disasters

17.Areas under anthropogenic stress
- 17.1 Polluted areas
- 17.2 Noise and radiation zones
- 17.3 Areas of intensive exploitation

Table 2: Current structure of the themes (INSPIRE, 2007)

Annex I

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Addresses
6. Cadastral parcels
7. Transport networks
8. Hydrography
9. Protected sites

Annex II

1. Elevation
2. Land cover
3. Orthoimagery
4. Geology

Annex III

1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and Government services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution – demography
11. Area management / restriction / regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy resources
21. Mineral resources

5 Annex I Themes

5.1 Coordinate reference systems

Definition:

(INSPIRE, 2007) Systems for uniquely referencing spatial information in space as a set of coordinates (x,y,z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.

Description:

The theme aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analysing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations.

This topic shall link to appropriate standards for information technology and data where possible, and provide a framework for the development of sector-specific applications using geographic data. The ISO/TC211, WI 11 – Spatial referencing by coordinates (ISO 19111) standard – was developed for that purpose, but was not made for geodetic experts. It was made for producers and users of GIS. Therefore the structure is clear and easy – yet correct on a common level of abstraction. This level of abstraction is well suited for most GI work. Geodetic experts applying state-of-the-art technology for most accurate applications are likely to require additional technical specifications, which are not given in ISO19111.

ISO 19111 describes the conceptual schema and defines the description for a minimum data to two cases for which 1-, 2- and 3- dimensional coordinates reference system information shall be given. The first case is given by a coordinate reference system to which a set of coordinates is related. The second case consists of a coordinate operation (coordinate transformation, coordinate conversion, concatenated coordinate operation) to change coordinate values from one coordinate reference system to another.

There are no explicit accuracy numbers given in ISO 19111. We must consider that it has been developed for geographic information. Spatial information may be referenced to the earth surface with an improving accuracy on the global scale for the future. Such high accuracy level may be required for some themes of the directive, e.g., the trans-European railway transport network. Spatial referencing could no longer be considered as constant in time, if we reach the sub-centimetre level. We need additional parameters compared to ISO 19111 in that case, because that document considers changes in time of the coordinate reference only system through the “date of realisation”. This model is not suitable to describe continuous movements of the spatial reference. Kinematic models or so-called “loading models” are examples to get incorporate` such dynamics. A re-iteration of accuracy aspects may be needed, if specifications for Annex I and II are ready.

The spatial referencing is usually referred to selected points of the earth surface. Such point are, e.g., given by geodetic markers, stations performing permanent satellite observations, levelling benchmarks, or tide gauges. As soon as the marker coordinates are given, they provide a direct access to the realisation of the coordinate reference system.

Scope, use examples:

All users of GI-data need geodetic reference data to be in place. From that point of view the coordinate reference systems are a prerequisite for a successful realisation of all themes of the Directive. The use of GNSS for accurate mapping needs special services that provide various information and corrections from GNSS permanent reference stations (accuracy level 1 m to 1 cm). Selected themes, e.g., sea level rise, require the spatial reference and the corresponding changes of control stations for better than 1 mm/year.

ISO 19111 could be used as a basis for the implementation of coordinate reference systems in a European infrastructure for spatial information. The ISO document describes the **definition of a coordinate system** as well as **coordinate operations** to change from one coordinate system to another one. Changes in time are only considered in ISO 19111 through the date of realisation. It has to be studied, whether **kinematic** spatial information could be described by the attributes of coordinate operations as determined in ISO 19111. Alternatively new attributes will have to be defined in addition to the ISO standard to implement this theme. Implementation rules for coordinate reference systems should account for reference systems that are realised in real-time, e.g., through a GNSS real-time correction service provider. It has to be confirmed that ISO 19111 features are suitable to describe the reference system information as transmitted by the service provider. The full set of reference information data will not likely be transmitted by the correction service and thus requires further conventions.

The **ETRS89** is an example for a coordinate reference system in Europe, which has been adopted by the European Commission. It is today realised through a network of more than 200 permanent operating GNSS observing stations of the EUREF organization. This realisation not only provides static, but furthermore kinematic information of spatial referencing.

The new European Satellite Navigation System GALILEO will maintain its own coordinate reference frame, the Galileo Terrestrial Reference Frame (GTRF). It will be aligned to the International Terrestrial Reference Frame (ITRF) and is covered by the ISO 19111 standard.

The **European Vertical Reference System**
(EVRS) is a gravity related height system and was defined by EUREF. Gravity related heights are required to describe various environmental phenomena, e.g., all occurrences concerning water level. EVRS was recommended the European Commission as reference height system for geo data and was realised by the so-called EUVN/UELN initiatives within the frame of EUREF activities.

ETRS89 and EVRS could be implemented in a spatial information system following the ISO 19111 standards with the above mentioned restrictions concerning kinematic aspects.

An example of **Coordinate operations** in the scope of ISO 19111 is realised through the “Information and Service for European Coordinate Reference Systems (CRS)” at http://crs.bkg.bund.de, which was established by BKG, EuroGeographics and EUREF. This system provides among others the mathematical parameters to change the coordinates from national reference systems in Europe to the ETRS89.

Important feature types and attributes:

The following important features are extracted from ISO 19111 for

a) Coordinate reference system
- coordinate reference system identifier
- datum identifier
- datum type
- datum anchor point
- datum realization epoch
- datum valid area
- ellipsoid identifier
- ellipsoid flattening

and

b) Coordinate operation
- coordinate operation identifier
- coordinate operation valid area
- source coordinate reference system identifier
- target coordinate reference system identifier
- coordinate operation method name
- coordinate operation method formula
- coordinate operation parameter value

Links and overlaps with other themes:

The coordinate reference systems are a prerequisite for a successful realisation of all themes of the Directive.

Reference documents:

International Standard ISO 19111, Geographic information – Spatial referencing by coordinates

EUREF Publication No. 14 - Report on the Symposium of the IAG Sub-commission for Europe (EUREF) held in Bratislava, 2 – 5 June 2004

Map Projections for Europe. Institute for Environment and Sustainability, JRC, EC, 2003

From the reference material submitted by SDICs and LMOs, many documents relate with this theme. See categorised list of reference material, compiled by JRC

Suggested contributor in further specification work:

EUREF

5.2 Geographical grid systems

Definition:

(INSPIRE, 2007) Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells.

Definition adopted by Workshop on "European Reference Grids"
A grid for representing thematic information is a system of regular and geo-referenced cells, with a specific shape and size, and an associated property.

Description:

Geographical grids are an agreed, defined and harmonised grid net for Pan-Europe with standardised location and size of grid cells. Examples of cell sizes could be 10x10 m, 100x100 m, 1x1 km, 16x16 km. The INSPIRE-focused proposal of the Pan-European grid has been proposed as a result of the Workshop on "European Reference Grids".

The grid is based on the Lambert Azimuthal Equal Area coordinate reference system (ETRS-LAEA) with the centre of the projection at the point N 52^{o}, E 10^{o}. The grid is defined as hierarchical one in metric coordinates in power of 10.

The detail description of the proposed grid is available at the Proceedings of the Workshop on the European Reference Grids, EUR Report 21494 EN, 2005. The Proposal for a European Grid System is presented from page 39 to 46 of that document.

Scope, use examples:

Several grid-based inventories exist in many European organisations and professional communities. Some of them have a long time series of observations and have a strong standardising impact to the methodology of data collection, analysis and reporting.

Some important grid systems are listed below. The list is not exhaustive. It may be completed in the process of review by SDICs and LMOs.

LUCAS (Land Use/Cover Area Frame Statistical Survey) is a EuroStat pilot project focused on an area frame statistical survey aiming at establishing harmonised data at EU level on land use, land cover and environment. The survey consists in the ground visit in springtime of about 100 000 points sampled according to a regular grid. There are two levels of survey, i.e. at first stage using Primary Sampling Units (PSUs) with cells of regular grid of 18 km x 18 km size. At the second level, the Secondary Sampling Units (SSUs) are 10 points, distant 300m apart. The grids are based on UTM projection and the ellipsoid is GRS80 and are constructed individually for each country taking part in the project. The most southern-west point of a country has been chosen as an origin of individual grid.

MEUSIS (Multiscale European Soil Information System) has been developed in the framework of the activities of the European Soil Bureau and involves national soil surveys and soil science institutions in more than 45 countries of Europe, Siberia and part of North Africa and the Middle East. The system is based on the Soil Geographical Database of Europe (SGDBE) at scale 1 : 1 000 000. The reference grid of the MEUSIS will be based on the grid proposed for INSPIRE.

EMEP is a scientifically based and policy driven program under the *Convention on Long-range Transboundary Air Pollution* for international co-operation to solve transboundary air pollution problems. The inventory of air pollution is based on the models, which are using a grid system of two resolutions:

50 km x 50 km and 150 km x 150 km. The grid is based on a polar-stereographic projection with real area at latitude N 60^{o} and y-axis parallel to W 32^{o}. The EMEP 50 consists of matrix of 132 x 111 points, whereas EMEP 150 domain includes 44 x 37 points.

AFE (Atlas Florae Europaeae) is a project for mapping the distribution of vascular plants in Europe. The project was launched already in 1965 as a collaborative effort of European botanists and since then the secretariat has functioned at the Botanical Museum of the Finnish Museum of Natural History, Helsinki.

The chorological data are inserted into the map with squares of c. 50 x 50 km, based on the Universal Transverse Mercator (UTM) projection and the Military Grid Reference System (**MGRS**). The Military Grid Reference System (MGRS) is an extension of the UTM system. UTM zone number and zone character are used to identify an area 6 degrees in east-west extent and 8 degrees in north-south extent. UTM zone number and designator are followed by 100 km square easting and northing identifiers. The system uses a set of alphabetic characters for the 100 km grid squares. Starting at the 180 degree meridian the characters A to Z (omitting I and O) are used for 18 degrees before starting over. From the equator north the characters A to V (omitting I and O) are used for 100 km squares, repeating every 2,000 km. Northing designators normally begin with 'A' at the equator for odd numbered UTM easting zones.

CGMS (Crop Growth Monitoring System) grid has been developed in the framework of MARS (Monitoring Agriculture with Remote Sensing) and was based on collection of meteorological and remote sensing data. The data were transformed and modelled into crop parameters. The grid is based on the Lambert Azimuthal Equal Area projection with the centre of projection at N 48^{o} E 9^{o}. and consists of 5625 cells of 50 km x 50 km each.

Important feature types and attributes:

The feature types and attributes depend on the thematic data collected and maintained in the framework of the grid referencing systems. The most important spatial identifiers for the theme A 1.2 are code of grid cells, which has been described at the section “Description”, above.

The following feature and attributes may be relevant:

Grid cell (area, line, point)

- grid cell system identifier
- grid cell system name
- grid cell identifier
- grid cell value

Links and overlaps with other themes:

The main links and overlaps are where grids area being used to locate registration/monitoring sites, for aggregation of data from different topics and for display. Links and overlaps with INSPIRE themes are:

- Orthoimagery,
- Statistical units,
- Soil,
- Human health and safety,
- Population distribution – demography,
- Atmospheric conditions,
- Meteorological geographical features,
- Oceanographic geographical features,
- Species distribution.

Reference documents:

http://www.emep.int/grid/griddescr.html

http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=831

European Reference Grids. Proposal for a European Grid System. Workshop Proceedings and Recommendations. Edited by: Alessandro Annoni. JRC, Ispra, 27-29 October 2003. Institute for Environment and Sustainability, EUR Report 21494 EN, 2005.

5.3 Geographical names

Definition:

(INSPIRE, 2007) Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.

Description:

Geographical names or place names describe features on Earth – a location or a landscape object, on land as well as on sea. Often the term topographical name is used to emphasize the spatial dependency and relation to the adjacent topographical features. Geographical names can be associated to different kind of spatial features:

- Areal features (e.g. geographical regions, lakes, forests…)
- Linear features (e.g. rivers, railways, shipping lines, boundary lines…)
- Point features (e.g. spot heights, monuments, villages, buildings…)

(INSPIRE ETC, 2002)

The geographical names on a specific landscape object can be different in the different languages. Multi-lingual aspects should be covered in the data sets. In some datasets their primary purpose is to depict geographical locations and in others they may be attributes, and of secondary importance. Geographical names should in both cases be provided in the official form(s) and language(s) of the country, including the minority language(s). (UNGEGN)

Scope, use examples:

Geographical name datasets are commonly produced by mapping agencies and local authorities. Geographical names at scale 1:250.000 exist on map series and databases throughout Europe, possibly also at smaller scales. Geographical names data with pan-European coverage exist e.g. in GISCO. (INSPIRE IMS, 2003)

The geographical names database should be suited to generalise to versions/scales. It should provide links between an endonym (name form used in the language spoken at the location of the geographical feature) and its exonyms (names forms used in various foreign languages).

The geographical names database can be used for:

- search and overview,
- location at all layers,
- as a basis layer on maps,
- effective operations at local level (e.g. transport and emergency operations),
- documenting geographical names forms in minority languages.

(INSPIRE IMS, 2003), (UNGEGN, 2002)

A **Gazetteer** is a geographical dictionary. According to the definition in ISO 19112 a gazetteer provides a master record of all location instances for a particular location type or types. Gazetteers are not just geographical names' indexes but may be records of any kind of feature type or types. The positional information may include a coordinate reference, but it may be purely descriptive. (INSPIRE ETC, 2002)

Important feature types and attributes:

Geographical Name

- Language
- Status (official, exonym, endonym,etc.)
- Importance (e.g. indicated by map scale)
- Classification (feature type)
- Spatial reference; direct by means of coordinates and/or indirect by link to s spatial dataset

Links and overlaps with other themes:

Geographical Names serve is an indirect spatial reference system. As such their importance is similar to Coordinate Reference systems. Geographical Names are attributes to many feature types that appear in other themes of the directive, in particular:

- Administrative units
- Transport networks
- Hydrography
- Elevation
- Land cover
- Buildings
- Oceanographic geographical features
- Sea regions
- Habitats and biotopes

Reference documents:

(UNGEGN, 2002) Resolutions adopted at the eight United Nations Conferences on the Standardization of Geographical Names 1967, 1972, 1977, 1982, 1987, 1992, 1998, 2002. URL: http://unstats.un.org/unsd/geoinfo/uncsgnresolutions-en.pdf

International Standard ISO 19112, Geographic information – Location by Identifier

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for datasets that include geographical names. See categorised list of reference material, compiled by JRC, March 2007.

Suggested contributors in further specification work:

- United Nations Group of Experts on Geographical Names – UNGEGN
- EuroGeoNames project

5.4 Administrative units

Definition:

(INSPIRE, 2007) Units of administration, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.

Description:

Official administrative units should be provided according to the administrative levels used within each country. Each national territory is divided into administrative units. The administrative units are divided by administrative boundaries. (INSPIRE IMS, 2003)) The definition has been interpreted not to include administrative units such as census districts, post office regions and other sector-specific regions. In the Inspire IMS paper such regions were included under the heading "Administrative units", but with the Council version of INSPIRE definition for this theme, using the term "jurisdictional rights", such sector and management-specific units can not be included.

Administrative units and administrative boundaries form a polygon topology.

The reference date of the administrative unit may cause problem when being linked to statistical information, for instance when census data refers to different dates in the member states. Therefore, the aspect of temporal reference and update should be considered carefully for administrative units.

NUTS and LAU nomenclature is being used at the overall European scale, and could be considered more widely used also at lower levels in the context of INSPIRE. The Nomenclature of Territorial Units for Statistics (NUTS) was established by the European Office for Statistics (EuroStat) in order to provide a single uniform breakdown of territorial units for the production of regional statistics for the European Union. NUTS excludes specific territorial units and local units in favour of regional units of a general nature. At a more detailed level, there are the districts and municipalities. These are called Local Administrative Units (LAU) and are not subject of the NUTS Regulation. At the top of the hierarchy are the individual member states of the EU, below that are NUTS levels 1 to 3, then LAU levels 1 and 2.

Scope, use examples:

Administrative units data are used for

- operations and management,
- showing competent authorities,
- referencing of information and statistics,
- basis for generation of statistical map showing economic phenomena, demography etc.
- as a reference for correct location of objects
- for “cookie cutting” of databases.

(INSPIRE IMS, 2003)

The administrative division forms an indirect spatial reference system. The reference to an administrative unit provides a spatial dimension to data without using coordinates. (INSPIRE IMS, 2003)

Administrative boundaries are the key to horizontal interoperability between the products of national data custodians. Neighbours should agree on international boundaries with shared geometry at the best possible resolution. (INSPIRE RDM, 2002)

Important feature types and attributes:

Administrative unit

- Name(s): official name(s) of the administrative unit in the national language
- National administrative level (1st, 2nd, …)
- National code: official code of the administrative unit used by the National Statistical Office
- NUTS code for EU member states
- Country code according to the ISO 3166 definition

Administrative boundary

- National boundary level (international, 1st, 2nd, …)
- Status

Links and overlaps with other themes:

The main overlaps are :

- Hydrography: The coastline is an essential feature for many applications that need to differentiate between land and water areas. The coastline should be integrated in the administrative units data. Administrative boundaries may coincide watercourses or shorelines.
- Geographical names: names of administrative units
- Cadastral parcels: Administrative boundaries do coincide in most (but not all) cases with the boundaries of Cadastre and Land registration.
- Protected sites: Administrative boundaries may coincide with the boundaries of Protected sites.
- Land use, especially for land use planning or spatial planning where it is in a domain of different authorities, such as local or regional authorities
- Area management/restriction/regulation zones. Managing bodies are often organised according to administrative units.

Reference documents:

Regulation (EC) No. 1059/2003 of the European Parliament and the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS). Official Journal L154, 21.06.2003

ISO 3166-1:1997 Codes for the representation of names of countries and their subdivisions - Part 1: Country codes

ABDS for the CEEC - Memorandum of Understanding

ABDS for the CEEC - Public Report

EuroGeographics: Seamless Administrative Boundaries of Europe (SABE), Data Specification

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for datasets that include administrative units. See categorized list of reference material, compiled by JRC, March 2007.

Suggested contributors in further specification work:

- EUROSTAT
- EuroGeographics

5.5 Addresses

Definition*:*

(INSPIRE, 2007) Location of properties based on address identifiers, usually by road name, house number, postal code.

The theme name has been changed with the Council version. Previous name was: Identifiers of Properties.

Description:

An address is a code and abstract concept expressing the fixed location of a home, business or other building (real property) on the earth's surface. Addresses serve several purposes, such as their use in the delivery of mail. The definition of addresses may seem simple; e.g. a sequence of town, street, house number (and annexes) and often completed with a postal code. The NEN5825:2002 describes four functions of addresses: location function (e.g. for the delivery of mail), identification function (e.g. in context of a building registration), jurisdiction function (e.g. which authorities are responsible for object attached to address), and sorting- and ordering function.

Under real property a number of different objects types can be identified: land parcels, buildings (including apartments), but sometimes also other types such as utilities. For (apartment-) buildings there is in most cases an association with an address. In rural area's there exist buildings without a complete postal address. Same in urban area's: e.g. utility service buildings. Note: the registration of the addresses is currently not harmonized within Europe. Other 'non-building' objects that might have addresses include (official) location of a mobile home (house trailer, caravan) or the location of a houseboat (mooring place).

Scope, use examples:

Address information might not be considered true geo-information at the first sight, but there is an important location component (and therefore they are geo-information). Addresses are used to link to many other sources of administrative information, which can be related to a location via addresses.

Many countries have their own specific standards for unique addresses (see References for a few examples, such as Switzerland, Italy, France, UK and the Netherlands), which are all a little different. There was an international standard ISO 11180:1993 'Postal addressing', but this has been withdrawn on 2004-01-15 by the responsible Technical Committee (TC 154). However, in practise the principles of this standard are still used in many countries. The ISO standard 19112:2003 'Spatial referencing by geographic identifiers' describes methods to specify spatial references via other geographic features (such as a road). These relationship to the other feature can have different forms; e.g. containment (in a town), relative local measurements (e.g. given distance along street from start point), fuzzy (e.g. between two other buildings).

It is also clear that within one country very often, different organisations are responsible for different aspects of the address (e.g. state/province for the official names of towns, municipality for the official road names and house numbers, postal service for the postal code), which makes consistent updating of the addresses a non-trivial task.

Also the way house numbers are assigned can be completely different (and some harmonization is welcomed). A number of alternatives are:

- house numbers are in sequence of their location within the street (with left/right having odd/even numbers and the low numbers towards city centres). The drawback is that this is not so very

dynamic: inserting of new building requires 'tricks' (adding letters after number) or one has to plan very careful and accept non-used number (for planned buildings/addresses)
- house numbers are in sequence of the creation, which is easy to realise and will provide unique numbers. However, for the users of this 'system' it may be difficult to find the proper location
- house numbers are derived from the distance to the start of the road; for example in the urban areas very 10 metres a number, and in rural areas every 100 metres a house number (even if there are no houses). Changing from urban to rural the means adding one digit.
- not using house numbers but (2D or 3D) geographic coordinates directly

Cadastres and Land Registries do not in all cases maintain an address register (linked to coordinates). In most cases municipalities are responsible for establishment of road names and building numbers, national post for postal codes. Maintenance is not uniform. Front door or centroid coordinates are mostly available in a nationwide co-ordinate reference system, not directly in ETRS89. In most countries the transformation parameters are available.

Important feature types and attributes:

The main feature types are address with relationships to other features such as cadastral parcel, (apartment-) building and other immovable register objects (such as utilities). Relevant in the context of this theme is first of all the real property identifiers (possibly based on an administrative unit hierarchy), next the attributes relating this to address and/or reference coordinate of the object and possibly successor/predecessors.

Important address attributes are: Postal code, geographic coordinate of address reference point, town, street, house number (and annexes), and textual descriptions. In International context also the country specification is relevant (ISO 3166-1). In between other levels might be mentioned (state, province, municipality, etc.), but in other cases it is advised to omit these (in order to avoid confusion).

The role of list of approved items is often an important part of the standards: approved official names of towns (in multiple language), roads, postal codes, etc.

Links and overlaps with other themes:

There are strong links with:

- Buildings
- Cadastral parcels
- Transport (for street name and road number)
- Administrative units

Many countries have building registers (Annex III.2). A single building may consist of several units (and sometimes grouped in a specific way, e.g. by entrance). Those registers also often include buildings with building construction permissions. Addresses are linked to (apartment-) buildings, except P.O. boxes. There is no 1:1 relationship between addresses and parcels (or buildings). There can be many addresses linked to zero (P.O. Boxes), one or more parcels (apartment buildings). Addresses do not cover all property units in a country especially in the countryside. For land parcels without a building there may not be a full (complete) postal address, but just an indication of the road name and for real property objects such as utilities it may even be more difficult. Therefore each real property object should have at least a unique cadastral identification. This implies (often) an association between real property identifiers, postal addresses and centroid (or front door/building) coordinates. The operation to obtain a coordinate related to an address is called geo-coding. For apartments this might even be a 3D coordinate (or 2D coordinate, with indication of the level).

Reference documents:

United Nations Economic Commission for Europe (UN-ECE). Guidelines on Real Property Units and Identifiers. United Nations, New York and Geneva, 2004.

Institut Géographique National (France): Service des Bases de Données Vecteurs, RGE – Composante Adresse, SPÉCIFICATIONS DE CONTENU, Version: 1.0, 2 sept. 2003.

INTERNATIONAL STANDARD, ISO 11180:1993, Postal addressing (withdrawn 2004-01-15 Technical committee TC 154)

INTERNATIONAL STANDARD, ISO 19112:2003, First edition, 2003-10-15 Geographic information — Spatial referencing by geographic identifiers

Schweizerische Normen-Vereinigun SN 612040:2004, Vermessung und Geoinformation - Gebäudeadressen - Struktur, Georeferenzierung, Darstellung und Datentransfer (Surveying and geographic information – Address of buildings – Structure, spatial referencing, presentation and data transfer method)

Nederlands Normalisatie Instituut NEN 5825:2002, Adressen- Definities, tekenset, uitwisselingsformats en fysieke presentatie (Addresses – Definities, character sets, interchange formats and physical prepresentation)

SERVIZI INFORMATIVI TERRITORIALI, AMBIENTALI E CARTOGRAFICI, STRUTTURA DB_STRADARIO_UNICO, Descrizione della struttura del DB dello Stradario Unico della Regione Piemonte

5.6 Cadastral parcels

Definition:

(INSPIRE, 2007) Areas defined by cadastral registers or equivalent.

Outdated version: (INSPIRE, 2004)
Areas defined by cadastral borders, with specific legal status of ownership.

The parcel definition of WPLA published in the document "Guidelines on Real Property Units and Identifiers" is the following:

> (WG-CPI, 2006) A single area of land or more particularly a volume of space, under homogeneous real property rights and unique ownership.

Remark: By unique ownership is meant that the ownership is held by one or several owners for the whole parcel. By homogeneous property rights is meant that rights of ownership, leases and mortgages affect the whole parcel. This does not apply to specific rights as servitudes which may only affect part of the parcel.

Description:

A cadastral parcel is single area of land or more particularly a volume of space, under homogeneous real property rights and unique ownership (UNECE, 2004 and WG-CPI, 2006). Remark: By unique ownership is meant that the ownership is held by one or several owners for the whole parcel. By homogeneous property rights is meant that rights of ownership, leases and mortgages affect the whole parcel. This does not apply to specific rights as servitudes, which may only affect part of the parcel. Irrespective of the legal system adopted by each Member State, the Cadastre is defined as a register under the responsibility of the government. Its use complies with the principles of equality, security and justice to all the citizens of the European Union. Access to cadastral information is ruled by laws and regulations in order to protect the personal information. The Cadastre basic unit is the parcel. Parcels can be grouped in register units. A parcel has a nationwide unique real property identifier. The spatial description of the parcels and other cadastral objects should be provided with an adequate degree of accuracy. Descriptive data may include the nature, size, value and legal rights or restrictions associated with each separate land object under or over the surface (adapted from PCC, 2003). Cadastral parcels cover a territory nationwide and there are no overlaps or gaps (in reality). An exception to this rule may be government land (or public domain) not registered within the Cadastre (though this is not recommended practice).

Scope, use examples:

The scope of the cadastral information in the INSPIRE context is limited to the geographic side of the cadastral information systems (land administration) and does not cover the administrative or legal side, with objects such as rights and persons. However, a parcel has strong associations with these objects as its definition is based on this.

Every country (countries can be in a federation) in Europe has a Cadastral or Land Administration system operational, often as the responsibility of a national organisation, or as the responsibility of a more local government organisation. Due to different legal systems and different national tradition, there is a rich variety of cadastral systems around. As this limits interoperability (e.g. in the context of EULIS) and results in high system development and maintenance costs, non-governmental (international) organisations, such as the FIG, developed the core cadastral domain model (CCDM) and submitted this to ISO TC211 as a new work item proposal (N2125).

Cadastres or Land Information Systems form an important part of the Land Administration Systems of the Member States. Cadastral activity is related to creating and updating the land parcel's alphanumerical and graphical information and its aggregation. The Cadastral Organisations in each Member State are those public organisations that have specific legal responsibility in creating and updating the land parcel's alphanumerical and graphical georeferenced information, or its coordination at national level (PCC, 2003).

We find different situations of the Cadastre in the European Union. Cadastres are always institutions that comply with the European public model, albeit with a large range of possible variations. In brief, it could be pointed out that while in some countries a Cadastral model linked to Land Registers with functions of enhancing security in the real estate market has been designed, other countries have placed greater attention on tax issues and supporting agrarian and global development activities.

The Cadastral Organisations provide data for many purposes to the citizens, the Public Administration and to different sectors of society. They can have different aims, purposes, administrative belonging, and managing models from one country to another.

In most countries Cadastres are responsible for real property (including parcel) identification. In some countries the parcel coverage is not yet complete. There are no European or other standards for parcel identifiers. However, recently Guidelines on Real Property Units and Identifiers became available (UNECE, 2004).

Important feature types and attributes:

The main geographic feature types are Parcels, Boundaries, and (Survey) Points. The main administrative/ legal feature types are Right (Restriction, Responsibility) and Person (natural and non-natural), which will not be further described (outside the scope of this theme). Important attributes are the geometry (point, line depending on the feature and could be a bounding box for easy access), the source of data (reference field documents as field sketches and files from total stations or GNSS instruments or for example to the id of the photogrammetric project), quality (accuracy), legal area (included in the official legal documents, in general this area is not equal to calculated area from the spatial cadastral boundary vertices), and sometimes also value and use codes. A Right has the following attributes: type of right (country dependent), share in right, time specification of right (can be limited), references to legal source document and association with mortgage which may rest on the Right (or better RRR=Right, Restriction, Responsibility).

Cadastral parcels must have a unique real property identifier to which the legal status is attached. This identifier is always based on a hierarchy of administrative area's (provinces/districts/cantons/..., municipalities/communes/...., sections/polygons/...) and sometimes to the 'mother' parcel (subdivision of parcel ..../..../..../37 means for example ..../..../..../37/1 and ..../..../..../37/2). At a European level, the national identifiers should get a country code prefix to make them unique within Europe. Alternatively there could be explicit associations between predecessors and successors. The cadastral information should be maintained continuously in order to reflect the actual legal situation. Of course, in reality and in information provision there might be a slight delay. Due to the legal importance, the history is currently maintained in some countries, but this may be needed in many countries.

Besides ownership, cadastral parcels, or to be more general immovable register objects, can be associated with other types of real rights (usufruct, superficies, long lease,…), responsibilities or restrictions. The line where a discontinuity in the specific legal situation occurs is the cadastral boundary. Vertices of this boundary can be marked in the field (or not). In many cases field sketches with survey observations are available. Observations (existing coordinates, bearings and distances) are used to determine coordinates; those coordinates are adjusted to the cadastral map. Current practice is to express the coordinates in the cadastral map in the National reference system. In the future this might be changed to the European Terrestrial Reference System (ETRS89), because 1. more and more GNSS (GPS, GLONASS and Galileo) surveys will be used to collect data and 2. this will better enable data consistency near the country boundaries within Europe.

A boundary does have several attributes of its own. Filed sketches (or survey plans) can be used for boundary reconstruction. From a technical point of view the set of related boundaries is sometimes stored as a closed polygon, with a risk for gaps and overlaps between parcels (quality problem in the database, not in reality). This also implies that every boundary would be stored at least two times (in left and right parcel), which is redundant. Further, boundaries do also have their own attributes, which have to be attached to a specific instance (which would imply a three representation). In order to avoid these issues, a parcel representation based on a topological structure is often used. Mostly boundaries do not have a meaningful (based on an administrative hierarchy) identifier, but could be associated with field sketches (which do have some kind of meaning full identifier, known in the outside world).

As space is getting more and more scare, people are creating construction above and below each other. In a number of European countries this legal solutions for this are (being) created. One option is to register the resulting property, is the use 3D volume cadastral parcels (based on 3D survey plans or field sketches).

The following core attributes of the cadastral parcel were identified by the joint working group of the PCC and EuroGeographics, (WG-CPI, 2006, note that these core data have to exist in digital form):

- Unique identifier
- Area
- Boundaries
- Georeference [in a national coordinate reference system]
- Origin and history of the parcel

The following additional content of the cadastral parcels was identified by the joint working group of the PCC and EuroGeographics (WG-CPI, 2006). This does not mean that these topics necessarily are part of the responsibility of the cadastral administrations. Some topics establish links with other INSPIRE themes (e.g. Addresses and Buildings), and again, some topics are probably out of the scope of INSPIRE (Owner, User, in these cases only references are included and not the content itself).

- Owner
- User
- Rights and restrictions
- Localisation
- Administrative boundaries (boundaries of administrative units)
- Buildings or parts of buildings and all kinds of constructions
- Official zoning (administrative restrictions)
- Land use: the manner in which land is used, including the nature of the vegetation upon its surface. (WPLA)
- Land cover (vegetation, crops, forest)
- Values/level of productivity
- Address(es)
- Description

Links and overlaps with other themes:

A boundary can be just a parcel boundary and/or a boundary of an administrative unit (municipality, province, country); this is an important relationship with theme 4 from Annex I

Parcels and boundaries have associations with Buildings (Annex III) - sometime used as local reference for boundaries, but also used for orientation purposes

Parcels and boundaries have associations with Transport networks (Annex I) - same orientation purpose, but also roads, railroads, waterways are separate parcels as they are often owned by government.

A strong link exists between cadastral parcels and Addresses.(Annex I)

Links exist between cadastral parcels, land use (Annex III) and land cover (Annex II).

Reference documents

ISO TC 211/WG 2, 1999a, 'Geographic information - Spatial schema', Technical Report second draft of ISO 19107 (15046-7), International Organization for Standardization, November 1999.

Kaufmann, J. and D. Steudler, 1998, 'Cadastre 2014, A Vision for a Future Cadastral System, FIG, July 1998, http://www.swisstopo.ch/fig-wg71/cad2014.htm

van Oosterom, P. and Lemmen, C, 2005, The Core Cadastral Domain Model: A Tool for the Development of Distributed and Interoperable Cadastral Systems, in Proceedings of UN Human Settlements Programme (UN-HABITAT) Expert Group Meeting (EGM) on "Innovative Land Tools for Sustainable Urban Development, Moscow on 25-27 October 2005.

Stoter, J.E., 2004, 3D Cadastre, PhD thesis, 327 pp, TU Delft, the Netherlands

UNECE, 2004, Guidelines on Real Property Units and Identifiers, United Nations, New York and Geneva, 2004

UNECE, 1996, United Nations/Economic Commission for Europe, 'Land Administration Guidelines', Geneva, Switzerland, www.unece.org/env/hs/wpla/welcome

WG-CPI, 2006, Role of the cadastral parcel in INSPIRE and national SDIs with impacts on cadastre and land registry operations. Joint Working Group of EuroGeographics and the PCC (WG-CPI), Inventory document.

PCC, 2003: Common Principles on Cadastre in the European Union. Declaration, Rome, 3rd December 2003

Institut Géographique National (France): BD Parcellaire version 1.1 descriptif technique

Regione Emilia-Romagna: Data Base Topografico alle grandi scale (1:1.000 - 1:2.000 - 1:5.000)

Institute of Geodesy, Cartography and Remote Sensing (Hungary): Digital Base Map Standard

Suggested contributors in further specification work:

- PCC :Permanent Committee on Cadastre in the European Union
- WPLA : Working Party on Land Administration, operating under the auspices of the United Nations Economic Commission for Europe, Committee on Human Settlements.
- WG-CPI: joint working group of the PCC and EuroGeographics on the Cadastral Parcel in INSPIRE

5.7 Transport networks

Definition:

(INSPIRE, 2007) Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network * and future revisions of that decision. * OJ L 228,9.9.1996, p.1. Decision as last amended by Decision No. 884/2004/EC (OJ L 167,30.4.2004, p.1. Corrigendum published in OJ L 201,7.6.2004,p.1).

Description:

The transport component should comprise an integrated transport network, and related features, that are seamless within each national border. Transportation data includes topographic features related to transport by road, rail, water, and air. It is important that the features form networks where appropriate, and that links between different networks are established, i.e multi-modal nodes, especially at the local level, in order to satisfy the requirements for intelligent transport systems such as location based services (LBS) and telematics. The transport network should also reflect the transport flow to enable our navigation services. (INSPIRE IMS, 2003)

Routes is a kind of "abstract" or invisible objects describing the spatial services offered within a transport system. Bus routes, ferry lines, scenic roads route, bicycle routes may be examples of route information. Commonly links or segments of a transport system is brought together to form a route, but may exist as separate feature data. It should be clarified if such data are included within this theme or if not, how one through the INSPIRE data and services can support such route information.

Scope, use examples:

- routing systems, traffic management
- environmental assessments,
- security,
- disaster and emergency management,
- social and economic planning, etc.
- Transport planning,
- Land use planning,
- Risk planning/management,

(INSPIRE IMS, 2003)

Community policies:

- Decision no. 1692/96/EC on Community guidelines for the development of trans-European transport network.

Important feature types and attributes:

for the road network:

Road link

- form of way (motorway, dual carriage way, single carriage way, slip road, …)
- functional road class (importance for traffic)
- road number
- road name
- condition of facility (disused, under construction, functional)
- Road surface (paved, unpaved)

Bridge, Tunnel

Road node

- form of node (junction, roundabout, ..)
- node number
- node name

for the water network:

Navigable channel, navigable watercourse

Ferry link

Harbor

for the railway network:

Railway link

- railway type
- condition of facility (disused, under construction, functional)
- railway gauge classification
- energy (electrified or not)
- bridge, tunnel

Railway station

- name
- condition of facility
- function (passengers, freight, both)

for the air transport:

Airport

- name
- ICAO identifier, IATA identifier

Heliport

- name

In view of navigation services, it might be useful to keep the navigation attributes on the road network (Direction of flow, Access restriction, Seasonal restriction, Speed limit, …).

Links and overlaps with other themes:

The main overlaps are:

- Hydrography as water network is both part of Hydrography and Transport
- Addresses: a road link may carry useful information about addresses.
- Land use, as roads is a category in land use data and land use plan data

Reference documents:

EuroRoadS: Specifications of core European road data (D6.5 v1.2)

Institut Géographique National (France): Route 500 descriptif technique

EuroGeographics: EuroRegionalMap Specification and Data Catalogue

EuroGeographics: EuroGlobalMap (v2.5) data specification

DGIWG: Feature and Attribute Coding Catalog (FACC) v2.0

DGIWG: DFDD

ISO/TC204 Transport Information and Control Systems (TICS):

ISO/TR 14825:1996 Geographic Data Files (GDF)

Several SDICs/LMOs from EU Member States or Regions have submitted specifications for topographic datasets that include transport networks. See categorised list of reference material, compiled by JRC, March 2007

Suggested contributor in further specification work:

EuroRoadS

5.8 Hydrography

Definition:

(INSPIRE, 2007) Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins. Where appropriate, according to the definitions set out in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *, and in the form of networks.
* OJ L 327,22.12.2000, p.1. Directive as amended by Decision No. 2455/2001/EC (OJ L 331, 15.12.2001, p.1.).

Outdated version: (INSPIRE, 2004)
Hydrographic elements, both natural and artificial including rivers, lakes, transitional waters, reservoirs, aquifers, channels or other water bodies, where appropriate in the form of networks and linked with other networks. Includes river basins and sub-basins as defined in Directive 2000/60/EC. 26

Description:

Hydrography data include surface water features such as lakes and ponds, streams and rivers, canals, oceans and shorelines. Each of these features has the attributes of a name and feature identification code.

The hydrological components should constitute an integrated water network

River basin, as defined in the Water Framework Directive, Art 2, annex I, ii, means the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta. Sub-basin means the area of land from which all surface run-off flows through a series of streams, rivers and, possibly, lakes to a particular point in a water course, normally a lake or a river confluence. (INSPIRE IMS, 2003)

Scope, use examples:

Hydrography data is being used in: (INSPIRE IMS, 2003)

- Water navigation / transport routes
- Tourism environmental
- Assessment and monitoring in estimation of water resources,
- Assessment of flow patters of particles and pollutants, pollution monitoring,
- Wastewater cleaning estimation,
- Species migration and biodiversity assessment, the hydrological elements being habitats.
- Inland fisheries management.
- Hazardous waste disposal sites.
- Land use planning/ management,
- Recreation planning and management,
- Transport routes,
- Water supply

Water catchments is used in assessment of water flow and flooding, flow of contaminants, erosion monitoring. Catchments are used to create WFD River Basin Management Districts, but does not have full correspondence in boundaries. (INSPIRE IMS, 2003)

Community policies:

- Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p.1
- Flood Risk management; Flood Prevention, protection and mitigation. Communication from the Commission of the European Communities, COM(2004)472 final, Brussels, 12.07.2004

The **Water Framework Directive (2000/60/EC)** – "WFD" - was adopted by the European Parliament and of the Council in 2000 and establishes a framework for Community action in the field of water policy and has since then been incorporated in the legislation of Member States. It requires that inland and coastal waters within defined river basin districts must reach at least good status by 2015 and defines how this should be achieved through the establishment of environmental objectives and ecological targets.

Article 5 defines the responsibility for each Member State to define the characteristics of the river basin district, review of the environmental impact of human activity and economic analysis of water use.

Article 8 defines the responsibility for Member States to establish programmes for the monitoring of water status in order to establish a coherent and comprehensive overview of water status within each river basin district.

The implementation of the WFD requires the handling of spatial data both for the preparation of the River Basin Management Plans and for the reporting to the Commission. In the first case GIS techniques will be essential for the derivation of various information layers (e.g., on the characteristics of river basins and water bodies, on the chemical and ecological status of water bodies), while in the second case GIS will be the tool for the preparation and delivery of the GIS layers required for the reporting.

Important feature types and attributes:

Watercourse

- Name
- Hydrologic code
- Hydrologic persistence (perennial, intermittent)
- Hydrographic Origin Category (natural, man-made)
- Type (stream, canal, aqueduct, ditch, estuary, …, virtual)
- Position/ground
- Navigability

Lake, pond

- Name (if any)
- Hydrologic code
- Hydrologic persistence (perennial, intermittent)
- Hydrographic Origin Category (natural, man-made)

Other entities on water network, such as waterfall, sluice, lock, dam

Isolated water infrastructures, such as fountain, pumping station

River basin

- name
- hydrologic code
- level ("administrative importance")

Links and overlaps with other themes:

The main relations with other themes :

- Transportation - for water navigation (Annex I)
- Geographical Names - for names of water features
- Elevation - for geometric consistency and coastline
- Land cover - for wetlands, water bodies (Annex II)
- Geology – for aquifers
- Utility and governmental services – for water supply
- Production and industrial facilities – for water abstraction facilities
- Agricultural and aquaculture facilities - specially for irrigation systems
- Area management/restriction/regulation zones and reporting units as some of these zones are related with hydrography
- Natural risk zones - for instance for flood risks
- Sea regions - concerning the limit between land and see.

Groundwater is by geologists commonly treated as a geological resource. Groundwater in aquifers mainly depends on the geological structure of the subsurface (rock type). Thus it is an integral, inseparable part of Geology. It is mentioned in the INSPIRE Annex as aquifers. However, as being part of the hydrological cycle, it is strongly related with the theme Hydrography as well. The current definition of Hydrography would accommodate groundwater bodies under “all other water bodies related to hydrographic elements”.

Reference documents:

SDIGER: Reference water common model (2005)

Common Implementation Strategy for the Water Framework Directive (2000/60/EC), *Guidance document no. 9* Implementing the Geographical Information System Elements (GIS) of the Water Framework Directive
URL: http://forum.europa.eu.int/irc/DownLoad/k0eHAOJ_mtGq7VjevHT5SFOiSIQRb4g4lbR-pMbj4IJBTp9eAgHVN0ZTmGzX5L_0FdM3IG6SBcLlBO76jEy4dc/Guidance%20No%209%20-%20GIS%20%28WG%203.1%29.pdf

Stanli (Sweden): SS 63 70 08 Geographic information - Surface water systems - Conceptual model and Application schema

EuroGeographics: EuroRegionalMap Specification and Data Catalogue

EuroGeographics: EuroGlobalMap (v2.5) data specification

DGIWG: Feature and Attribute Coding Catalog (FACC) v2.0

DGIWG: DFDD

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for topographic datasets that include hydrography. See categorized list of reference material, compiled by JRC, March 2007.

Suggested contributor in further specification work:

- WFD GIS Working Group
- WISE
- EuroGeographics
- RISE project

5.9 Protected sites

Definition:

(INSPIRE, 2007) Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

Outdated version:
(INSPIRE, 2004) Area designated or regulated and managed to achieve specific conservation objectives. 25 Decision nº 1692/96/EC on Community guidelines for the development of trans-European transport network. 26 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p. 1.

Description:

Areas with certain protection targets defined by sectors. Many of the categories refer to conservation of nature, but could also refer to other objectives, e.g. cultural heritage objects or areas.

Scope, use examples:

The theme refers to policies from Community and UN:

- Habitat directive (1992) (Directive 92/43/EEC)
- Directive 79/409/EEC (Birds).
- World Heritage
- Ramsar Convention
- Barcelona Convention
- Helsinki Convention
- OSPAR Convention

Habitat directive sites. Sites designated under the Habitat directive (1992) (Directive 92/43/EEC) most sites registered as polygons. Coverage: All EU countries. Requested also by WFD: “areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant sites designated under Directive 92/43/EEC (habitats).

Birds directive sites. Sites designated under the bird directive (1979), most sites registered as polygons. Coverage: All EU countries.
Also requested by WFD: areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including sites designated under Directive 79/409/EEC (Birds).

Habitat and Birds sites are mostly managed and reported under the Natura 2000 programme.

Other internationally designated sites Internationally designated areas may be found in European and national databases, such as locations for the Ramsar, World Heritage and Biosphere areas. The data may include the following designations: Biogenetic Reserves, European Diploma Biosphere Reserves, World Heritage Sites, Ramsar Convention Sites, Barcelona Convention Sites, Helsinki Convention Sites, , OSPAR Convention sites.

Nationally designated sites The dataset contains the geographic location and size of the nationally designated areas. The inventory of nationally designated areas began under the CORINE programme. It is now maintained for DG ENV by the European Topic Centre on Nature Protection and Biodiversity and is being maintained by member states.

Protected cultural heritage – land and sea Protected objects or sites, kind of object, reference to law/directive, protection date. The protected sites is only a small proportion of the full occurrence of localities of ancient old houses, medieval sites/ constructions, ship wrecks or other cultural values at sea. In order to see the conservation and management of valuable natural sites in relation to the cultural heritage value sites.

Important feature types and attributes:

Protected site, area, point, line

- Classification system
- Category
- Id
- Name of area/site
- Description
- Reference to legal foundation/ agreement
- Date of establishment of protected site
- Date of modification of protected site
- Target of protection

Links and overlaps with other themes:

The objects, being administratively defined boundaries, may follow object boundaries in natural (e.g. forest stands) or man-made environments (e.g. roads), property boundaries, administrative boundaries of different kinds, coastline, rivers, thus link and overlap with many themes.

- Administrative units
- Cadastral parcels
- Hydrography - for instance: rivers, lakes, waterfalls can be classified as natural heritage or natural parks
- Elevation - particularly coastline
- Land cover
- Land use (as protection often is seen as a kind of land use)
- Area management/restriction, regulation zones and reporting units
- Bio-geographical regions
- Habitats and biotopes

Reference documents:

http://dd.eionet.eu.int/dataset.jsp?mode=view&ds_idf=CDDA

Ioannis Kannellopoulos (Editor, EC-JRC) with the support of GISIG and the contribution of the NATURE-GIS Partners: NATURE - GIS Guidelines: Data Infrastructure for Protected Areas

NATURA 2000: Identification & GIS Classification of Flora Habitants in Significant Reservation Areas: Greece

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for datasets that include protected sites. See categorized list of reference material, compiled by JRC, March 2007.

6 Annex II Themes

6.1 Elevation

Definition:

(INSPIRE, 2007) Digital elevation models for land, ice and ocean surfaces. Includes terrestrial elevation, bathymetry and shoreline.

Description:

The theme includes:

- terrestrial elevation, e.g.
    - Digital elevation information and digital elevation models for land surface and surface of inland waters.
    - Simplified or pre-processed data as contours. Spot Heights.
- Bathymetry, e.g. a gridded bottom model

The height will be according to European Vertical Reference System 2000 (EVRS).

The requirements on vertical and horizontal accuracy of data should be investigated. The large scale dataset might have different accuracy in flat areas and areas with steeper slopes. The slope % and frequency parameters that define which areas have the different quality requirements should be defined.

Scope, use examples:

- Modelling of land slides and avalanches, flooding vulnerability, risk to erosion, flow of water and pollutants, spread of air pollution, fires, noise, and biodiversity.
- Environmental applications
- Water supply
- Energy sector
- Agricultural and forestry
- Safety at sea,
- Location of valuable biodiversity sites in shallow waters,
- Location of sea resources and valuable sites for fish farming
- Understanding of flow pattern and chemical composition in water
- Assessment of location of pipelines at sea.

Important feature types and attributes:

Vector data:

Contour line and depth contour:
- altitude

Breakline
- category (crest, thalweg, other)

Spot height
- altitude
- category (summit, mountain pass, …)
- name (?)

Sounding
- altitude

High and low water line

Coverage data:

DEM as regular grid, in different resolutions, for land and sea bottom.

Links and overlaps with other themes:

The main relations with other themes are:

- Administrative boundaries: some boundaries may be defined as crests.
- Geographical Names: names of spot heights, e.g. mountain tops
- Hydrography: there is overlap for some features (coastline) and consistencies rules between the two themes, for instance: a river must flow in the thalwegs, a lake or a sea must have the same elevation for all surface points of the water body.
- Orthoimagery: Elevation data is required for the rectification of aerial or satellite images
- Buildings, for 3-D models of urban areas

Reference documents:

Institut Géographique National (France): BD Alti Descriptif technique

Submitted by INTESA GIS (Italy): Technical Specifications for the Elaboration of Digital Elevation Models

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for topographic datasets that include data on elevation. See categorized list of reference material, compiled by JRC, March 2007

Suggested contributors in further specification work:

- EuroGeographics
- RISE

6.2 Land cover

Definition:

(INSPIRE, 2007) Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies.

Description:

Land cover data is a physical or biological description of the earth surface. In this way it is different from the land use data (annex III, theme number 5), dedicated to the description of the use of the earth surface.

Land cover information has to be homogenous and comparable between different location in Europe. Classification should be consistent with LCCS and CORINE. DG ENV among other DGs, together with 37 participating countries are financing and implementing the European multi-annual land cover database, within the framework of the GMES precursor Fast Track Service on Land Management and as the result of the users' requirements at national and European levels. .

Land cover typology includes features such as artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies. Each of these elements are divided in separate subgroups in order to describe all features useful for environmental matters and existing in Europe and are produced with an adequate minimum area threshold ("Minimum mapping Unit").

Land cover is described by the hierarchical nomenclature system, which classes must be defined and kept in time in order to identify land cover changes within time series.

Scope, use examples:

Refers to policies from Community and UN:

- Climate Change Kyoto protocol (priority area in 6 EAP)
- Convention Long Range Transboundary air pollution (EU party of the convention)
- New European Regional development Fund (New EC initiative)
- Water framework directive
- European Soil Thematic Strategy
- Nature conservation Biological diversity convention
- Agriculture (greening CAP)

Refers to use examples by policy framework:

- Regional planning / ESDP, ESPON, Structural funds : assessing impacts of policy against regional development perspectives
- Agricultural and environmental policy / CAP reform, Nitrate directive, UNCDD : assessing impacts of agriculture policies to the environment
- Environmental policy / Habitat Directive: implementing biodiversity conventions, habitats and protected sites,
- Environmental policy / Water Framework Directive : integrated watershed analysis,
- Environmental policy / Air quality directives, IPCC, UNFCCC) : assessing air emission and air quality measures
- Transport policy / Common transport policy, SEA: strategic environmental assessment of Trans-European transport networks, transport and Environment Reporting Mechanism.

Important feature types and attributes:

Features:

- Artificial surfaces
  - Urban fabric
  - Industrial, commercial and transport units
  - Mine, dump and construction sites
  - Artificial, non-agricultural vegetated areas
- Agricultural areas
  - Arable land
  - Permanent crops
  - Pastures
  - Heterogeneous agricultural areas
- Forests
- (semi-)natural areas
  - Scrub and/or herbaceous vegetation associations
  - Open spaces with little or no vegetation
- Wetlands
  - Inland wetlands
  - Maritime wetlands
- Water bodies
  - Inland waters
  - Marine waters

* Each of these features have should be divided in features or subgroups in order to meet requirements from policy framework listed above.

Important attributes: Area, perimeter, Land cover type.

Links and overlaps with other themes:

A strong link exists with Orthophotos, which are the major source for information on land cover.

Moreover, strong links exist with other INSPIRE themes that can be considered elements of land cover:

- Transport Networks
- Hydrography
- Buildings
- Production and industrial facilities
- Agricultural and aquaculture facilities
- Oceanographic geographical features

Land cover is related with Land use.

Reference documents:

IMAGE2000 and CLC2000, Products and methods. EUR 21757 EN; ISBN 92-894-9862-5

CORINE Land cover technical guide, 1994, Office for the Official Publications of the European Communities, Luxembourg.

CORINE Land Cover Technical guide, Addendum 2000, Technical Report N)40, Copenhagen, EEA, May 2000

The Landcover Classification System LCCS. http://www.glcn-lccs.org/

Herold, Martin et al: International land cover harmonization initiative - GOFC-GOLD report 20. Global Terrestrial Observing System (GTOS) of the United Nations.

Herold, Martin et al: UN Global land cover network: an international framework for standardized development of land cover data. Global Terrestrial Observing System (GTOS) of the United Nations.

FAO: Land Cover Classification System classification concepts and User Manual

Several SDICs/LMOs from EU Member States or Regions have submitted data specifications for datasets that include information on land cover. See categorized list of reference material, compiled by JRC, March 2007

6.3 Orthoimagery

Definition:

(INSPIRE, 2007) Geo-referenced image data of the Earth's surface, from either satellite or airborne sensors.

Description:

Georeferenced, mosaiqued and enhanced image data. Source is either satellite or air-borne sensors. Data is rectified to fit a given topographic map accuracy (INSPIRE IMS, 2003).

Scope, use examples:

Airborne or spaceborne orthoimagery can be considered:

- for the extraction and updating of specific reference data components (e.g. Transport network, Hydrography, Land cover, Geology)
- for the production of thematic information (e.g. Land use, Production and industrial facilities, Agricultural and aquacultural facilities)
- to provide a synoptic view of a given territory.
- for display as a backdrop to other data

(INSPIRE RDM, 2002)

Other applications include:

- the localisation of other thematic data
- the localisation of earth observation image data itself, whether lower resolution (e.g. environmental applications) or higher resolution (space or airborne)
- the quick georeferencing and delivery of recently acquired images (dedicated to natural or industrial hazards e.g.) to be co-localised with other thematic interest data (geology, soil, old maps...)
- the continuous updating of rapidly evolving Reference Data layers

Different data already exists or is planned in the near future for pan-Europe, e.g. aerial photos, SPOT, IRS P6 data (for IMAGE2006) and Landsat 7 ETM+ (for IMAGE2000).

Efforts are made at national, European and Global level to implement efficient methods for Earth observation. The '**Global Monitoring for Environment and Security' (GMES)** represents a concerted effort to bring data and information providers together with users, so they can better understand each other and make environmental and security-related information available to the people who need it through enhanced or new services. The services provided by GMES can be classified in three major categories:

- Mapping, including topography or road maps but also land-use and harvest, forestry monitoring, mineral and water resources that do contribute to short and long-term management of territories and natural resources. This service generally requires exhaustive coverage of the Earth surface, archiving and periodic updating of data.

- Support for emergency management in case of natural hazards and particularly civil protection institutions responsible for the security of people and property. This service concentrates on the provision of the latest possible data before intervening.

- Forecasting is applied for marine zones, air quality or crop yields. This service systematically provides data on extended areas permitting the prediction of short, medium or long-term events, including their modelling and evolution.

At the World Summit on Earth Observation in Washington in July 2003, the Group on Earth Observations (GEO) was established, with the goal of addressing the information requirement for the environment on a global scale. This work was completed in Brussels in February 2005 by the adoption of a 10 year implementation plan of an integrated **Global Earth Observation System of Systems (GEOSS)**. The GEOSS is an ambitious programme of information for ecological security and durable development intended for mankind. It principally foresees the monitoring and understanding of nature, the extent of disasters due to human activities, the impact of global warming, desertification, erosion and deforestation.

Overlaps and links with other themes:

Orthophotos relate with many other themes in INSPIRE, as information can be extracted from orthophotos through computer analysis or visual interpretation. Strong interrelations exist for instance with:

- Elevation,
- Hydrography,
- Transport network
- Land cover

Reference documents:

IMAGE2000 and CLC2000, Products and methods EUR 21757 EN; ISBN 92-894-9862-5

Kay, S. et al, 2003: Guidelines for best practices and quality checking of ortho-imagery, JRC, Ispra

Institut Géographique National (France): BD Ortho version 2 descriptif de contenu

Institut Géographique National (France): Spécification de la composante orthophotographique du RGE

EuroGeographics: Report on Reference Data Sets and Feature types in Europe.

Agriculture and Fisheries Unit, JRC of the EC: Guidelines for Best Practice and Quality Checking of Ortho Imagery v2.5

Suggested contributors in further specification work:

- GMES
- GEOSS
- JRC

6.4 Geology

Definition:

(INSPIRE, 2007) Geology characterised according to composition and structure. Includes bedrock, aquifers and geomorphology.

Outdated version:
(INSPIRE, 2004) Geology characterised according to composition and structure. Includes bedrock and geomorphology.

Description:

Geological information provides basic knowledge about the physical and chemical composition and the genesis of the underground, in particular on the properties of the rocks and sediments (age, petrography, genesis and tectonic elements, ...) and their structure.

Scope, use examples:

Geological information, on-shore and off-shore, is the basis to locate distribution of natural resources such as ore, groundwater, oil and building stones. They may, albeit indirectly, warn about the danger of natural hazards, climatic change or supply information about suitable sites for land-fill, house-building or tourism. They thus provide the basis for environmental planning and protection and support public-policy decision. Geological maps are the basis for understanding the earth and its processes.

Thus, geological Data are used in:

- Detecting geo-hazards,
- Locating natural mineral resources (oil, gas, gas hydrates, coal, ore, e.g. iron, copper or aluminium, sand, gravel, limestone etc.)
- Locating groundwater resources for drinking water supply
- Aid in depicting indicators for climatic change
- Aid in protecting ground water
- Ensuring the security of constructing buildings and infrastructures
- Ensuring the security of infrastructures
- Support for public decisions
- Crucial information for environmental planning
- Crucial information for hydro geological information
- Add value to tourism information
- crucial information for the interpretation of geophysical and geochemical data

Important feature types and attributes:

Feature types

- Age
- Rock type
    - Plutonic rocks
    - Volcanic Rocks
    - Sedimentary Rocks
    - Metamorphic rocks
- Genetic aspects
- Tectonic aspects
- Regional names
- Metamorphism
    - grade
    - PT conditions
    - Age
- aquifer type and location
    - porous aquifers
    - fissured aquifers
    - karstic aquifers
- productivity aspects of aquifers

Overlaps and links with other themes:

The main relations with other themes:

- Soil
- Land use
- Hydrography
- Protected sites
- Area management/restriction/regulation zones & reporting units
- Natural risk zones
- Oceanographic geographical features
- Bio-geographical regions
- Habitats and biotopes
- Energy resources,
- Mineral resources.

Groundwater is by geologists commonly treated as a geological resource. Groundwater in aquifers mainly depends on the geological structure of the subsurface (rock type). Thus it is an integral, inseparable part of Geology. It is mentioned in the INSPIRE Annex as aquifers. However, as being part of the hydrological cycle, it might be part of Hydrography as well.

Reference documents:

Asch, K. (2003): The 1: 5 Million International Geological Map of Europe and Adjacent Areas: Development and Implementation of a GIS-enabled Concept; Geologisches Jahrbuch; SA 3, BGR, Hannover (ed.); Schweitzerbart (Stuttgart), 190 p., 45 fig., 46 tab.

Asch, K. (2005): The 1: 5 Million International Geological Map of Europe and Adjacent Areas. Map. (BGR) Hannover.

BGR & UNESCO (1974 – ongoing): The 1 : 1.5 Million Internationale Hydrogeological Map of Europe (in 25 map sheets). BGR (Hannover)

Gilbrich, W.H. (2000): Internatioanle Hydrogeological Map of Europe. – Feature Article. Waterway No. 19 (Paris), 11 pp., 1 fig. 1 tab.;

Gillbrich, W.H., Krampe, K. & Winter, P. (2001): Internatioanle Hydrogeologischen Karte von Europa, 1 : 1 500 000. Bemerkungen zum Inhalt und Satnd der Bearbeitung.- Hydrologie und Wasserbewirtschaftung, 45, H.3, BFG (Koblenz) pp 122 – 125

Gradstein, F.M., Ogg, J.G., and Smith, A.G., Agterberg, F.P., Bleeker, W., Cooper, R.A., Davydov, V., Gibbard, P., Hinnov, L.A., House, M.R., Lourens, L., Luterbacher, H.P., McArthur, J., Melchin, M.J., Robb, L.J., Shergold, J., Villeneuve, M., Wardlaw, B.R., Ali, J., Brinkhuis, H., Hilgen, F.J., Hooker, J., Howarth, R.J., Knoll, A.H., Laskar, J., Monechi, S., Plumb, K.A., Powell, J., Raffi, I., Röhl, U., Sadler, P., Sanfilippo, A., Schmitz, B., Shackleton, N.J., Shields, G.A., Strauss, H., Van Dam, J., van Kolfschoten, T., Veizer, J., and Wilson, D., 2004. A Geologic Time Scale 2004. Cambridge University Press (Cambridge), p 589

International Commission on Stratigraphy (2006): International Stratigraphic Chart. http://www.stratigraphy.org/cheu.pdf

IUGS-SCMR ; 2004; Subcommission on the Systematics an Nomenclature of Metamorphic Rocks,

Streckeisen, A. L. (1976): To each plutonic rock its proper name.- Earth Sci. Rev., 12: 1-34.

Streckeisen, A. L. (1978): Classification and Nomenclature of Volcanic Rocks, Lamprophyres, Carbonitites and Melilitic Rocks.- IUGS Subcommission on the Systematics of Igneous Rocks. N. Jb. Miner. Abh., 141: 1-14.

Voges, A. et al. (1993): Geologische Karte der Bundesrepublik Deutschland. *(Map and GIS),* BGR (Hannover).

Suggested link:

The just started OneGeology project that will globally make available cross-boundary geological information at a 1 : 1 Million scale: www.\\onegeology.org

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

Geological knowledge and digital geologic mapping: hints derived from CARG activity (reference document submitted by MAGGIS)

Ministery of the Flemish Community - Natural Resources and Energy Devision, Water Devision, Geotechnics Devision: A view to subsoil of Flanders - http://dov.vlaanderen.be

UKHO/Ordnance Survey/ British Geological Survey: ICZMap - Data Research Project

Suggested contributor in further specification work:

EuroGeoSurveys

7 Annex III Themes

7.1 Statistical units

Definition:

(INSPIRE, 2007) Units for dissemination or use of statistical information.

Outdated version:
(INSPIRE, 2004) Units for referencing census or other statistical information.

Description:

The theme statistical units must be seen as one of several thematic groups of administrative units. The IMS paper (INSPIRE IMS, 2003) describes the following sub-grouping of administrative units

- official administrative units
- government management zones
- blocks, census and statistical districts
- civil security units
- environmental reporting and management units
- postal codes/ regions

Units for dissemination of statistical information can be viewed as spatial units; areas, lines or point objects used in reporting of information, in geographical analysis and in distribution systems for environmental and socio-economic information. "Use" can be interpreted as something else than "dissemination", as the words is connected with the word "or". The use may represent any use in the full cycle of establishment, aggregation, assessment and display of "statistical information". Statistical information can be defined as "any numerical representation of a phenomenon".

Scope, use examples:

Users of statistics express an increasing need for harmonisation in order to have comparable data across the European Union. In order to function, the internal market requires statistical standards applicable to the collection, transmission und publication of national and Community statistics so that all operators in the single market can be provided with comparable statistical data. In this context, classifications are an important tool for the collection, compilation and dissemination of comparable statistics. Regional statistics are an cornerstone of the European Statistical System. For many years European regional statistics have been collected, compiled and disseminated on the basis of a common regional classification, called ‘Nomenclature of territorial units for statistics’ (NUTS). Clear rules for this classification system have been fixed in a legal framework (Regulation (EC) No 1059/2003). The NUTS classification serves as an harmonised system for applications at European and regional level, while it does not preclude the existence of other subdivisions and classifications.

There is a long tradition in collecting demographic and economic/activity statistics. All geographical levels are interesting, includes municipal and intra-municipal levels. It is common to have statistics with geographical breakdown on country level, regional/ county level and municipal level. In some countries we also find information on census districts. The last decades the statistical offices have started producing demographic and socio-economic statistics in large urban areas with a reference to blocks of houses and to process these data with a GIS. In some countries, the methodology chosen refers to aggregation of location-based information (address/households) on a grid (e.g. 1x1 km or 0.1x0.1 km).

Needed within local to national governments, settlement, urban and regional development, health and education planning, school enrolment planning, risks assessment. Of major importance to integrated analysis for sectors and regions. Necessary as geographical features also in environmental and social assessments, e.g. on estimates on exposure to pressures and on availability of services.

The present focus on eGovernment systems within all sectors and the general rapid changes towards including a spatial dimension in management activities and planning will mean that both points, areas and boundaries of different kind of regions become important, as there is an interest in almost any sector to aggregate information.

Statistical units can be used for collecting data (mostly spatial data at larger scales) as well as for aggregating or presenting data (at different scales for different purposes, for instance: at different statistical NUTS levels). Likewise administrative units the statistical units can be used to geo-reference data from different statistical fields, like demography and social statistics, economy, environment and natural resources.

Important feature types and attributes:

The definition in the directive specifies kinds of features relevant to demography: The definition includes the term "aggregated". Probably information in this theme does not refer to address level information, but aggregations presented as point based location may be relevant, e.g. of production activities in cities. Underneath is given examples of features. The most needed attribute is the unique ID, as this can be used for connecting attribute information. No thematic information should be part of data in this "statistical unit" theme.

administrative unit, e.g. from the NUTS5 level.

- Id

census districts

- Id

small area statistics "free" regionalisation

- Id

settlement – small settlement, village, block, township, town, city

- id

Can also give population figures at other regional aggregations, e.g. on water catchment level, being done in assessments being part of WFD work.

Links and overlaps with other themes:

The datasets addressed in this theme may also be covered in other themes, either as overlapping geometry/ objects, or as a needed geometry for thematic presentations. Statistical units can be used as a basis for aggregation and presentation of choroplet maps for nearly any theme or sector-specific issue. The links given emphasis here are the most important ones linked mainly to the geometry of the statistical units.

- Administrative units; closely linked to this theme, as both are kinds of a broader package of administratively defined boundaries and regions. Statistical units may be composed of, or coincide with administrative units. According to the NUTS regulation, the overlap with administrative units is on purpose, and meant to distinguish zones where coherent decision power enables one to elaborate policies.

- Population distribution/demography; the theme also includes similar geographical objects as the theme "statistical units", however the demography theme also include a multitude of thematic attribute information, this is absent in the "statistical unit" theme. One could say that the demography theme for some kinds of information and aggregation borrow/is based on object types from the "statistical unit" and "administrative unit" themes.

- Area management/restriction/regulation zones and reporting units. These can be sector specific and certain management zones. These include major common operational spatial units such as fire, police, ambulance, coastguard etc. Of very high value both in the sectors own operations and in cross-sector emergency operations, e.g. at occasions of natural and technological hazards, accidents where health, economy or ecology is affected. Such sector/management zones are commonly used as a basis for aggregation of economic, production or services information, could also be health information or other socio-economic information. Usually not used for biological information. The theme could overlap with "statistical unit", and the boundary between them should be clarified. Probably the statistical unit system should be defined only to include units/ systems made for a multipurpose use/ to be non-sector specific statistical unit system.

- Geographical grids: In many cases the geographical grid systems and grid cells functions as statistical units as statistical information is aggregated/displayed cell by cell, however as these are defined in a separate theme, they should not be included in the theme "statistical units".

- Human health and safety, the theme "statistical units" could be a basis component for aggregation and presentation of health related information.

Reference documents:

Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 16 May 2003 on the establishment of a common classification system of territorial units for statistics (NUTS), OJ L 154, 21.06.2003, p.1

Regional statistics at EuroStat (NUTS regions, GISCO database)

Object catalogue and data product specification Norway

Tandem project reports

International agreements on reporting of socio-economic statistics

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

SIGMA-TER project (Italy): DBTI (DataBase Territoriale Integrato): modello dati.

Norwegian feature catalogue and standards

CSI-Piemonte: Descrizione della struttura del DB dello Stradario Unico della Regione Piemonte

Suggested contributors in further specification work:

- EuroStat
- SDIC Nordic geostatistics
- Gisco user community
- National statistical offices

7.2 Buildings

Definition:

(INSPIRE, 2007) Geographical location of buildings.

Description:

Database with information on location of buildings, as points or with the actual basic form of the building. Relevant to couple with information on e.g. ownership, size, height. A building is a covered facility, usable for the protection of humans, animals, things or the production of economic goods.

Usually buildings are part of cadastre. On the local level buildings are available within the large scale cadastral maps or cadastral data sets and are geometrically represented as surfaces

The location of a building should be described by coordinates. Most buildings can be identified by address (separate theme in INSPIRE).

Scope, use examples:

- Local planning and management
- Emergency operations
- Property agents
- Construction sector
- Taxation
- Environment (noise level, protection of cultural heritage sites, …)

Important feature types and attributes:

The feature type 'Building' may be described with:

- condition of facility (ruin, under construction, functional)
- function: industrial, commercial, agricultural, ….
- height
- size
- cadastral identifier, if any
- link with address

and for specific buildings :

- nature (school, museum, church, hospital, …)
- name

Links and overlaps with other themes:

A strong link exists with:,

- Addresses
- Cadastral parcels

Buildings relate with themes :

- Elevation
- Land cover
- Land use
- Utility and government services
- Production and industrial facilities
- Agricultural and aquaculture facilities.

Reference documents:

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

GiMoDig: Report on Global Schema

EuroGeographics: Report on Reference Data Sets and Feature types in Europe.

EuroGeographics: EuroRegionalMap (v4.0) data specification.

Institut Géographique National (France): Spécifications BD UNI v0.1

INTESA GIS: 1n1007_3 - Specifiche per la realizzazione dei Database Topografici di interesse generale, Specifiche di contenuto: La presentazione cartografica (Italy)

Institut Géographique National (France): BD Parcellaire version 1.1 descriptif technique

FÖMI: Digital Base Map Standard (Hungary)

RAVI: NEN3610 - Basic scheme for geo-information - Terms, definitions, relations and general rules for the interchange of information of spatial objects related to the earth's surface (The Netherlands)

Regione Emilia-Romagna: Data Base Topografico alle grandi scale (1:1.000 - 1:2.000 - 1:5.000)

Suggested contributors in further specification work:

- EuroGeographics Expert Group on Cadastre & Land Registration
- PCC

7.3 Soil

Definition:

(INSPIRE, 2007) Soils and subsoil characterised according to depth, texture, structure and content of particles and organic material, stoniness, erosion, where appropriate mean slope and anticipated water storage capacity.

Outdated version:
(INSPIRE, 2004) Soils and subsoil characterised according to depth, texture, structure and content of particles and organic material, stoniness, where appropriate mean slope and anticipated water storage capacity.

Description:

The collection of soil information in Europe can be broadly classified into four categories:

a) **Soil Mapping**, enabling to identify areas of land for management purposes.
b) **Soil Inventories**, providing a one-off assessment of soil conditions and/or properties at a point in time.
c) **Soil Monitoring**, providing a series of assessments showing how soil conditions and/or properties change over time.
d) **Soil Thematic Mapping** (see also digital soil mapping acc. to Dobos et al. 2006)

(a) Soil maps
Soil mapping has been historically the main activity of National soil survey organisations in Europe. The general aim of soil mapping is to provide a spatial representation and description of the soils of continents, countries, regions, farms, or any area of land of interest. It involves identifying the different types of soils that occur, collecting data on their nature, properties and potential use, and recording this information on maps and in supporting documents.

(b) Soil Inventories and (c) Soil Monitoring
Soil inventories are usually the basis to produce attribute data of soil mapping units. In extension, representative soil plot inventories in national or Europe-wide grid systems, or in stratified sampling regimes, are designed to provide information about how soils are changing with time and to observe, whether the quality of a soil is improving, deteriorating or staying about the same under a particular use and management practice.

(d) Thematic data/risk maps in soil protection and environmental reporting
With the general adoption of GIS technology and the creation of databases of georeferenced soil information, the assessment of policy relevant information from the basic soil data has been improved considerably. For example, modelling approaches using the existing soil inventories allow to derive information like soil erosion risk, organic matter content, diffuse contamination, soil compaction, salinisation, etc. Systematic inventories are usually the pre-condition for the establishment of a soil monitoring system. The GIS facilitate the production of these information and its monitoring, analysis, integrated uses and dissemination of the results

Scope, use examples:

Soil maps: soil maps have been prepared in for regional and national environmental assessment and reporting in **overview scales**, involving the scales 1:5,000,000 (Europe), 1:1,000,000 (Europe, countries), and 1:250,000 (countries, regions). On the basis of the work conducted by the European Soil Bureau Network (ESBN), the soil classification has been agreed to be the World Reference Base for Soil Resources (WRB) (Finke et al. 2001). All three scales represent the core integral components of the European Soil Information System (EUSIS). Manuals have been developed by the European Soil Bureau Network to improve harmonized soil mapping in overview scales (Finke et al. 2001; Lambert et al. 2001).

In contrast to overview scales, **basic soil data/soil maps** are available throughout Europe at different scales (scale > 1:50,000) and are using different classification systems, mapping reference dates, and map legends. They are the results of extensive soil surveys performed in the past 50 years, mostly for agricultural purposes (see also Jones et al. 2005).

Soil monitoring: there are only very few examples in Europe which represent fully operational soil monitoring systems. Many of the reported systems by Member States have performed only one observation in time, and cannot therefore be considered as fully operational systems. Montanarella (2004) concludes that a minimum set of common parameters (see TWG Monitoring, task group report on parameters) to be monitored by the existing soil monitoring systems at national level still need to be selected. The same holds true for standardised methods and procedures (see TWG Monitoring, task group report on harmonisation). More information can be received in the review of existing soil monitoring systems by Huber et al. (2001), updated but unpublished by EEA/ETC-TE (2003).

Thematic data: The need for soil information has been intensively increased lately (see below list of policies asking for soil data). Therefore, the European Soil Bureau Network (ESBN) has recently set up two working groups which specifically address methodologies and data needs to process soil basic and monitoring data (Dobos et al. 2006; Eckelmann et al. 2005). In the context of risk assessment under the effect of soil threats, Eckelmann et al. (2005) distinguish two basic evaluation schemes (Tiers). Tier I refers to the 1:1,000,000 scale, Tier II to 1:250,000. The higher resolution involved with Tier II also corresponds to nationally agreed overview scales for environmental reporting, for example in Germany, where the 1:200,000 soil map has been formally adopted to fulfil the regional and national reporting obligations under the German Soil Protection Act.

The development and use of soil monitoring, harmonized soil mapping data, and soil information systems refers to the following **Community and UN policies** (full list is provided by Van Camp et al. 2004):

- European Climate Change programme (ECCP)
- UN/ECE Convention on Long-Range Transboundary Air Pollution (LRTAP); Forest Focus Regulation
- Common Agricultural Policy (CAP): cross-compliance, Agri-environmental Regulation, Rural Development Regulation
- other specific EC policies (Water framework directive, Nitrate Directive, Landfill Directive, Sewage Sludge Directive, European Soil Thematic Strategy)
- UN Convention on Biological Diversity (CBD) and the European Community Strategy (COM (1998) 42)
- UN Convention on Climate Change (UNFCCC) and the Kyoto protocol (KP)
- UN Convention to combat desertification

Important feature types and attributes:

Within the **Soil Geographical Data Base for Europe 1:1,000,000**, soil information is provided for **soil typological units (STU)**. At this geographical representation, it is not technically feasible to delineate each STU. Therefore STU's are grouped into **Soil Mapping Units (SMU)** to form **soil associations**. The criteria for soil groupings and SMU delineation have taken into account the functioning of pedological systems within the landscape. STU's characterize distinct soil types that have been identified and

described by attributes (variables) specifying the nature and properties of the soils, for example the texture, the moisture regime, the stoniness, etc.

The mapping concept **1:250,000** distinguishes soil bodies and soilscapes. **Soil body** represents a portion of land with imprecisely known geographical limits (see also Finke et al. 2001). It describes a three-dimensional entity in a soil continuum using WRB soil classification, parent material, depth to obstacle for roots and dominant surface texture. Similar to the STU, the soil body thus contains the relevant attributes describing the soil. The **soilscape** is delineated at the 1:250,000 scale and groups the soil bodies.

Soil regions 1:5,000,000 represent the regionally restricted part of the soil cover characterized by a typical climate and parent material (Finke et al. 2001).

Overlaps and links with other themes

- Hydrography – for groundwater, aquifers
- Land cover
- Land use
- Geology
- Bio-geographical regions

Reference documents:

Soil Classification:

IUSS/FAO/ISRIC (1998). World Reference Base for soil resources. World Soil Resources Report 84. FAO, Rome.

Manuals (harmonized soil mapping in overview scales in Europe):

Lambert, J.J., J. Daroussin, M. Eimberck, M. Jamagne, D. King and C. Le Bas (2001). Instructions Guide for the elaboration of the soil geographical database of Eurasia and Mediterranean countries at 1:1 million scale, Version 4.0. Office of the Official Publications of the European Communities, EUR 20422 EN, Luxembourg.

Finke, P., R. Hartwich, R. Dudal, J. Ibàñez, M. Jamagne, D. King, L. Montanarella and N. Yassoglou (2001) Georeferenced Soil Database for Europe: Manual of Procedures Version 1.1. European Soil Bureau, Scientific Committee. EUR 18092 EN 184 pp. Office for Official Publications of the European Communities, Luxembourg.

BGR [Bundesanstalt für Geowissenschaften und Rohstoffe] (2005): Soil Regions Map of the European Union and Adjacent Countries 1 : 5 000 000 (Version 2.0). – Hannover. EU catalogue number S.P.I.05.134.

Hartwich, R., Baritz, R., Fuchs, M., Krug, D. & S. Thiele (2005): Explanations to the Soil Regions Map of the European Union and Adjacent Countries 1 : 5 000 000 (Version 2.0). – Arbeitshefte Boden; Hannover (German version, in preparation).

Relevant reviews at European level:

Montanarella, L. (2004). Task Group on Existing soil monitoring systems. In: Van Camp, L., Bujarrabal, B., Gentile, A.R., Jones, R.J.A., Montanarella, L., Olazábal, C. and S.-K. Selvaradjou (eds.) (2004). Reports of the Technical Working Groups established under the Thematic Strategy for Soil Protection. Volume 5: Monitoring. EUR 21319 EN/5. Office for Official Publications of the European Communities, Luxembourg, p.653-718.

Jones, R.J.A., Houskova, B., Montanarella, L. and P. Bullock (2005). Soil Resources of Europe: including Neighboring Countries. European Soil Bureau Research Report No. 9, EUR 20559 EN (2005). 350 pp. Office for Official Publications of the European Communities, Luxembourg.

Huber, S., A. Freudenschuss, and U. Staerk (2001). European Soil Monitoring and Assessment Framework. EIONET workshop proceedings. EEA Technical Report 67 (2001). 52 pp. European Environment Agency, Kopenhagen.

Eckelmann, W., R. Baritz, S. Bialousz, F. Carre, B. Jones, M. Kibblewhite, J. Kozak, C. Le Bas, G. Toth, G. Varallyay, M. Yli Halla and M. Zupan (2005). Common Criteria for Risk Area Identification according to Soil Threats. European Soil Bureau Network: Soil Information Working Group. Report to DG Environment (unpublished; planned for publication).

Dobos, E., F. Carré, T. Hengl, H.I. Reuter and G. Toth (2006). Digital soil mapping as a support to the production of functional maps. European Soil Bureau Network: Digital Soil Mapping Working Group. EUR 22123 EN (2005). 68 pp. Office for Official Publications of the European Communities, Luxembourg.

Soil Information Systems:

Heineke H.J., W. Eckelmann, A.J. Thomasson, R.J.A. Jones, L. Montanarella and B. Buckley (eds.) (1998). Land Information Systems: Developments for planning the sustainable use of land resources. EUR 17729 EN. 546 pp. Office for Official Publications of the European Communities, Luxembourg.

King D., R.J.A. Jones and A.J. Thomasson (eds.) (1995). European Land Information Systems for Agro-environmental Monitoring. EUR 16232 EN. 284 pp. Office for the Official Publications of the European Communities, Luxembourg.

Examples for fully operational national soil information systems:

Bodeninformationssystem (BORIS): http://www.umweltbundesamt.at/umweltschutz/boden/boris/

Fachinformationssystem Boden of the BGR (FISBo BGR): http://www.bgr.bund.de/cln_030/nn_454934/DE/Themen/Boden/boden__node.html__nnn=true

Land Information System (LandIS): http://www.silsoe.cranfield.ac.uk/nsri/services/cf/gateway/ooi/intro.cfm

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Regione Emilia-Romagna: Capitolato tecnico – Realizzazione della terza edizione della carta e del database dell'uso del suolo della Regione Emilia-Romagna

Norwegian feature catalogue and standards

Other:

ISO/TC190 Soil Quality "Recording and exchange of soil-related data". Submitted to ISO by AFNOR, France, June 2006

Suggested contributors in further specification work:

- ENVASSO: http://www.envasso.com/
- European Soil Bureau Network (ESBN): http://eusoils.jrc.it/esbn/Esbn_overview.html
- Joint Research Centre (JRC): http://eusoils.jrc.it/

7.4 Land use

Definition:

(INSPIRE, 2007) Territory characterised according to its current and future planned functional dimension or socio–economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational).

There are two main land use definitions, a **functional** one and **sequential** one (Duhamel, 1998). The first of them defines land use as *the description of land in terms or its socio-economic purpose (agricultural, residential, forestry etc.)*. The second one describes land use as *a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources.*

Description:

Land regulation is the general spatial planning tool at regional and local levels. Land use may be characterised as ordinary mapping of existing functions as an objective picture of the use and functions of a territory, but may also be plans characterising how land may be utilised at present and in the future.

Land use plans/ land user regulation

The land use plans regulate actual and future use of areas. The land use plans commonly have significant textual regulations to each area/ land category or specific areas. The land use plans are of varying detail; Municipal land use plans, detailed regulation plans for blocks or smaller areas within urban areas.

- Land use may be seen as divisions at a high level, e.g. distinguishing between private and state owned land. , e.g. at scale 1: 1 mill.
- Land use plans is commonly made at regional levels as kinds of master plans, e.g. covering the full extent of municipalities and being at the scale 1: 50.000
- Land regulation plans at detailed low level may cover populated areas or areas of specific economic or social interest. The plans may direct utilization level, the % of building coverage within areas, height regulations or functional regulations, and maps produced may have a detailed scale, e.g. 1: 5000.

It is a very diverse situation concerning land regulation/ land use plans as these spatial data commonly are based on national or regional legislation or other kinds of regulation. The documents/maps are frequently seen as legal documents, and the categories remain for decades as rights directing use land and property. Categories of land use follow such regulations. Furthermore, operational plans may for some areas be old and based on older legislation, and the nomenclature may have changed through time. Operational land use plans may be as old as 100 years or more. Also plans being proposed and being in a process or public/sectoral hearing can be relevant for dissemination in the infrastructure.

Common strategies to activate land use plans in a GIS is through the production of raster versions of land use plans. This is by some seen as a very good strategy, as the rasterisation makes a "copy" of the visual content, thus locking the content and accuracy for changes and misleading interpretation of the legal map documents. Some organisations have a strategy of first supplying raster versions of existing plans, and with a long term plan for establishment of vector versions.

Functional land use – according to socio-economic purpose

Functional areas within urban or rural areas may be mapped through fieldwork, register information or through modelling using socio-economic input data in a GIS.

The recommended classification of the land use phenomenon is based on the ISIC Rev.3 (International Standard Classification of All Economic Activities) classification drawn up by the United Nations (approved

by the Statistical Commission in 1989) and recommended for use throughout the world. This classification is integrated in the sense that it ensures a full harmonization with another main branches of economic classifications: the classifications of products ICPC Central Product Classification) which are fundamental for foreign trade statistics, statistics of production and consumption, energy statistics, etc. The ISIC Rev. 3, it is important to state, is fully compatible with the EU NACE Rev. 1 (Nomenclature des Activités de la Communauté Européenne) system for the first two levels.

The **ISIC system** is made of four levels of breakdown: 17 sections, 60 divisions, 159 groups and 292 classes. The 17 sections of the first level are characterizing main economic activities. These categories are:

SECTION A	Agriculture, Hunting and Forestry
SECTION B	Fishing
SECTION C	Mining and Quarrying
SECTION D	Manufacturing
SECTION E	Electricity, Gas and Water Supply
SECTION F	Construction
SECTION G	Wholesale and Retail Trade, Repair of motor vehicles, motorcycles and Personal and household goods
SECTION H	Hotels and Restaurants
SECTION I	Transport, Storage and Communication
SECTION J	Financial intermediation
SECTION K	Real estate, Renting and Business activities
SECTION L	Public Administration and Defence, Compulsory social security
SECTION M	Education
SECTION N	Health and Social work
SECTION O	Other Community, Social and Personal Service Activities
SECTION P	Private Households with Employed Persons
SECTION Q	Extra-territorial Organizations and Bodies

Scope, use examples:

Many of the management and planning activities at local level require detailed data. Proper location, the geographical position, is important. The level of accuracy needed in location varies, the need for (and will to produce) accurate data being higher in urban or built-up areas and lower in rural and natural/semi-natural environments. Similarly, interest in frequent updating decreases with distance from central areas. The detailed area planning covers both land and sea/coastal areas.

Land Use is important for impact assessment and monitoring of implementation of policies and legal instruments for sustainable management of the environment, like Natura2000.

Policies:
6EAP, EIA guidelines. Several policies and strategies give highlight the value of regional approaches with integrated land/area management, such as the Integrated Coastal Zone Management, Communication on planning and environment, Water Framework Directive and the Communication on risk prevention.

Environmental Impact Assessments (EIAs) for projects and Strategic Environmental Assessment (SEAs) for policies, plans and programmes ensure that significant environmental impacts are identified, assessed and taken into account in decision-making process to which the public can participate.

Important feature types and attributes:

Kinds of features depend on kind of land use and land use plan. A representation of a land use plan may be structured as a layered dataset.

- boundary of plan/regulation
- land use category area
- land use regulation area
- land use restriction area
- elements within a plan (road boundaries, building boundaries, forest/agricultural land boundaries etc)

Important attributes

- land use category
- land use regulation category
- land use restriction category
- present/existing or proposed/planned/future
- legal reference
- date of entry into force
- link to text regulations for each area

Links and overlaps with other themes:

- Hydrography
- Transport networks
- Protected sites
- Land cover
- Buildings
- Habitats and biotopes
- Human health and safety
- Utility and governmental services
- Production and industrial facilities
- Agricultural and aquacultural facilities
- Population distribution – demography
- Area management/restriction/regulation zones and reporting units
- Energy resources
- Mineral resources

Reference documents:

Norwegian feature catalogue for land use plan data – SOSI

Norwegian data product specifications for land use plan data

Christophe Duhamel (1998) First approximation of a reference land use classification, Report to the FAO

United Nations, International Standard Industrial Classification (ISIC), Rev. 3, at: http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2

Nomenclature statistique des Activités économiques dans la Communauté Européenne (NACE), revision 1.1, at : http://www.fifoost.org/database/nace/index_en.php

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

INTESA-GIS: 1n1007_1 - Specifications for producing general Topographic Data Base - Layers, Themes, Classes (Italy)

RAVI: NEN3610 - Basic scheme for geo-information - Terms, definitions, relations and general rules for the interchange of information of spatial objects related to the earth's surface (The Netherlands)

EuroGeographics: EuroRegionalMap Specification and Data Catalogue

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Suggested contributor in further specification work:

EEA - European Environment Agency

7.5 Human health and safety

Definition:

(INSPIRE, 2007) Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.

Outdated version:
(INSPIRE, 2004) Geographical distribution of occurrence of diseases linked directly (epidemics, spread of diseases, health effects due to environmental stress, air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, stress, etc.) to the quality of the environment.

Description:

A descriptive approach to human health and safety will focus on the

- descriptive geographical distribution of diseases, wellbeing of humans or other health and safety qualities showing geographical patterns, may also include probability descriptions.
- causes and elements affecting health
- wellbeing of humans, including quality of the human environment
- safety issues, behaviour linked to safety
- health care services

To illustrate kinds of geographical information which can be included in this Inspire theme, some examples on medical statistics and medical geography can be given:

General statistics on health - change over time

- **mortality** – the number of death in relation to a total population over a given period of time
- **life expectancy** – the average number of years newborn children may expect to live if death subsequently occurs in accordance with the mortality for each age group of the population within this period. Life expectancy may also be estimated as the expected remaining time of life at any particular age.
- **Morbidity**: incidence of disease in relation to a total population over a given period of time. Morbidity can be described by many different indicators:
    - incidences: the number of new cases in relation to a total population over a given period of time
    - cumulative incidences: the total number of new cases for a longer period of time, e.g. several years, in relation to a total population
    - prevalence: the total number of cases registered in a population at a given time in relation to a total population
- rate, age-specific rate, age-adjusted rate.

Relevant material on geographical patters of health is comparison of the major sources of death or illness at different points in time. This can, for instance, illustrate epidemiological transitions, with a fall in infant mortality and infectious disease and a rise in degenerative diseases.

Incidence data on specific diseases or other health issues

Incidences overviews can be split by male/females, age, region or rural-urban sub-division, and data may give opportunities to depict trends over time. Examples which can be treated geographically:

- **Kinds of diseases and illnesses**: coronary heart disease, stroke, infant mortality, mortality related to cancer, morbidity overview, cardiovascular diseases, musculo-sceletal diseases, mental health problems, injuries, sexually transmitted diseases, infectious diseases.
- **Cancer incidence in particular**: Cancer comprises a variety of types with different geographical patterns. Incidence data from pubic registers material on age-specific trends, gender variations in a geographical context, incident rates and survival rates: Cancer of the tongue, mouth, throat, stomach, colon, rectum, lunge, prostate, kidney, urinary bladder, malignant melanoma, lymphatic cancer.

Causes of poor or good health – risk factors - exposures

The theme may also include focus on the causes of poor (or good) health. For the purpose of Inspire it is convenient to define health in an environmental context, viewing health as a result of an interplay between three factors, man as a biological organism, habitat and behaviour - the human organism's ability to withstand chemical, physical, biological, psychological or social stresses.

- Firstly, it can provide clues about the causes of disease. Although examples of geographical studies leading to basic new knowledge about disease causation are rare, geographical disease patterns may generate hypotheses about causes which can be followed up using other approaches, or suggestions from other research approaches can be tested geographically.
- Secondly, such information can be useful in the planning of strategies for health promotion.
- Thirdly, knowledge about geographical variations in different aspects of health can be useful in health care planning.

Geographical distribution over exposure elements may help understanding links between exposure and health or illness. A causation analysis should include the following two concepts: **Risk factor**: factor which is known to increase the risk of a disease or other problems: **Exposure**: to be exposed to a risk factor:

- Exposure to chemical agents in the environment, in air, water, food and soil, has been implicated in numerous adverse effects on humans from cancer to birth effects.
- Among exposures which have been shown to be carcinogenic the following can be mentioned; radioactive and ultraviolet radiation, some chemicals, stimulants such as alcohol and nicotine, food and some occupational factors.
- Two groups of hazardous chemicals – heavy metals and persistent organic pollutants (POPs) are currently receiving particular attention. Exposure to heavy metals has been linked with developmental retardation various cancers and kidney damage. Exposure with gold and lead has also been associated with the development of auto-immunity. Growing evidence that POPs have serious human health effects.

Human well-being:
Human wellbeing may be linked to environmental stress, e.g. noise, heavy traffic, pollution, it may also be reflected in statistics on rates negative wellbeing, e.g. psychiatric problems, alcohol-related causes of illness, social problems or death, health problems or death by traffic accidents, injuries or death by other accidents, suicide in general or firearm suicide as a particular case.

Security
Security may contain issues like peoples' own experience or perception of their security situation, be linked to rates of a long range of indicators e.g. crime rates, or be probability maps for e.g. crime.

Health services
Health services may be interpreted as part of the theme health, as their occurrences and quality in closely linked to health and wellbeing. The issues may reflect public health services in a geographical context, - distribution of e.g. hospitals and similar institutions, medical laboratories or institutions for rehabilitation purposes. Details may be given on distribution, rates, and quality parameters about doctors, nurses, physiotherapists or other practitioners. It may also include services in the form of ambulance services, ambulance regions and other kinds of emergency management systems, where use of GIS have proved to improve performances. Peoples own health care of themselves and their families - by their next of kin – is another important service not commonly being registered.

Scope, use examples:

- Important aspects on health in the 6EAP, followed by the health communication. High concern for the citizen. (INSPIRE IMS, 2003)
- Health planning and management.
- Research on causes of illness and death: Through medical geography and geographical epidemiology different health issues can be analysed in a geographical context.
- Emergency management
- Security management: Over the last decade the criminal justice community has begun to reap the valuable analytic benefits of geographic information systems (GIS) technology. The powerful technology enhances the ability of researchers and practitioners to identify hot spots, analyse spatial patterns of crime and criminal behaviour, and to share disparate data sets across jurisdictional boundaries.

Important feature types and attributes:

Geographical grid systems, administrative units and statistical units
Data on rates of a variety of heath related issues may be linked to geographical grid systems (grids), administrative units and statistical units. The use implies a linkage between health-related attribute information with geometry on grids, administrative or statistical units. It is important that these data with different regional breakdown have stable and know IDs (identifiers). Detailed geographical information on total population, gender and age is crucial is geographical mapping of health. There are no particular health attributes that should be mentioned, the topic is so vast that this would not make sense. For details on minimum requirements on features and attributes, see these themes.

Distribution area/ observation area/ observation point
Point or area localisation showing any kind of health or security related observation, e.g. diseases like malaria, potential human epidemics/risks as avian flue, distribution or crime incidences. Important attributes being kind of incidence, date of observation, sources of observation. The existing material does not allow a more specific outline relevant features and attributes.

Location of health care institution
Sector-specific management regions – e.g. health care/management regions/ambulance regions.

Sector-specific management region

- sector
- sub-sector
- management activity type
- responsible organisation
- year of verification

Risk factors being used in causation assessments may be linked to a series of features treated as other themes. There may be quality information about the human environment, stress and pollution data not treated in other themes relevant in as input element in analyses covered by the theme Human health and safety. It should be assessed if these are to be brought into this topic, such as for instance noise level zones.

Links and overlaps with other themes:

- Geographical grid systems
- Administrative units
- Statistical units
- Utility and government services
- Area management / reporting units
- Atmospheric conditions

Reference documents:

Classification/Nomenclature: The international system for coding diagnoses (International classification of diseases (ICD) for diseases, injuries and causes of death makes comparison between different countries possible. This system is revised on a regular basis.

Owe Lofman pp117-132 Att anvenda GIS før analyser av helsa – ohelsa, sjukdomar och deras determinanter, (to use gis for analysis of health – unhealthy, illness and their determinants) In: Melinder K, Schærstrøm Statens folkhelsoinstitut www.fhi.se, 2005: Platsen, individen og folkhalsen – teorier, metoder og tolkningar - epidemiologiska data på kartan: sjuklighet och exponering - en oversikt.

Aase, A. & Storm-Furru, I, 1996: National atlas for Norway - health. Nasjonalatlas for Norge – Helse. Norwegian Mapping Authority.

Cliff AD, Hagget P 1988: Atlas of Disease Distribution, Analytic approaches to Epidemiological Data. Oxford.Blackwell Reference 1988

Web GIS in practice III: creating a simple interactive map of England's Strategic Health Authorities using Google Maps API, Google Earth KML, and MSN Virtual Earth Map Control http://www.ij-healthgeographics.com/content/pdf/1476-072X-4-22.pdf

Avian flu feed for Google Earth (.kmz)

http://www.ij-healthgeographics.com/

http://gamapserver.who.int/mapLibrary/

world health organisation – public health mapping and gis map library

http://gamapserver.who.int/mapLibrary/Files/Maps/EMRO_endemic.png

Eurosurveillance 2005;10 (10): 051027

Mapping and analysis for public safety

Medical Geography

Atlas of mortality in Europe: Subnational patterns, 1980/1981 and 1990/1991: http://www.euro.who.int/InformationSources/Publications/Catalogue/20010911_22

Atlas of United States mortality: http://www.cdc.gov/nchs/products/pubs/pubd/other/atlas/atlas.htm

Suggested contributor in further specification work:

EEA - European Environment Agency

7.6 Utility and Government services

Definition:

(INSPIRE, 2007) Includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals.

Outdated version:
(INSPIRE, 2004) Sites for governmental services, location of hospitals and medical treatment locations, schools, kindergartens, etc. Includes sewage, waste and energy facilities, production sites and environmental monitoring facilities operated by or for public authorities.

Description:

A very broad INSPIRE theme including different kinds of objects:

Utility services/networks: Physical construction for transport of defined products: These may include pipelines for transport of oil, gas, water, sewage or other pipelines, Transmission lines may include electrical, phone, cable-TV or other networks. Transmission lines for both land and at sea/water (bottom) is important.

- **Oil and gas pipelines**: Major lines from oil and gas fields/extraction areas and storage sites. GISCO, Energy/ industry authorities, Companies
- **Water pipelines**: Location of water pipelines – large and local network. Large transmission lines are of interest here. Linked to production facilities for water for consumption/processes. Irrigation lines treated separately under agricultural facilities. Water supply institutions, Utilities/ health
- **Sewage pipelines**: Sewage network, linked to sewage facilities. Major lines of interest here. Utilities
- **Transmission lines- electrical**: Data set showing larger transmission lines for electricity, both at land and sea. The location of lines is important knowledge for the energy sector itself, land use planners, construction, fisheries for sea cables. Parts of the information important in low flight hindrance databases. Large: national energy/industry institutions. Local authorities, Companies
- **Transmission lines-phone/ data/cable-TV**: Location of phone/ data: Rough data needed in land planning. The cables placement can conflict other natural resource utilization activities, e.g. fisheries. Technical data accuracy for local level Companies

Rough pipeline and utility service databases exist at European level, e.g. GISCO database with scale 1: 1.000.000. Data within countries is non-homogenous. There are examples of national portals warning on construction, distributing maps/data on location of pipelines. At local and regional level the responsibility of government offices or different operators/ firms. In some countries there are national portals for information about cables etc in construction work.

Waste treatment facilities and waste storage:
It is important to identify the environmental protection facilities with unique identifiers. The data component category coincides with economic/statistical categories (NACE/SERIEE). Location by geographical point, by address or in some cases as area.

- **Controlled waste treatment sites for non-hazardous waste at land:** geographical location of official or regulated facilities for waste treatment and storage; Included in the spatial component category "environmental protection facilities"
  - storage sites at land - landfills
  - incinerators
  - other treatment facilities

  Information on kind of treatment, kind of substances treated, capacity, percentage biodegradable waste, energy recovery from incinerators and landfills

- **Controlled waste treatment facilities for hazardous waste at land:** geographical location of official or regulated facilities for treatment and storage of hazardous waste; Included in the spatial component category "environmental protection facilities". Reported according to SEVESO II Directive. Distinction between
  - thermal treatment,
  - landfills
  - nuclear waste treatment and storage
  - and other treatment for hazardous waste (e.g. chemical),
  - other treatment facilities

  Information about kind of treatment, kind of substances treated, capacity (and potential risks).

- **Regulated areas for dumping of waste at sea:** Areas at sea for dumping of waste, e.g. ships, oil drilling platforms, industrial waste, military waste. OSPAR Permits on marine dumping. Reporting per contracting party and site (?) waste category, number of permits issued, tonnes licensed and contracting party. Important in environmental management and management of biological resources at sea. . Submission of data for the Annual OSPAR Report on Dumping of wastes at Sea from OSPAR Convention for the protection of the marine environment of the north-east Atlantic. The anticipated delivery authorities could be sea management/ marine/ waste/ environmental authorities, OSPAR. Included in the spatial data component "area regulation".

  Does also include nuclear waste. Example is Russian dumping sites: Official sources states a total of 0.45 PBq of liquid radioactive material has been dumped in the Barents Sea and 0.32 PBq in the Kara Sea. Most of the solid radioactive waste has been dumped along the east coast of Novaja Zemlya and the open Kara Sea. Some material on existing sites and amounts are available.

- **Illegal or non-controlled dumping of waste - sea and land.** Illegal landfills/"wildfills" on land areas are common, but policies are directed to reduce the number of such storage of waste. It is important in local waste management and pollution control to locate such illegal land fills, in order to carry out targeted actions. Non-controlled areas at sea where waste is recorded is also important, this can be shipwrecks, industrial waste, military waste, cars. OSPAR Permits on marine dumping.

- **Mining waste:** Mining waste is a special kind of waste. The residues from mining can contain a low content of metals or minerals not being economically extractable, but leaching can cause contamination of soil and water. The tailings of mining activities are usually located near the site of extraction. In management and assessment of mining waste there are needs for spatial data such as location of mines and tailings, water catchments, river network, water and sea, soil.

- **Sewage sludge: generation, sewage pipelines network and sewage treatment facilities:** Is treated as a group here:
    - Sewage/wastewater treatment facilities, Information on capacity, kind of treatment, category of recipient.
    - Sewage networks treated under the data component: utilities.
    - Sewage sludge spread to agricultural lands - regulated "permission zones"
    - Sewage sludge spread - agricultural lands and soil deposits suitability mapping

Environmental. protection facilities
The theme does also include a specific kind of facilities: Environmental protection facilities include a series communal or private facilities of sewage/ wastewater treatment sites, waste treatment facilities (e.g. incineration , landfills), anti-noise constructions facilities, protection facilities against natural hazards (slide walls, flood walls etc). It is important to identify the environmental protection facilities with unique identifiers. The data component category coincides with economic/statistical categories (NACE/SERIEE). Location by geographical point, by address or in some cases as area.

Examples
- **Waste treatment and disposal site- hazardous waste** Waste treatment plants location for hazardous waste. Major distinction between hazardous and non-hazardous waste. Distinction between thermal treatment, landfills and other treatment for hazardous waste (chemical/ radioactive),. incineration, landfills and other treatment for non-hazardous waste. Information about kind of treatment, kind of substances treated, capacity (and potential risks). SEVESO II, WFD, MS to DG ENV
- **Sewage/ wastewater treatment site** Wastewater treatment facilities, Information on capacity, kind of treatment, category of recipient. Sewage networks treated under the data component: utilities. WFD, MS to DG ENV, local authorities.

Natural hazards protection facilities: Any kind of facilities or constructions protecting against natural hazards, e.g. land slide walls, flood walls etc). Hydrographic services, civil security, local authorities.

- **Anti-noise constructions:** Constructions/walls or other facilities for limiting the spread of noise from road, rail and air traffic, industrial or other noise. For industrial includes modification at the source. Workplace protection excluded. 6EAP

Administrative and social governmental services such as public administrations, civil protection, sites, schools, hospitals. The kinds of sites are commonly presented in governmental and municipal portals and map system as "point of interest"-data, and may be point-based location of a variety of categories of municipal and governmental services and social infrastructure.

- police stations,
- fire fighter stations
- hospitals
- health care centres
- care centres for the elderly
- schools and kindergartens
- renovation/ waste delivery sites
- government and municipal offices

Scope:

Land use planning. Risk planning/ management. Foreseen development of Seveso II Directive to treat transmission lines as possible technological hazards, the Seveso Directive is of major importance in regulating management of risk. Access to utility data as needed in environmental impact assessment, to

be carried out when planning of larger transmission lines for electricity or pipelines. Existing and planning transmission lines should be available for general land use planning. Detailed network data needed in construction.

Information about environmental protection facilities is to be used in evaluation of policies, indicator development and generally on reporting of environmental issues. Statistics linked to the protection facilities can be linked to a location. There is a need for such information if spatial analysis of anthropogenic pressure on river basins. At local level important in land use planning, management of water, coastal areas, natural and technological risks.

Administrative and governmental service information is being used by the citizen and public information systems, in government and municipal management actions and in planning. The navigation databases used in cars commonly include such information.

Community policies:

A community Strategy for Waste Management was initially adopted by the European Commission in 1989 followed by the 1996 Review of the Community Strategy for Waste Management. The 6 Environmental Action plan is the latest document from the Community, with expected developments on “Thematic strategy on the Sustainable Use of Natural Resources”.

Waste management is linked to two issues: preventing waste generation and sustainable management of waste: re-use and recovery (recycling), optimisation of final disposal and regulation of transport. The 6EAP gives a high priority to waste prevention, and to achieving a de-coupling of resource use from economic growth through significantly improved resource efficiency, dematerialisation of the economy and waste prevention. Other policy areas are linked to waste policies, e.g. policies on climate change, air, urban, soil and water (WFD).

- Seveso II, EIS Environmental Impact Assessment, Waste, EAP

Important feature types and attributes:

Objects in networks could both include transmission lines and nodes being pump stations etc.

Pipeline – oil, gas, heat
- category of content
- segment id
- capacity, max
- average volume
- construction system
- date of construction
- responsible organization

Sewage system network
- segment id
- capacity, max
- average volume
- construction system
- date of construction
- responsible organization

Water supply system network
- segment id
- capacity, max
- average volume

- construction system
- date of construction
- responsible organization

Electricity transmission lines
- segment id
- capacity, max
- average volume
- construction system
- date of construction
- responsible organization

Public/governmental services/ facility (point)
- Category of service/facility
- Name
- Id
- Information
- Link to web site

Overlaps and links with other themes

Water supply and sewage might overlap with themes
- Hydrography,
- Buildings
- Environmental monitoring facilities (like treatment plants/pumping stations).

Reference documents:

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

INTESA-GIS: 1n1007_1 - Specifications for producing general Topographic Data Base - Layers, Themes, Classes (Italy)

Regione Piemonte: Descrizione della struttura del DB dello Stradario Unico della Regione Piemonte

LabNets: Subsoil network Laboratory: Mapping specifications of the technological networks.

RAVI: NEN3610 - Basic scheme for geo-information - Terms, definitions, relations and general rules for the interchange of information of spatial objects related to the earth's surface (The Netherlands)

Regione Emilia-Romagna: Data Base Topografico alle grandi scale (1:1.000 - 1:2.000 - 1:5.000)

CSI – Piemonte: SIRI Conceptual Schema

Suggested contributors in further specification work:

- DG Environment
- EEA – European Environment Agency
- DG Transport

7.7 Environmental monitoring facilities

Definition:

(INSPIRE, 2007) 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.

Description:

Monitoring sites are locations were monitoring of physical, chemical, biological or other aspects occur. The monitoring sites may be permanently located at a site or can be temporal, only used for a certain time. Usually monitoring sites should be reported as georeferenced points.

Scope, use examples:

Many different conventions, directives and other agreements direct monitoring and the flow of monitoring information linked to the monitoring sites. At present different institutions use different data models and definitions. INSPIRE includes a more general model of monitoring sites.

Examples:

- **Weather stations**: Meteorological stations with simple information on precipitation, temperature, but also stations with additional info on snow cover, humidity etc. Important in many kinds of environmental assessment.
- **European Climate climatological stations**: Point location of meteorological station. Long-term mean monthly and mean annual values of ca. 19 meteorological attributes for up to 4773 stations, General attributes and additional on max/min monthly temp/precipitation, wind speed, solar radiation, atmospheric pressure relative humidity, potential evapotranspiration, cloud cover. Includes ca. 10.000 stations for the more common variables (rainfall, temp.)
- **Air quality monitoring stations** Site location of monitoring site and stations for registration of air quality, hazardous substances (ozone), other pollutants. INSPIRE/ CAFÉ
- **Water monitoring stations** The WFD directive is presenting different kinds of monitoring sites.
  - surface monitoring stations
  - dinking water abstraction (investigative station, operational station)
  - groundwater monitoring stations (Groundwater Level Station, OperationalGWstation, SurveillanceGWstation)
- **Phenological observation points:** sites where observations of phenological networks are performed (European phonological network EPN)
- **Marine environment monitoring stations**: HELCOM reporting obligation: Monitoring sites in the Baltic Sea, on eutrophication, pollution by metals, pollution by toxic substances, water quality and water pollution. Different frequencies**.** Coverage: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russian Federation, Sweden. See HELCOM reporting obligation from Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Helsinki Convention, revised in 1992).
- **Soil monitoring sites:** monitoring of trends in chemical conditions of soils
- **Bathing site**: Compliance to the Bathing Water Quality Directive 76/160/EEC: Coastal and Fresh Water Zones Data reported are on the quality of bathing waters (coastal and freshwater zones) as per Directive 76/160/EEC on Bathing Water Quality. Parameters for which compliance is calculated include: total coliforms, faecal coliforms, mineral oils, surface-active substances and phenols. The information is submitted to the Commission by the Member Countries and is made available as country reports on the web site of DG Environment. Source: DG Environment.

Important feature types and attributes:

Registration/monitoring site

- registration authority
- registration regime
- registration parameter
- value
- registration date, time

Links and overlaps with other themes:

Environmental facilities may be buildings or located to existing facilities, industry etc. The theme may thus overlap with INSPIRE themes such as

- Buildings,
- Production and industrial facilities,
- Agriculture and aquaculture facilities, and
- Utility and government services.

Reference documents:

WFD: annex V – 1.3, VII – 4: surface water monitoring network in the river basin management plan.

See also references in the text above.

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

CSI – Piemonte: SIRI - Conceptual Schema

Suggested contributors in further specification work:

- EEA - European Environment Agency
- EuroGeosurveys
- Meteorological organisations

7.8 Production and industrial facilities

Definition:

(INSPIRE, 2007) Industrial production sites, including installations covered by Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control * and water abstraction facilities, mining, storage sites.

* OJ L 257, 10.10.1996, p.26 Directive as last amended by Regulation (EC) No 1882/2003

Outdated version:
(INSPIRE, 2004) Industrial production sites. Includes water abstraction facilities, mining, storage sites.

Description:

Location of production industry, mines and energy production facilities. Concerning industry these may be chemical, hydrocarbons (oil-gas), mines or any other industry. The international categorisation system like NACE or SERIEE could be used as common nomenclature for such facilities. The ISIC system for classification of industrial sites may also be relevant.

The theme production and industrial facilities" must be seen as one of several thematic groups of "facilities" The IMS paper (INSPIRE IMS, 2003) describes the following sub-grouping of utilities and facilities

- transmission lines and pipelines
- environmental protection facilities
- production facilities, industry
- agricultural facilities
- trade and service facilities

The first and last is not mentioned as separate themes in the draft directive text, In the council text the environmental protection facility has been taken away and two new themes have been introduced: "Utility and governmental services" and "Environmental monitoring facilities".

The Council definition has included a reference to the IPPC directive, and mentions also water abstraction, mining and storage sites. The storage sites for different kinds of "products" needed as input in industrial/production processes, or may be seen as storage sites for real products and also form "waste" from the production process.

Kinds of production/industry facilities:

Industrial sites: Agglomerations and individual localisation of major industry, including chemical, hydrocarbon refineries, forestry, fisheries etc. Id on firm/site. SEVESO II

Nuclear installation location: Will be used as a reference point for discharges from Nuclear Installations. Reporting on each production unit: Submission of data for the Annual Report on Liquid Discharges from Nuclear Installations from OSPAR Convention for the protection of the marine environment of the North-East Atlantic Ocean. This is a legal obligation for the following nations: Belgium, Denmark, France, Germany, Norway, Portugal, Spain, Sweden, Switzerland, the Netherlands, and United Kingdom. Not necessarily reporting on geographical location, but unit name/address or other id could link information to a geographical location. OSPAR/ HELCOM

Energy resource extraction and production site: Localisation of energy production sites for production of heat, electricity, oil and gas. The sites may include extraction sites, e.g. for oil and gas (platforms),

hydropower stations, nuclear power plants, The sites also includes the distribution facilities for energy, storage sites, but not the network (See data component utilities).

Mines: Individual localisation of mines or generalised mining areas, including storage sites, landfills, sedimentation dams etc.

Scope, use examples:

Needed in modelling and assessment of pressures on the environment, in land use planning, in risk and hazards management. Needed at all geographical levels, from European to local. Needed for information to the pubic. Rough representation in a European dataset for some of the objects in GISCO. Also a geographical database in the EPER, with a map viewer with details about production site, see www.eper.eu.int

European Policies: 6EAP, IPPC, EPER, Ospar/Helcom, Seveso II,

Important feature types and attributes:

The first thought of objects in this theme is point location of a production/ industry facility. However, many of the production facilities cover large areas, so that area objects should also be considered. In detailed mapping/ referencing building or delineation of other objects could be considered. In the IMS paper transmission lines and pipelines where included as kinds of "utilities and facilities". Transmission lines of different kinds could be viewed as linked objects to the "true" production/ industry facilities.

Concerning attributes, the same structure of attributes should as far as possible be used as for agricultural and aquaculture facilities.

Production/ industry facility

- id
- name
- classification system
- classification of activity/ production , Nace-code
- volume of production, per component and time
- volume of emission, per component and time
- owner/ responsible
- emission permitted volume
- etc

Storage facility

- id
- name
- classification system
- class/type
- component, name and volume
- owner/ responsible organisation

Waste site

- id
- name
- classification system
- class/type
- component, name and volume
- owner/ responsible organisation

Links and overlaps with other themes:

The datasets addressed in this theme may overlap with other themes and borders between themes should be identified. Particular care towards

- Land use
- Agricultural and aquaculture facilities. Closely related
- Utility and government services; which includes utility facilities such as sewage, waste management, energy supply and water supply
- Environmental monitoring facilities. marginal link, when the monitoring facility is located at a production facility location

Links also to:

- Buildings
- Addresses

Reference documents:

EPER database, European Pollution Emission register, reporting of different kinds of production

Water framework directive: Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p.1 (as this directive is based on a characterization of water bodies/catchment areas and pressure assessment based on emission from emitting production and industry facilities.

Directive 96/61/EC (IPPC) and water abstraction facilities, mining, storage

GISCO database, industry etc

Teleatlas database

NACE and SERIEE classifications

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

INTESA GIS: 1n1007_1 - Specifications for producing general Topographic Data Base - Layers, Themes, Classes (Italy)

RAVI: NEN3610 - Basic scheme for geo-information - Terms, definitions, relations and general rules for the interchange of information of spatial objects related to the earth's surface (The Netherlands)

Suggested contributors in further specification work:

- DG ENV
- EEA - European Environment Agency
- EuroStat
- National statistical offices

7.9 Agricultural and aquaculture facilities

Definition:

(INSPIRE, 2007) Farming equipment and production facilities (including irrigation systems, greenhouses and stables).

Description:

Agricultural facilities*:* The farming facilities are constructions used in agricultural production. Agriculture is defined to include cropping of annual crops or perennials and rearing/ breeding of animals. Forestry in general is probably not included, but intensive forestry plantations on former fields may be included? Facilities can be classified according to the NACE1.1 used in official statistics when relevant. The ISIC system for classification of industrial sites may also be relevant. Examples of farming productions facilities are irrigation systems, greenhouses, stables, tanks and pipelines. The definition of a facility should be clarified, e.g. if facilities such as wall systems for prevention of erosion, channel systems used in irrigation, terrace systems used for fruit production are constructions outside the scope of a "facility".

Aquaculture facilities: Productions and treatment facilities for fish, mussels, seaweed and other kinds of aquaculture. Aquaculture does only include permanent or semi-permanent systems for breeding of the organisms, and does not include locations for catching animals or plants in their natural environment. Aquaculture facilities may exist both in marine waters, inland water environments and as terrestrial production systems.

Scope, use examples:

Important in local land use planning and agricultural and water management, also of interest to the public, Environmental Impact Assessment, as input to identify resources/facilities under threat in crisis management. Also important knowledge in a spatial follow-up of the spread of human or plant/animal diseases. Also relevant in the follow up of different directives and policies: IPPC/EPER Register, the Seveso Directive, Emissions to water.

Important feature types and attributes:

Agricultural productions/treatment facility and aquaculture production/treatment facility may have an exact location of site (point, area). Objects may be spatially expressed as points, but where production area is substantial, area coverage may be relevant, e.g. greenhouse areas or mussels production sites at sea.

The location may for some kinds of facilities be carried out by indirect location through the use of id and use of other reference data – e.g. address, property identifier or building identifier. Use of GIS or web services may give location information.

Agricultural facility

- classification system
- kind of facility
- role of facility in production system
- kind of production
- quantity of production
- kind of emission, different substances
- quantity of emission, different substances

Aquaculture facility

- classification system
- kind of facility
- role of facility in production system
- kind of production
- quantity of production
- kind of emission, different substances
- quantity of emission, different substances

Links and overlaps with other themes:

Links/Overlaps with:

- Buildings
- Addresses
- Hydrography (for irrigation systems).
- Land Cover
- Land Use
- Environmental monitoring facilities. marginal link, when the monitoring facility is located at a agricultural or aquaculture facility

Reference documents:

NACE1.1, classification of facilities

EPER register

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Suggested contributors in further specification work:

- EEA - European Environment Agency
- DGAgric

7.10 Population distribution – demography

Definition:

(INSPIRE, 2007) Geographical distribution of people, including population characteristics and activity levels, aggregated by grid, region, administrative unit or other analytical unit.

Outdated version:
(INSPIRE, 2004) Geographical distribution of people aggregated by grid, region, administrative unit or other analytical unit.

Description:

The demand for local statistics has increased over time. For example, the national statistical offices commonly disseminate statistics by municipalities, blocks of houses or grids. The uses of local statistics are many, from the local, regional and national management of public services (education, health, environment, urban planning…) to the consulting companies in domains such as public works or market studies and the research in the socio-economic domain. Data themes of major importance are demography, production, economy, but also natural resources, but also a variety of environmental themes.

Includes a broad spectrum of information sources, such as regional statistics at EuroStat; other European and National data, Regional data and Local breakdowns. The theme may thematically be divided into several components. The directive text points at broad groups of sub-themes

- population characteristics
- population activity levels

Concerning population information, this will or can include total population, age: population figures for each year class or aggregated year classes (0-5, 6-15, 16-20, 21-30, 31-40, 41-50, 51-67, 68-80, over 81). It could also include gender, mortality, life expectancy, migration. Figures could be offered as yearly versions, one could also like to give information of changes over time, such as growth/reduction in population, e.g. last 2 years, last 5 years, last 10 years. It could also include details on average night and day figures for some of the components. The sub-theme of population could include socio-economic information about the population, such as number of households, rate of employment, education, income, households with children etc.

Themes relevant to local, regional and national statistics also includes topics such as resource exploitation, agricultural production and a variety of environmental themes. Concerning "activity levels" used in the definition of the theme, this is probably an inclusion of a theme being treated separately in the INSPIRE position paper – namely "economic activities/local statistics". Economic activities including production, consumption, stocks, income, employment: statistics referred to administrative units, grids, facilities, networks, addresses, monetary and physical units. Economic data on transport and traffic are classified here. In general, economic activities are described according to the NACE rev.1.1. The NACE is the official classification of economic activities in the European Union and covers all industries. Examples relating directly to the protection of the environment is given underneath:

- 23.30 (part) Processing of nuclear fuel
- 37.10 Recycling of metal waste and scrap
- 37.20 Recycling of non-metal waste and scrap
- 41.00 Collection, purification and distribution of water
- 51.57 Wholesale of waste and scrap
- 90.01 Collection and treatment of sewage
- 90.02 Collection and treatment of other waste

- 90.03 Sanitation, remediation and similar activities
- In other industries, Environmental protection activities and expenditure need additional data, as it is presented in the SERIEE handbook (CEPA), EuroStat 1994 (Version 2002).

Population distribution could also mean geographical aggregations of buildings into settlements, villages, townships, towns, cities. Data may be materialised as hierarchical settlement databases with details on population figures for geographical objects either **centre point location** or **area/settlement extent**. Population distribution may also be or functional or physical characterisation of built-up areas **within** a settlement area. One example of an overall functional zoning can be the distribution of CBD areas within a city (CBD=Central business district). Detailed area categorisation can be done, e.g. kind of apartment, flat, cooperative society, self-owned, house/villa, semi-detached house, terrace house, apartment block.

Disaggregating of statistics is a methodology for transforming data at a higher aggregation to lower aggregates based on models. The EEA European population base introduces a transformation of statistics form administrative regions to small grid cells by a model based on knowledge of population distribution – land cover. Figures are aggregated to grid cells, and may therefore be seen as within the definition of this theme.

Population censuses take place with a periodicity of e.g. 10 years. In between, administrative registers of civil state supply a regular flow of data used generally for presenting annual statistics. New trends in statistics will probably lead to abandon the national censuses of large countries for a rotating system based on regional censuses supplemented by a broader collection of data from administrative registers.

Scope, use examples:

There is a long tradition in collecting demographic and economic/activity statistics. All geographical levels interested, includes municipal and intra-municipal levels. Common to have statistics with geographical breakdown on country level, regional/ county level and municipal level. In some countries also information on census districts. These last decades, the statistical offices have started producing demographic and socio-economic statistics in large urban areas with a reference to blocks of houses and to process these data with a GIS. In some countries, the methodology chosen refers to aggregation of location-based information (address/households) on a grid (e.g. 1x1 km or 0.1x0.1 km).

Needed within local to national governments, settlement and city development, health and education planning, school enrolment planning, risks assessment. Of major importance to integrated analysis for sectors or regions. Existing statistics covering long time series make demographic statistics an essential information. The present focus on eGovernment systems within all sectors and the general rapid changes towards including a spatial dimension in management activities and planning will probably boost the use of socio-economic data with a geographical reference. In order to prepare for the increasing user needs, it is expected that European and national providers disseminate information on relevant aggregation levels, with internationally agreed id's and on formats making it possible to link geometry and attributes.

Community policies: 6EAP, and all the policies in which the exposure of the population to a risk or harm is a concern as well as whose where population increase or migration is a key driver.

Important feature types and attributes:

The definition in the directive specifies kinds of features relevant to demography: The definition includes the term "aggregated". DT anticipates that non-aggregated data about population is excluded. Probably therefore information in this theme does not refer to address level or point based location, e.g. of production activities. The mentioned examples of aggregation are by grid, region, administrative unit or other analytical unit.

Underneath is given examples of features, important attributes, however, can be very diverse and is generally referred to as socio-economic attributes

administrative unit, e.g. from the NUTS5 level.
- id
- socio-economic attributes as mentioned above

grid, e.g. 1x1 km, 100x100m
- id
- socio-economic attributes as mentioned above

census districts
- id
- socio-economic attributes as mentioned above

small area statistics "free" regionalisation
- id
- socio-economic attributes as mentioned above

settlement – small settlement, village, block, township, town, city
- id
- socio-economic attributes as mentioned above

physical region/area within settlement
- category

functional region/area within settlement
- category

Can also give population figures at other regional aggregations, e.g. on water catchment level, being done in assessments being part of WFD work.

Links and overlaps with other themes:

The thematic information in the form of attributes collections/tables can be linked to geometry datasets also addressed in other themes, such as geographical grid systems, administrative units and statistical units (census districts). Other themes may be more indirectly linked to the theme demography, as they can be used as an input parameter or geometry needed in the generation of an aggregated population dataset, such as the themes address, land cover and utility and government services

Reference documents:

Regional statistics at EuroStat

GISCO database

Object catalogue and data product specification Norway

Tandem project reports

International agreements on reporting of socio-economic statistics

NACE rev.1.1.

SERIEE handbook (CEPA) European commission/ EuroStat 2002: SERIEE: European System for the collection of economic information on the environment. Methods and nomenclature.

Statistics Norway database and map service:
http://statbank.ssb.no/statistikkbanken/default_fr.asp?PLanguage=1
http://statbank.ssb.no/map/pximap.asp?pxfile=2006549121611571561Kostra2KEKommune.px&TempPath=/statistikkbanken/temp/&language=1

Suggested contributors in further specification work:

- Eurostat
- SDIC Nordic geostatistics
- GISCO user community

7.11 Area management/restriction/regulation zones and reporting units

Definition:

(INSPIRE, 2007) Areas managed, regulated or used for reporting at international, European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas.

Outdated version:
(INSPIRE, 2004) Areas managed, regulated or used for reporting at European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, OSPAR areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, OSPAR reporting units and coastal zone management areas.

Description:

A wide range of management areas are relevant both at European, national, regional and local levels. Here only a few examples are given.

Sector-specific management areas in any sector, not being included as the INSPIRE theme "Administrative units". These may include health care management regions, defence enrolement regions, school regions, fire fighter management regions, police responsibility regions, rescue operation regions etc.

INSPIRE River Basin Districts, Management area for WFD, not strictly being defined of subsets of water catchments, needs to be defined as a separate management area. WFD: art 2, annex I, ii): River basin district means the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwater and coastal waters, which is identified under Article 3(1) as the main unit for management of river basins. WFD: Annex I, ii): Geographical coverage of the river basin district- the names of the main rivers within the river basin district together with a precise description of the boundaries of the river basin district. Anticipated sources: Environmental / hydrological institutions, Mandatory reporting from MC

Scope, use examples:

These are major sector or thematic management areas being used primarily by the sector itself. Sector management and reporting areas are also widely being used in reporting and statistical presentations. In order to fulfil needs defined in EU policies, one should secure the flow of main sector management/ reporting units at the European level.

OSPAR reporting units at sea: General micro-scale data of management units at sea. Only a few region areas in Pan-Europe. Anticipated sources: OSPAR

Bio-geographic regions: Biogeographical regions : Europe is divided into eleven broad biogeographical zones. The data is a polygon data set with the major biogeographical regions. The boundaries should be considered to be ambiguous as they are generalisations that have been fit with political boundaries. Scale 1: 10 million.

Important feature types and attributes:

Management region

- sector
- sub-sector
- management activity type
- responsible organisation
- year of verification

Reference documents:

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

INTESA GIS: 1n1007_1 - Specifications for producing general Topographic Data Base - Layers, Themes, Classes (Italy)

RAVI: NEN3610 - Basic scheme for geo-information - Terms, definitions, relations and general rules for the interchange of information of spatial objects related to the earth's surface (The Netherlands)

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Regione Emilia-Romagna: Data Base Topografico alle grandi scale (1:1.000 - 1:2.000 - 1:5.000)

Links and overlaps with other themes:

- Administrative units
- Statistical units
- Hydrography
- Sea regions
- Biogeographical units

7.12 Natural risk zones

Definition:

(INSPIRE, 2007) Vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions.

Outdated version:
(INSPIRE, 2004) Vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides, avalanches, forest fires, earthquakes, volcanic eruptions.

Description:

Hazards may here be defined as sudden geological or orographic phenomena causing damage on people, economy, production and the environment. The natural hazards may be because of adverse climate, steep slopes, geological activity etc. Technological hazards are sudden failure of a construction or a process causing significant damage. Natural hazards have the potential to precipitate technological hazards. Continuous pollution/emission is not to be seen as a hazard. However, repeated emissions might be called hazards, e.g. large scale chemical, radiation or oil spills. Continuous pollution and other environmental problems may have an adverse effect also on the size and frequency of some kinds of natural hazards.

Underneath an identification of important natural hazards, with information on occurrence: location and frequency and with some information on the datasets, coverage etc.

Areas prone to flooding by inland waters and lakes:
Areas flooded due to exceptional raise of water table in rivers and lakes, affecting adjacent land or areas further away being at the same altitude or lower than the flooding water. Affecting housing and industrial sites, agricultural land, transport network, sewage systems, dams etc: Occurrence: Flat river plains, delta areas, valley bottoms and shorelines.

- Physical mapping of areas susceptible to flooding, line for highest recorded level, also division into zones with different susceptibility classes. Data needs: detailed elevation model and measurements in the field
- Areas with certain regulations/ restrictions for different land use/ resource use linked to flooding risk.
- Constructions for flood control
- Data set on restriction zones on land use/ building/ activities downstream reservoirs in case of reservoir brake-down
- Drainage capacity of ground and soil sealing areas with low drainage capacity

Areas prone to flooding by spring tide/ exceptional sea level rise

Areas prone to flooding due to exceptional raise of water table the sea and backwaters, affecting adjacent land or areas further away being at the same altitude or lower than the flooding water. Affecting housing and industrial sites, agricultural land, transport network, sewage systems, dams etc Occurrence: Flat coastal areas, areas lower than original sea level. Commonly harbours, trade areas etc.

Frequency: Floods, as storms, are among the most common natural disasters in Europe- thus also being the most costly in terms of economy and insurance.

- Physical mapping of areas susceptible to flooding, line for highest recorded level, also division into zones with different susceptibility classes. Data needs: detailed elevation model and/or measurements in the field.
  - measures by radar satellites or air born equipment to measure water level
  - field measurement
- Constructions for flood control
- Areas with certain regulations/ restrictions for different land use/ resource use linked to flooding risk.

Earthquakes

Earthquakes are widespread in the EU and other European Countries. The most destructive events have occurred in the Mediterranean countries, particularly Greece and Italy, which are in the collision zone between the Eurasian and African crustal plates. Through the last three decades several thousand persons have died and injured, several hundred thousand became homeless in events in Greece and Italy. Data needed for getting overview and handling the hazard:

- Geographical point presentation of seismic activity/ epicentres, including information the strength of the earthquake; depth in km, value on Richter scale.
- Data needed for emergency/ rescue operations

Volcano eruptions:

A few active volcanoes exist in the EU and other European Countries. The activity is low and generally the threats are minimal compared to other natural hazards. Some destructive events have occurred in the Mediterranean countries, such as Italy over the past decades. Actions are usually coped with at the local level.

- It is difficult to outline important spatial data sets linked to volcano activities. There might exist maps on expected lava flow channels and restriction areas for certain activities.

Mud slides, land slides and quick (saline leached) clay soils slides:

- areas of unstable terrain, slide area divided into zones of different susceptibility classes
- borehole locations with further information on the salt content etc
- affected area if area is subject to slumping and landslip
- Areas with activity restrictions – which kinds of operations are allowed in order to prevent slides and which areas are not to be built on. Different countries have different threshold levels e.g. concerning slope degree on land used for buildings, the values depending on the ground condition (soil, clay, bedrock)

Areas prone to mountain blocks slides and stone slides:

Occurrence: Mountain block slides mostly in alpine environment with "young landscapes" where frost and water erosion is active, stone slides areas with steep slopes and loose material. Problems occur where land use includes settlements, infrastructure etc.

- Physical mapping of areas susceptible to land block slides divided into zones with different susceptibility classes. Based on mapping of bedrock structures.
- Physical mapping of areas susceptible to stone slides divided into zones with different susceptibility classes. Further info on kind of material. A rough assessment can be based on analysis of slope angle, slope length and rock stability.
- Anticipated affected areas followed by a land block slide; the stone masses themselves and following flooded areas.
- Areas with certain regulations/ restrictions for different land use/ resource use linked to land block slide risk and stone slide risk.
- Constructions for directing stone slides

Areas prone to snow slides - avalanches:

Occurrence: In areas with significant snow cover combined with steep slopes. Wind will affect the creation of snowdrifts.

- Physical mapping of areas susceptible to snow slides divided into zones with different susceptibility classes
- Areas with certain regulations/ restrictions for different land use/ resource use linked to snow slide risk.
- Constructions for directing slides

Areas susceptible to forest, bush and grassland fires

Areas susceptible to forest, bush and grassland fires can be analysed by using

- Satellite images
- Vegetation cover, composition and strata
- Elevation data
- Meteorological data, Precipitation, temperature, winds,

Areas of installations prone to storms/ wind damage

Occurrence: Unclear picture; seas, coastal areas and narrow valleys, but also other areas within the continent. also storms, as floods, are among the most common natural disasters in Europe – thus also being the most costly in terms of economy and insurance.

- Data sets. Areas with recorded extreme wind

Scope, use examples:

Recent local and trans-national disasters have demonstrated to the European Commission and the Member States of the European Union the paramount importance of efficient risk management. Every year European citizens experience the negative consequences of natural disasters caused by flooding, forest fires etc. This was one of the reasons why "Safety of the Citizen" has been selected as one of the main topics for future EU research and development activities within the JRC during the Fifth Framework Program. The enhanced 'risk and hazard' monitoring and coordination responsibilities of EU services Environment DG and Research DG underpin this trend. In addition European policies covering different thematic domains, planned or already in place are directly linked to Natural Hazards problems e.g. Agriculture and Forestry domain - Agriculture DG, Spatial planning domain - Regional Policy DG. Concerning technological hazards, the Seveso Directive is of major importance in regulating management of risk.

It is an aim to minimise risks by making the society more resistant to hazards, either by minimising threats or by regulation of land use and production activities susceptible to the hazards. Some areas are more prone to natural hazards than others. It is important to identify these areas and build up regulations for long term land and production management. Maps and spatial databases are being used actively to carry out such management. Risk analysis is the basis for all work on planning and living with natural and technological hazards. All areas may in some way or other be affected by natural hazards, and areas with certain kinds of human activity may be hit by technological hazards.

The different kinds of users for handling hazards may be grouped into four:

- reporting, trends and overall policy development , commonly at national and international level
- assessment of natural and technological risks – mapping of areas prone to be hit by hazards
- planning phase for securing public safety- long term regulation and management of land and activities
- disaster response and emergency operations

In order to perform these activities certain kinds of data are needed. It is essential with a well organised supply system. The different kinds of data to be used and handled in these kinds of actions can be

- satellite images and air photographs as orthophotos
- vector data sets with polygons and lines
- simple point information tables
- address information system handled in GIS data bases

The issues will be further elaborated below.

Four different forms of usage are identified below, including an outline of their spatial data needs;

- **Reporting, indicators, trends, overall policy development:** The needs for spatial data by this use is limited. Usually one will need reporting units such as countries, NUTS regions, or catchment areas. There will be some use of generalised versions of data sets to be used under the other use categories. Overall trends in frequency of natural hazards is for some of the phenomena linked to the environmental situation – climate change in particular and land cover changes in particular. Data needed for analysing links and dependencies are needed.
- **Susceptibility analysis, mapping and prediction:** Data sets describing and analysing the natural phenomena causing hazards, commonly detailed data with high accuracy is needed, such as measuring stations, detailed thematic mapping through fieldwork (e.g. specific aspects of soil and land cover) , air photo interpretation or remote sensing, analysis of detailed elevation models, water flow data linked to the river and lake network, meteorological and climate data, seismic activity mapping etc. Work is seen to be carried out by both local authorities, national mapping agencies, national thematic agencies or international organisations.
- **Physical and sector disaster-prevention planning:** Making disaster-resistant communities by long term physical and sector planning, usually carried out at local and regional level. The mapping carries of by thematic agencies as described over will is used and transformed into simplified data sets and planning documents showing areas of high risk and restriction zones at or around high risk areas. The delimitation of the restriction zones would need population data, land use plans etc.
- **Emergency operations/disaster response:** The emergency operations for both natural and technological hazards needs more or less the same kinds of data. In order to make emergency management a faster and more accurate means to reduce effects, data are needed in several parts of the operation;
    - Monitoring; continuous or real time situation reports, giving information on trends, direction etc. Using GNSS linked to detailed topographic map data,
    - Overview and identification of qualities at land and sea; persons, property, production activities, infrastructure and environmental qualities that can be affected by the hazard/ disaster. It is essential to access the extensiveness of the anticipated damage caused by natural and technological hazards. There is a need to know about population information at the lowest possible level, property information making it possible to identify owners of individual properties, address register for information purposes and identification, mapping of areas/ infrastructure affected, such as roads, rail, telecommunication lines, water, gas pipe lines, oil installation at sea, storage areas for hazardous substances, resources such as important groundwater bodies, other extraction points for water or other resources, land use, location of high value environmental areas (biodiversity, recreation, cultural heritage sites etc)
    - Location of resources needed to perform the operation; Infrastructure, road and rail capacity, water supply points, depot for emergency equipment (oil spill extraction boats, vehicles etc) location and capacity of hospitals, information to see vehicle information on location, allocating resources, deploying personnel. Included here is also the administrative boundaries for responsibility areas of different bodies involved in the operation.

Links and overlaps with other themes:

The broad field of natural risks may link and overlap may other themes, mostly concerning physical environment; Land use (land use plans may reflect risk zones), Elevation, Hydrography, Land cover, Geology, Meteorological geographical features, Oceanographic geographical features.

Reference documents:

http://nedies.jrc.it/

Schmidt-Thomè, P (2006): Natural and Technological Hazards and Risks Affecting the Spatial Development of European Regions. Geological Survey of Finland, Special Paper 42. (Espoo), p. 167, fig. 35, tab. 56, maps 22

http://www.eu-medin.org/

http://reports.eea.europa.eu/environmental_issue_report_2004_35/en/

http://reports.eea.europa.eu/environmental_assessment_report_2003_10/en/kiev_chapt_10.pdf

http://ioc.unesco.org/igospartners/Geohazards.htm

http://www.jcomm.info/

http://www.tsunamiwave.info/

http://www.geohazards.no/

http://geohazards.cr.usgs.gov/

http://www.ngu.no/kart/skrednett/?lang=English

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Oosterom, Peter van; Siyka Zlatanova and Elfriede M. Fendel (editors): Geo-information for Disaster Management

Glade, Thomas; Malcom Anderson and Michael J. Crozier (editors): Landslide Hazard and Risk

Norwegian feature catalogue and standards

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Balestro, Gianni; Piana, Fabrizio: GIS technology as tool to bring out the role of geological interpretation in the assessment of geological hazard

7.13 Atmospheric conditions

Definition:

(INSPIRE, 2007) Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurement locations.

Description:

Spatial data reflecting the physical conditions of the air and atmosphere, either as isolines, grids or other spatial forms. These can be based on measurements or models. This could also include the measurement locations. (INSPIRE IMS, 2003)

Physical conditions in the atmosphere, represented as lines, grids or points. Includes spatial data sets based on measurements, on models or on a combination thereof and includes measurement locations. (INSPIRE Scoping, 2004)

The typical 'forecast cycle' of a national meteorological service (NMS) will: (a) collect observations over (say) a six-hour interval, (b) 'assimilate' these into a numerical model to produce an estimate of the current atmospheric state, (c) use this analysis as the initial condition for a model forecast run forward in time (typically out to several days). Three broad types of data are involved at different phases of the cycle:

1. **Observations**: around 11000 surface stations globally make up the Global Observing System, reporting such atmospheric parameters as weather, cloud, temperature, humidity, wind, visibility, pressure. A subset of these stations make '*climate observations*' which include daily temperature minimum and maximum, sunshine hours, rainfall amount etc. In addition, around 1000 '*upper-air*' stations make radiosonde (free-rising balloon) observations of pressure, wind, temperature and humidity. Voluntary observing ship and drifting buoys make *marine observations* including sea surface temperature, and wave height and period. Several hundred thousand reports per day of pressure, winds and temperature are made from *aircraft observations*.
2. **Synoptic analysis**: Gridded wind, temperature, humidity, geopotential height, precipitation, etc. Also, 'sensible weather' elements (fronts, cloud, thunderstorm activity etc) will be analysed.
3. **Forecasts**: Numerous forecast products are produced operationally. A conventional weather forecast contains similar elements to the synoptic analysis.

The WMO operates a dedicated network (the Global Telecommunications System) to distribute observations and data products. Data exchange is governed by WMO Resolution 40, which provides for free and unrestricted exchange of observational data 'essential' for forecast activities. 'Additional' nominated data and products may be provided with charge, while all data must be supplied free of charge for research and education.

The Drafting Team proposes that the scope of 'atmospheric conditions' thematic data should be limited to synoptic analysis and climate data.

Providers:

- National Meteorological Services: The ECOMET Catalogue (http://www.meteo.oma.be/ECOMET/Categories_of_data_and_products.htm) provides a 'one-stop shop' index of both 'essential' and chargeable data and product offerings from European NMSs. A similar catalogue is available for the European Centre for Medium-range Weather Forecasting (ECMWF) (http://www.ecmwf.int/products/catalogue/)
- GMES: ECMWF is also contributing meteorological and atmospheric data to the MERSEA and GEOLAND Integrated Projects contributing to GMES ocean and land themes. HALO (Harmonised coordination of Atmosphere, Land and Ocean) is a GMES Specific Support Action to coordinate the interaction of these GMES backbone projects. A document describing ECMWF data and products for GMES is at http://www.ecmwf.int/research/EU_projects/HALO/pdf/HALO_report_ecmwf_draft.pdf

Scope, use examples:

Used in environmental and security assessments, in assessment of climatic change etc. (INSPIRE IMS, 2003)

- For the ETC 'Renewable energy resources' data component, solar power estimation requires national, regional and local inventories on soar energy conditions (climate data); wind energy requires climatological wind measurements.
- The evaluation of 'natural and technological risk zones' (ETC) is based in part on climate data (e.g. rain, snow, wind)
- Wind/climate information is required to evaluate soil erosion (ETC)
- Wind information is required for advanced noise zone mapping (ETC)

Important feature types and attributes:

Four-dimensional (space+time) gridded coverage data, very large datasets; station-based climate records.

Links and overlaps with other themes:

Potential overlap with:

- Meteorological geographical features

Reference documents:

"WMO Reference Information for INSPIRE", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/common_area)

"OGC Web Services and GML Modelling for Operational Meteorology", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/meteorological_geographi&vm=detailed&sb=Title)

"Climate Science Modelling Language (CSML)", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/atmospheric_conditions&vm=detailed&sb=Title)

"MarineXML position paper", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/atmospheric_conditions&vm=detailed&sb=Title)

HALO public documents: http://www.ecmwf.int/research/EU_projects/HALO/docs_public.html

From the other reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Link list to documents relating to: Framework for the WMO Information System (submitted by GRDC)

Ross, Gil: Introduction to WMO for INSPIRE

Suggested contributors in further specification work:

Relevant SDICs and LMOs include: ATMOS-DMC, DFD, EMI, ESBN, GNOSIS, GRDC, INMGIS, INTERO, NETCEN MIT, STIL-BAS, WMO-RAVI, British Atmospheric Data Centre, Bundesamt fur Kartographie und Geodesie (BKG), COGIS – KOGIS – COSIG, Coordination Center UDK/GEIN (KUG), Danish Meteorological Institute, Defence Estates, Deutscher Wetterdienst, ECMWF, EUMETSAT, Institut Geographique National, Institute of Geodesy and Cartography, METEO-FRANCE, Met Office, Ministere de l'Ecologie et du Developpement Durable, Ministry for Environment Physical Planning and Public Works, OMSz - Hungarian Meteorological Service, Ravi/NCGI, Regione Emilia-Romagna, Royal Netherlands Meteorological Institute (KNMI), Surveying and Mapping Authority of the Republic of Slovenia, Swedish Environmental protection Agency, United Kingdom Hydrographic Office.

7.14 Meteorological geographical features

Definition:

(INSPIRE, 2007) Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.

Description:

Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind. .(INSPIRE IMS, 2003)

Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction (INSPIRE Scoping, 2004)

The Drafting Team proposes that the scope of 'meteorological geographical features' should be limited to high-resolution local weather-related data – observations and analyses.

This includes synoptic observations from stations making up the WMO RA VI (European) Regional Basic Synoptic Network, and analysed weather parameters output by numerical weather prediction (NWP) models, e.g.:

- mean sea level pressure (gridded and contours)
- surface winds, temperature
- dew point
- precipitation, snow
- analysed sensible weather elements (fronts, cloud cover)

Scope, use examples:

Used by the environmental sector to predict natural hazards e.g. flooding, drought, forest fires. Also used by other sectors, e.g. water supply to estimate recharge, for forecasting agricultural performance, for giving meteorological forecasts to shipping etc (INSPIRE IMS, 2003).

- A range of meteorological observations is required in support of 'air and climate change' environmental policy implementation and management (ETC)
- A range of meteorological (e.g. rainfall, snow, temperature, winds) data is required for natural hazard prediction and monitoring – floods, avalanches, fires; and for the management of chemical and other hazardous events (ETC)

Important feature types and attributes:

Raw data organised by station (location, id), and analyses in gridded two-dimensional form.

Some analysis products are vector (e.g. analysed fronts, isobars).

Links and overlaps with other themes:

Potential overlap with:

- Atmospheric conditions

Reference documents:

Science Modelling Language' (CSML)", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/meteorological_geographi&vm=detailed&sb=Title)

"Marine XML", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/meteorological_geographi&vm=detailed&sb=Title)

"OGC Web Services and GML Modelling for Operational Meteorology", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/meteorological_geographi&vm=detailed&sb=Title)

"WMO Reference Information", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/meteorological_geographi&vm=detailed&sb=Title)

HALO public documents: http://www.ecmwf.int/research/EU_projects/HALO/docs_public.html

From the other reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Link list to documents relating to: Framework for the WMO Information System (submitted by GRDC)

Ross, Gil: Introduction to WMO for INSPIRE

Suggested contributors in further specification work:

Relevant SDICs and LMOs include: ATMOS-DMC, DFD, EMI, ESBN, GNOSIS, GRDC, INMGIS, INTERO, NETCEN MIT, STIL-BAS, WMO-RAVI, British Atmospheric Data Centre, Bundesamt fur Kartographie und Geodesie (BKG), COGIS – KOGIS – COSIG, Coordination Center UDK/GEIN (KUG), Danish Meteorological Institute, Defence Estates, Deutscher Wetterdienst, ECMWF, EUMETSAT, Institut Geographique National, Institute of Geodesy and Cartography, METEO-FRANCE, Met Office, Ministere de l'Ecologie et du Developpement Durable, Ministry for Environment Physical Planning and Public Works, OMSz - Hungarian Meteorological Service, Ravi/NCGI, Regione Emilia-Romagna, Royal Netherlands Meteorological Institute (KNMI), Surveying and Mapping Authority of the Republic of Slovenia, Swedish Environmental protection Agency, United Kingdom Hydrographic Office.

7.15 Oceanographic geographical features

Definition:

(INSPIRE, 2007) Physical conditions of oceans (currents, salinity, wave heights, etc.).

Description:

The measurable physical conditions of oceans e.g. salinity, oxygen, other chemical components, currents. Representation e.g. as isolines, grids or other spatial organisation. Based on measurements directly or combined with models. (INSPIRE IMS, 2003)

Physical conditions of oceans (e.g. currents, salinity, etc) represented as lines, grids or points. Includes spatial data sets based on measurements, on models or on a combination thereof and includes measurement locations (INSPIRE Scoping, 2004)

Operational forecasting of ocean dynamic physical conditions is still a research activity, with France and UK both running a semi-operational facility.

Observational data include:

- remote-sensing of sea surface temperature, dynamic topography (by satellite altimeter), synthetic aperture radar winds, ocean colour (for primary productivity and sedimentation)
- drifting buoys – surface velocity, temperature, atmospheric pressure
- ships-of-opportunity and regular voluntary observing ships provide temperature (bathythermograph) profiles
- Argo floats provide temperature and salinity profiles

Scope, use examples:

Used in environmental assessments, sector resource exploitation. (INSPIRE IMS, 2003)

- Integrated Coastal Zone Management requires measurement of temperature, salinity, sea current speed and direction, and monitoring of sea-level rise (ETC)

Important feature types and attributes:

Typically vertical profile or ocean surface data.

Links and overlaps with other themes:

Potential overlap with:

- Sea-regions

Reference documents:

"Climate Science Modelling Language (CSML)", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/odeanographic&vm=detailed&sb=Title)

"Liste des données géographiques de référence en domaine littoral", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/odeanographic&vm=detailed&sb=Title)

"MarineXML position paper", available on CIRCA (http://forum.europa.eu.int/Members/irc/jrc/imaco2000/library?l=/drafting_folders/data_specifications/reference_material/annex_iii/odeanographic&vm=detailed&sb=Title)

Marine Metadata Interoperability: http://marinemetadata.org/

SeaDataNet FP6 project: http://www.seadatanet.org/

HALO public documents: http://www.ecmwf.int/research/EU_projects/HALO/docs_public.html (see particularly MERSEA)

French operational oceanography (http://www.mercator-ocean.fr/en)

UK operational oceanography (http://www.metoffice.com/research/ncof/foam/)

EuroGOOS (http://www.eurogoos.org/) is an association of agencies to further the development of operational oceanography within Europe including data management and pilot studies.

From the other reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

IHO Presentation Library for ECDIS (Publication S-52, Appendix 2, Annex A)

IHO: IHO Transfer Standard for digital Hydrographic Data (Publication S-57)

Suggested contributors in further specification work:

Relevant SDICs and LMOs include: EGMOS, EMI, EUCC-CIIG, EuroGeoSurveys, EuroGOOS, GI-CLAN, IRCCM, NATURE-GIS, SDISEA, Sea-Search, SGSETAU, SRSA, BRGM, British Geological Survey (Natural Environment Research Council), Bundesamt fur Seeschifffahrt und Hydrographie (BSH), Federal Maritime and Hydrographic Agency, Colegio de Registradores de la Propiedad, Mercantiles y Bienes Muebles de Espa a (Association of Land and Mercantile Registrars of Spain), Danish Meteorological Institute, Deutscher Wetterdienst, EUMETSAT, European Land Registry Association (ELRA), European Space Agency, Global Terrestrial Observing System (GTOS) of the United Nations, Institut Geographique National, Met Office, Ministry of Transport, Public Works and Watermanagement, OMSz - Hungarian Meteorological Service, Ordnance Survey of Northern Ireland, Regione Emilia-Romagna, Service meteorologique de l'Administration de l'Aeroport de Luxembourg (SMAL), The National Board of Fisheries, United Kingdom Hydrographic Office.

7.16 Sea regions

Definition:

(INSPIRE, 2007) Physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.

Description:

Seas and saline water bodies divided into regions and sub-regions. Each region with common characteristics, concerning water flow/ circulation, adjacent river catchments, bio-chemical or temperature of water, based on scientific criteria. Detailed information at regional level exist. (INSPIRE IMS, 2003)

Whereas 7.3 'Oceanographic geographical features' focuses on physical conditions and general circulation of offshore oceanic waters, the 'sea regions' theme is concerned with marine features of the coastal zone – 'transitional waters' and 'coastal waters' using the terminology of the Water Framework Directive:

- transitional waters: bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows
- coastal waters: surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters

Both biotic and physical parameters and indicators are important in the classification and delineation of sea regions. Physical data requirements for important indicators defined in the WFD and the Integrated Coastal Zone Management policy are outlined in the ETC paper. These include:

- nutrients (nitrate, phosphate and nitrogen: phosphorus ratio) by regional sea and water body type
- concentrations of hazardous substances and pollutants (incl. heavy metals, persistent organic pollutants)
- productivity indicators (incl. surface cholorophyll-a)
- biological classification of waters
- water masses/layers characterised by bulk temperature and salinity properties
- polar area features (incl. pack ice)
- wind (climatological and meteorological)
- benthic parameters (sediment, benthic communities/habitats)
- sea level
- chemical species and concentrations
- physical characteristics (incl. temperature, salinity)
- currents
- tidal zones

Scope, use examples:

Water Framework Directive: The WFD classes of surface saline water bodies, transitional waters, coastal waters to some extent coincide with sea regions, but have boundaries based on administrative/ reporting criteria, not scientific definitions. (INSPIRE IMS, 2003)

The Integrated Coastal Zone Management (ICZM) policy is an EU integrated strategy for coastal zone management. Key areas of action for ICZM are environmental impact assessment, coastal land planning, habitat management and pollution control. The Working Group on Indicators and Data has determined a set of indicators of sustainable development of the coastal zone, including sea-level rise and extreme weather conditions.

Important feature types and attributes:

- point measurements of physico-chemical properties
- biological surveys
- meteorological and climate measurements (time-varying)
- tidal timeseries and currents

Links and overlaps with other themes:

Potential overlap with:

- Oceanographic geographical features

Reference documents:

ICZM policy documents (see DG-ENV http://europa.eu.int/comm/environment/iczm/home.htm)

Water Framework Directive policy documents (see DG-ENV http://europa.eu.int/comm/environment/water/water-framework/index_en.html)

IHO S-57, S-100 data models: http://www.iho.int/PUBLICATIONS/Publications_E.htm#S57, http://www.iho.int/COMMITTEES/CHRIS/TSMAD/S-100_Info_Paper.pdf

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

IHO Presentation Library for ECDIS (Publication S-52, Appendix 2, Annex A)

Norwegian feature catalogue and standards

Suggested contributors in further specification work:

Relevant SDICs and LMOs include: EGMOS, EMI, EUCC-CIIG, EuroGeoSurveys, EuroGOOS, GI-CLAN, IRCCM, NATURE-GIS, SDISEA, Sea-Search, SGSETAU, SRSA, BRGM, British Geological Survey (Natural Environment Research Council), Bundesamt fur Seeschifffahrt und Hydrographie (BSH), Federal Maritime and Hydrographic Agency, Colegio de Registradores de la Propiedad, Mercantiles y Bienes Muebles de Espa a (Association of Land and Mercantile Registrars of Spain), Danish Meteorological Institute, Deutscher Wetterdienst, EUMETSAT, European Land Registry Association (ELRA), European Space Agency, Global Terrestrial Observing System (GTOS) of the United Nations, Institut Geographique National, Met Office, Ministry of Transport, Public Works and Watermanagement, OMSz - Hungarian Meteorological Service, Ordnance Survey of Northern Ireland, Regione Emilia-Romagna, Service meteorologique de l'Administration de l'Aeroport de Luxembourg (SMAL), The National Board of Fisheries, United Kingdom Hydrographic Office.

7.17 Bio-geographical regions

Definition:

(INSPIRE, 2007) Areas of relatively homogeneous ecological conditions with common characteristics.

Description:

Data component description:
Bio-geographical regions show the extent of areas with common characteristics, usually based on climatic, topographic and geo-botanical information. Thus the bio-geographical regions show areas with relatively homogeneous ecological conditions. Included in this theme is vegetation map data. The determination of structure and composition of the vegetation is based essentially on stands of ecosystems and their correlation with particular site conditions, commonly based on plant-sociological classification. Vegetation can be mapped either as actual/existing or potential vegetation cover. The classification of potential vegetation depicts the potential distribution of the main natural plant communities. The mapping is based essentially on remaining stands of natural or near-natural ecosystems corresponding to the actual climatic and edaphic conditions. Several high-level data exists for Pan-European level, large-scale data with fragmented systems, resolution and coverage.

Once produced, the bio-geographical data and potential vegetation map data potential vegetation maps are relatively stable and regarded as reference data/maps. Mapping of existing vegetation at local level needs to be updated to depict changes in vegetation.

- **Nomenclature:** The high-level and pan-European data follow agreed nomenclatures. Concerning local and regional data, there exist a broad variety of nomenclatures, e.g. in vegetation mapping.
- **Span in accuracy**: Bio-geographical regional data commonly small-scale data, e.g. in 1: 1 mill or smaller. Vegetation data are commonly more detailed, at local level medium accuracy data, 1: 50.000 or better. Common scales used are 1:25.000 and 1: 10.000.
- **Clarification about definition, boundary to other INSPIRE themes:** Boundary between land cover and bio-geographical regions.

Scope, use examples:

The data are used for comparisons and assessments of biodiversity and conservation, at international, national even regional levels. Data in the form of detailed data are being used in land management and local land use planning. The European Bio-geographical regions are used for Natura 2000 national proposals validations, which are performed for whole regions.

Important feature types and attributes:

Bio-geographical/ ecological region
- Classification system/ nomenclature
- Name of class
- Code of class
- Date of last verification
- Source

Vegetation – potential vegetation

- Classification system/ nomenclature
- Name of class
- Code of class
- Date of last verification
- Source

Example data:

- **Bio-geographical regions** Europe is divided into eleven broad biog-eographical zones. The data is a polygon data set with the major bio-geographical regions. The boundaries should be considered to be ambiguous as they are generalisations that have been fit with political boundaries. Scale 1: 10 mill
- **Potential vegetation** The determination of structure and composition of the potential natural vegetation is based essentially on remaining stands of natural or near-natural ecosystems and their correlation with particular site conditions. The classification of natural (potential) vegetation depicts the potential distribution of the main natural plant communities corresponding to the actual climatic and edaphic conditions. Harmonised pan-European data exists, scattered data with a variety of classification systems exist at lower levels. Coverage: Pan-European: Existing dataset in small scale. Central delivery only
- **Ecological regions** Digital Map of European Ecological Regions The Digital Map of European Ecological Regions DMEER- delineates and describes ecological distinct areas in Europe, on the basis of updated knowledge of climatic, topographic and geobotanical European data, together with the judgement of a large team of experts from several European nature related Institutions and the WWF. The objective of the map of ecological regions in Europe is to show the extent of areas with relatively homogeneous ecological conditions, within which, comparisons and assessments of different expressions of biodiversity are meaningful. Coverage: Pan-European: Existing dataset in small scale. Central delivery only
- The bio-geographical regions for the European Seas are not finally agreed on. To date various models from the EEA, ICES and OSPAR/HELCOM are discussed and have to be added after designation.

Links and overlaps with other themes:

Bio-geographical regions may link with biodiversity themes such as the INSPIRE themes Species distribution, and Habitats and biotopes, but may also link to the themes Land cover and Area management/ restriction/ regulation zones and reporting units.

Reference documents:

European Community Biodiversity Clearing House Mechanism
http://biodiversity-chm.eea.eu.int/

European Biogeographical regions
http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=308

http://www.plant-talk.org/country/europe.html

Karte der natürlichen Vegetation Europas/Map of the Natural Vegetation of Europe. U. Bohn, G. Gollub, H. Hettwer, Z. Neuhäuslová, T. Raus, H. Schlüter & H. Weber. 2004. Landwirtschaftsverlag, Münster. Interactive CD-ROM at scale of 1:2,500,000 with explanatory text (in German and English), legend and maps. The project headed by the Bundesamt für

Naturschutz, Germany, started in 1979 with more than 100 participating scientists from 31 European countries.

Végétation du Continent Européen. P Ozenda. 1994. Pp. 271. Delachaux et Niestlé, Switzerland.

The Diversity of European Vegetation. An overview of phytosociological alliances and their relationships to EUNIS habitats. J.S. Rodwell, J.H.J. Schaminée, L. Mucina, S. Pignatti, J. Dring & D. Moss. 2002. EC-LNV. Report EC-LNV nr 2002/054, Wageningen.

Vegetation Mitteleuropas mit den Alpen in ökologischer, dynamischer und historischer Sicht. H. Ellenberg, 5th edition, 1996. Ulmer, Stuttgart. [Standard work on the vegetation of central Europe but also of value elsewhere; earlier version is available in English from Cambridge University Press as 'Vegetation Ecology of Central Europe' (1988)]

A guide to the vegetation of Britain and Europe. O. Polunin & M. Walters. 1985. Pp. 238. Oxford University Press.

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

LÖBF: OSIRIS-Datenmodell (Germany)

NATURE-GIS Guidelines: Data Infrastructure for Protected Areas. Edtor: Ioannis Kannellopoulos (EC – JRC) with the support of GISIG and the contribution of the NATURE-GIS Partners.

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Suggested contributor in further specification work:

EEA – European Environment Agency

7.18 Habitats and biotopes

Definition:

(INSPIRE, 2007) Geographical areas characterised by specific ecological conditions, processes, structure, and (life support) functions that physically support the organisms that live there. Includes terrestrial and aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural.

Outdated version:
(INSPIRE, 2004) Geographical areas characterised by specific ecological conditions and physically supporting the organisms that live there. Includes terrestrial or aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural. Includes small features of the rural landscape – hedgerows, brooks, etc.

Description:

The "Habitats and biotopes" category of spatial data defined in the INSPIRE directive is one of several themes in a wider grouping of biota/biodiversity. Includes habitats and biotopes as areas and their boundaries. Common to all spatial data that falls under this category is characterisation of the distribution of geographical areas being functional areas for living organisms, biotopes being the wider environments in which organisms live (ants biotopes->coniferous forest), while habitats being spatial environments of specific species or groups of related species (ants habitat=tree trunks within a forest).

Some species have strict specific requirements to the environment, while others are accepting broad ranges in environmental conditions. Thus biotopes and habitats may vary broadly between different organisms. Some species changes biotopes throughout the year, by changes in seasons or due to migration. Some biotopes/habitats are depending on management, e.g. all kinds of cultural landscapes. Time series in mapping may be used to identify changes in biotopes/habitats.

Description of living areas for any kind of biota, usually used as a term for describing areas used by zoo-biota. Habitats commonly follow bio-geographical regions/ vegetation types. In rough terms land cover classes and vegetation classes represent terrestrial habitats. Habitats can also be described at more detailed levels e.g. hedgerows, creeks etc. At sea differences in temperature, salinity, depth, current or sediment conditions may form different habitats. habitats and biotopes data can be made both by mapping in the field, remote sensing or modelling.

Habitats and biotopes does only include areas represented by natural boundaries and classified according to their ecological or physical condition. Habitats and biotopes being designated as protected sites is not included, they fall under another category of INSPIRE themes, namely "Protected sites", as these represent administrative area regulation and not ecologically founded boundaries.

The terms natural or semi-natural needs clarification, artificial landscapes being habitats (cultural landscapes like town areas, cultivated land, orchards, pastures etc) may be defined to be out of the scope of the theme.

Scope, use examples:

Assessment of changes in landscape and effects of wildlife and plant life. Linked to Habitats directive. The habitats designated to the directive are mentioned in the “area regulation” data component.

A selection of valuable habitats have been designated according to the Habitats and Birds Directives. In the marine environment a selection of valuable habitats have also been designated according to the OSPAR and HELCOM conventions.

Is being documented and used for identifying biotic diversity within areas or countries, both geographical distribution, variety and representation frequency. It is being used for planning of protection and management of biodiversity in natural, semi-natural and artificial environments. Users are both governments, professional environmental organisations, but also the practical land and resource managers being farmers or fishermen. Wide variety of different classification systems and levels of detail in mapping.

- Scale: An indication of common mapping scales: from 1: 5000 to 1: 1.000.000
- Community policies: 6EAP, Habitats and Birds directive, CAP.
- Initiatives: NATURA2000, The RAMSAR database, CORINE biotopes and others.

Example data:

Biotope sites: Areas of ecological/ biodiversity interest areas, recorded under the Natura programme. Sites of special ecological interest in Nature conservation recorded whether protected or not.

> **Attributes:** site surface statistics, habitat data, mammals, birds, amphibians, fish, invertebrate, plant, Site designation status
> **Coverage:** EU Countries and Phare Countries, Finish date collection 1995. Updates?

Important feature types and attributes:

Biotope (area)

- Classification/Nomenclature system
- Category hierarchy level
- Category name
- Category code
- Mapping date: verification date

Habitat (area)

- Classification/Nomenclature system
- Category hierarchy level
- Category name
- Category code
- Mapping date: verification date
- Species/species group to which the habitat refer
- Site description

Nomenclature should as far as possible follow internationally agreements.

Links and overlaps with other themes:

Habitats and Biotopes may link with biodiversity themes such as the Inspire themes Bio-geographical regions and Species distribution, but may also link to the theme Land cover.

Reference documents:

EUNIS, http://eunis.eea.eu.int/

Habitat classification system: http://eunis.eea.eu.int/upload/EUNIS_2004_report.pdf

Habitat types: http://eunis.eea.eu.int/upload/EUNIS_2004_list.pdf

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

LÖBF: OSIRIS-Datenmodell (Germany)

NATURE-GIS Guidelines: Data Infrastructure for Protected Areas. Edtor: Ioannis Kannellopoulos (EC – JRC) with the support of GISIG and the contribution of the NATURE-GIS Partners.

NATURA 2000: Identification & GIS Classification of Flora Habitants in Significant Reservation Areas (Greece)

CNIG: Annexe 5 – Liste des données géographiques de référence en domaine littoral (France)

Suggested contributors in further specification work:

- EEA - European Environment Agency
- GMES project partners
- DG Environment

7.19 Species distribution

Definition:

(INSPIRE, 2007) Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.

Description:

Pan-European, national or local mapping initiatives, resulting in spatial data of species, e.g. for birds, insects, mammals, amphibians, reptiles or vascular plants.

Clarification:

- The definition in INSPIRE directive proposal does not include individual observations or other point based data, but focuses on aggregated versions of data about geographical distribution of species. Aggregation can be at any level of resolution, e.g. in geographical grid systems divided into 100x100 meter grid or 50x50km grid cells. Possibly also point-based observations and isolines generation between observations should be accepted and included in INSPIRE. Possibly these can be defined as options in the "other analytical unit".
- Only species are mentioned in the INSPIRE definition. But earlier INSPIRE documents (INPIRE IMS, 2003) mentions both species or species grouped e.g. to families.

Scope, use examples:

Different initiatives aim to get a full coverage of up to date species distribution data at a Pan-European scale, for a major set of mammals, birds, mammals and reptiles, vascular plants, together with similar data for a selection of other organisms important as indicators on environmental quality of air, inland waters, sea, soil, habitats.

Digital data sets scan be used for conservation and statistical analysis, as the base of research in ecology and biodiversity, applied to the conservation and management of nature. In biodiversity assessment it is essential to have information on species distribution, quantities, development through time. Needed for Natura 2000. Is being documented in sciences and used for identifying biotic diversity within biotic regions or countries, both geographical distribution, changes over time, combination of species in communities and co-variance with environmental factors and ecological qualities. It is being used for planning of protection and management of biodiversity in natural, semi-natural and artificial environments. Users are both governments, professional environmental organisations, but also the practical land and resource managers such as farmers or fishermen. It is of high relevance to commercial exploitation of economic natural resources such as animals and plants living in natural and semi-natural environments, e.g. fisheries of specific species, both in marine and inland waters, hunting, forestry and sea weed harvesting.

The EU's principal instruments for nature conservation are the Birds Directive (1979) and the Habitats Directive (1992). Both directives are leading to the establishment of the Natura 2000 network of sites.

Variety of different classification systems and levels of detail in mapping.

- It is import to specify which scientific species name is valid. Regulation 865/2006 defines taxonomic references (Annex VIII) for the species listed in regulation 338/1997 (last modification by regulation 1332/2005). It is necessary to use the taxonomic references of the EC regulations, not the taxonomic references of – for instance - the Fauna Europaea in INSPIRE data models and classification systems.
- Scale: An indication of common mapping scales: from 1: 5000 to 1: 10.000.000
- Community policies: 6EAP, Habitats and Birds directive, CAP, Fisheries policies etc.
- Initiatives: NATURA2000, OSPAR convention, GBIF, Flora Europaea etc.

Example data:

- **Bird species distribution data:** Distribution of species by grid. Data sets on 440 different breeding birds in Europe have been compiled. Each breeding bird is classified according to its breeding status within 50 km grid squares. European Ornithological Atlas Committee. Mapping the breeding distribution of those European species, obtained through field work.

  Attribute information: presence and absence of each species, possible/probable/conformed/breeding, estimate of number of pairs in square, census period, square identity, survey completeness, altitude, observers, and comments.
  Coverage: Pan-European

- **Plant species distribution data:** A data set containing information upon the presence of plant species in grid squares across Europe.

  Attribute information: species found in each 50 km square, native occurrence, introduction, status unknown, probably extinct, record uncertain
  Coverage: Pan-European. It has taken 25 years to map 20 % of European Vascular plants. By 1999 there were plans of how to speed up the process.

- **Amphibian and reptile species distribution:** Species distribution in 50 km grid squares.

  Attribute information: coded latin name, date of sightings, regular presence of siting, the presence of the species.
  Coverage: Pan-European. Complete for Western Europe, incomplete for Eastern Europe (?)

- **Fauna Europaea:** A database containing information upon the presence of fauna species in particular states in Europe. Data collected in the most European countries and published in form of web site with the mapping capabilities. Fauna Europaea references differ regulation 865/2006 which is legally binding and founded on the international CITES agreement.

  Coverage: Pan-European

Important feature types and attributes:

Grid cell or area

- Classification system
- Family, scientific name, vernacular name
- Species, scientific name, vernacular name
- Verification date of presence in grid cell
- Period present throughout the year in grid cell
- Status: threatened, extinct, etc. (IUCN-category)
- Reference to source

Observation point

- Classification system
- Family, scientific name, vernacular name
- Species, scientific name, vernacular name
- Verification date of presence at location
- Period?
- Function?
- Status: threatened, extinct, etc. (IUCN-category)
- Reference to source

Classification/Nomenclature:

- EUNIS. http://eunis.eea.eu.int/
- GBIF, species in general,
- CITES convention,
- FAO system for classification of fishery resources, 3letter code :HER= herring, CAP= ….
- Coding-System for Status has to be defined. The coding system for different species (groups) differs from each other. IUCN classification system for status may be considered.

Links and overlaps with other themes:

- Geographical grid systems
- Habitats and Biotopes
- Biogeographical regions
- Protected sites: Species may sometimes only be registered within certain locations such as protected sites.

Reference documents:

Atlas of amphibians and reptiles in Europe: http://www.mnhn.fr/publication/spn/cpn29.html

Atlas Flora Europaea: http://www.fmnh.helsinki.fi/english/botany/afe/
http://www.biologie.uni-hamburg.de/b-online/ibc99/IDB/afe.html

Global Biodiversity Information Facility www.gbif.org

European Reference grids. Proceedings and recommendations. Proposal for a European Grid Coding System. IES/JRC. http://eusoils.jrc.it/projects/alpsis/Docs/ref_grid_sh_proc_draft.pdf

Common European Chorological Grid Reference System (CGRS) :
http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=625

Eunis: species: http://eunis.eea.eu.int/species.jsp

Eunis taxonomy: http://eunis.eea.eu.int/species-taxonomic-browser.jsp

EuroMed, Fauna Europae, at: http://www.euromed.org.uk/

Fauna Europea data base, at: http://www.faunaeur.org/

Natura 2000 Interpretation manual.

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

LÖBF: OSIRIS-Datenmodell (Germany)

NATURE-GIS Guidelines: Data Infrastructure for Protected Areas. Edtor: Ioannis Kannellopoulos (EC – JRC) with the support of GISIG and the contribution of the NATURE-GIS Partners.

NATURA 2000: Identification & GIS Classification of Flora Habitants in Significant Reservation Areas: Greece

Suggested contributor in further specification work:

EEA - European Environment Agency

7.20 Energy resources

Definition:

(INSPIRE, 2007) Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.

Description:

Pan-European, national or local initiatives on mapping occur, resulting from governmental initiatives or private interests. There is a main distinction between fossil fuels and renewable energy resources. The concept of energy resources provides focus to the resource aspect and the extent/distribution of the resources. Thus the technical constructions for abstraction, transport and treatment are not covered by this theme. However they are to a large extent covered in other themes, such as production and industrial facilities. Energy use, e.g. petrol consumption, is not covered by this theme. Licence areas, permission areas or planning areas linked to energy resource exploitation is covered by the theme "Area management/restriction/regulation zones and reporting areas".

The term resource can be problematic to define, the quantification and thus location of a resource is depending on the technical and economic situation. Resource aspects should not only be restricted to the resources under utilisation, but should also include un-utilised resources.

Fossil fuel resources include

- **Oil deposits:** hydrocarbon deposits, petroleum volumes
- **Gas deposits:** hydrocarbon deposits, gas
- **Coal ores:** shallow ores/deep coal ores
- **Resources for nuclear energy production:**

The different kinds of renewable energy resources may include:

- **Hydropower** Water resources especially mapped according to energy potential. Commonly undertaken in the MS, carried out by governmental bodies or private firms.
- **Bio-energy resources** Forest resources, “scrap” forest, cereals or agricultural residues can be used for energy purposes. The supply is sometimes being estimated and mapped.
- **Wind energy** Country inventories of wind energy is being done in areas where wind is being utilised or planned utilised. Estimated by wind measurement together with topographical information. http://www.nve.no/vindatlas/
- **Thermal water sources** Natural thermal water is of high interest to be utilised in energy supply the mapping of such sources is used at local and regional levels.
- **Energy sources for heat pumps** The energy sources for heat pumps is only of interest at the very local level, at the community or individual level. Residential and commercial areas can be planned for using local energy sources such as subsoil/deposits, groundwater, rivers, sea, air.
- **Solar power and resources** In order to reduce the need for extra heating solar conditions at local sites are important to bring into account in local planning. National, regional and local inventories on solar energy conditions is needed, relating to heating needs. Systems for storing solar heat is found at some locations. Solar resources may also be used in electricity production, through the use of solar cell technology (silicium cells).
- **Other energy resources such as waves, currents etc.** The different kinds of renewable energy resources is long. The list above is only giving some examples.

The quantification of the resources may be aggregated or detailed. The detailed information is to a large extent private business information. This includes for instance data about the internal structure of geological structures within oil fields. Within the Inspire context the data in question will mainly be aggregation and overview data. However, for public planning purposes at the local level detailed information about some of the renewable energy resources may be relevant.

The geographical representation of the resources (objects) may be different in different scales. In the mapping and exploitation of the resources 2-d (ordinary maps) and 3-d geographical data are being used. Resources may be mapped by natural boundaries. Aggregated or overview information can be referring to grid cells in a geographical grid system, administrative units/areas, statistical units/areas or points.

Scope, use examples:

Different initiatives aim to get a full coverage of up to date species distribution data at a Pan-European scale, for a major set of mammals, birds, mammals and reptiles, vascular plants, together with similar data for a selection of other organisms important as indicators on environmental quality of air, inland waters, sea, soil, habitats.

Digital energy resource data can be used in different settings

- in management of resources and exploitation activities
- in EU policy development and regional policies
- in strategic work and resources planning
- in land use and urban planning
- in environmental impact assessments
- as input-data in assessments of state of the environment, e.g. modelling of future emissions, pressure and sustainability

Example data:
The SDICs are expected to provide example data.

Important feature types and attributes:

Some energy resources, such as oil or hydropower can be localised quite distinctly, while other resources, such as solar resources or wind resources based on point measurements are modelled/interpolated into "continuous" area and 3D-objects,

Energy resource object (2D or 3D-volumes)

- resource type (oil, gas, wind,..)
- name (place/location name)
- id
- quantifitation
    - volume
    - date of quantification

Water catchment area

- id
- average runoff

Administrative/ statistical unit

- resource type (oil, gas, wind…)
- quantification
    - amount
    - date of quantification

Grid cell

- resource type (oil, gas..)
- name
- id
- quantifitation
    - volume
    - date of quantification

Links and overlaps with other themes:

- Grids
- Administrative units
- Statistical units
- Mineral resources
- Geology
- Hydrography

Reference documents:

Geowissenschaftliche Karten der Bundesrepublik Deutschland, 1 : 2 000 000 – Kohlereviere, Hannover 2006 / Geoscientific MAps of te hFEderal Republic of Germany, 1 : 2 000 000 – Coal Mining Districts

http://www.esa.int/esaEO/SEM9BL3VQUD_economy_0.html

http://www.esa.int/esaEO/SEMM8L3VQUD_economy_0.html

http://gis2.rrc.state.tx.us/public/

INSPIRE position paper: Environmental and thematic data. 2002.

INSPIRE IMS: Implementation Strategy Issues - Data requirements. 2003.

Inspire scoping paper, 2004.

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue, data model on oil/gas: http://www.statkart.no/standard/sosi/html/arbeidsdokumenter/Olje/Olje%204.0%20011105.doc

Suggested contributors in further specification work:

- EEA - European Environment Agency
- EuroGeosurveys

7.21 Mineral resources

Definition:

(INSPIRE, 2007) Mineral resources including metal ores, industrial minerals, etc., where relevant including depth/height information on the extent of the resource.

Description:

Pan-European, national or local initiatives on mapping occur, resulting from governmental initiatives or private interests. The concept of mineral resources provides focus to the resource aspect and the extent/distribution of the resources. Thus the technical constructions for abstraction, transport and treatment are not covered by this theme. However they are to a large extent covered in other themes, such as production and industrial facilities. Energy minerals such as coal, oil and gas are excluded in this theme, as they are found in theme "energy resources". This also accounts to licence areas, permission areas or planning areas, these may be covered by the theme "Area management/restriction/regulation zones and reporting areas".

The term resource can be problematic to define, the quantification and thus location of a resource is depending on the technical and economic situation. Resource aspects should not only be restricted to the resources under utilisation, but should also include un-utilised resources. Detailed resource information may be considered to be of economic/ private interest and therefore problematic to distribute and public resources in the infrastructure.

Relevant kinds of mineral resources may be:

- Localisation of ore deposits, for instance categorised according to size or kind of element; **size** like deposits up to different levels, e.g. 100.000 metric tons, 1 mill tons 10 mill tons, **kind of element**, e.g. copper, pyrites with copper, zink, and or lead, zinc, iron, titan, manganese, nickel, chromium, gold, uranium, thorium and others.
- Localisation of industrial minerals and rocks occurrences. The term industrial mineral and rocks includes all minerals and rocks exploitable for purposes other than their value as fuel or their content as heavy metals. I could also comprise dimension stone and rock slate but not clay, sand, gravel, and rock deposits suitable for crushed aggregates.
- Localisation of sand, gravel and other surficial materials and sediment resources, being resources from e.g. fluvial deposits, glacio-fluvial deposits or marine deposits. Their composition, genesis and quantification of the resources are relevant information elements. They represent considerable economic resources.

Scope, use examples:

The use and potential of geographical data about mineral resources will depend very much on scale and detail of available information. Digital geographical information about mineral resources can be used in different settings

- in management of resources and exploitation activities
- in EU policy development and regional policies
- in strategic work and resources planning
- in land use planning
- in environmental impact assessments
- as input-data in assessments of state of the environment, e.g. modelling pressure and sustainability

Example data:
The SDICs are expected to come up with example data.

Important feature types and attributes:

Feature types and attribute will be different when making overview data or detailed exploitation data. Here some examples of overview information are given:

Ore deposit location – point or area
- "place" name
- id
- kind of elements
- deposit size
- deposit exploitation yes/no
- deposit exploitation period

Industrial mineral and rock location – point or area
- "place" name
- id
- main group of mineral or rock type
- mineral or rock type; e.g. quartz, quartzite, sandstone, limestone, marble, dolomite, talc, soapstone, nepheline, gneiss, phyllite, slate, granitic pegmatite, gabbro, graphite, mica, kyanite, beryl, fluorspar …
- kind of use; e.g. industrial minerals or rocks, natural stones, slate and dimension stone …
- deposit exploitation yes/no
- knowledge/ exploitation; e.g. deposit in production, deposit possible economic interest, known deposit, abandoned quarry
- deposit exploitation period
- size: major, intermediate, minor (levels have to be given)

Surficial/ sediment material resources – point or area
- "place" name
- id
- material type, sand, clay, gravel, peat, etc
- exploitation yes/no
- exploitation period
- size of resource/ deposit

Generalised or aggregated information about mineral resources may be found as geographical data with grid cells or administrative regions resolution.

Links and overlaps with other themes:
Energy resources

- Geology, the mineral resources being industrial geology
- Land use
- Production and industrial facilities
- Area management/restriction/regulation zones and reporting units

Reference documents:

Karte der Oberflächennahen Rohstoffe der Bundesrepublik Deutschland, 1 : 200 000, BGR (Hannover) / Map of the Near-Surface Mineral Resources of Germany 1 : 200 000, BGR (Hannover)

Industrial Mineral Resources Map of Great Britain

http://www.bgs.ac.uk/mineralsuk/digital_maps/home.html

http://www.bgs.ac.uk/mineralsuk/minequar/industrial/home.html

http://www.bgs.ac.uk/mineralsuk/digital_maps/maps/home.html

http://www.bgs.ac.uk/geoindex/

http://www.bgs.ac.uk/scripts/geoportal/home.cfm

http://www.ngu.no/kart/mineralressurser/

http://www.ngu.no/kart/grus%5Fpukk/

INSPIRE position paper: Environmental and thematic data. 2002

From the reference material submitted by SDICs and LMOs, the following appear relevant to this theme:

Norwegian feature catalogue and standards

Suggested contributors in further specification work:

- EEA - European Environment Agency
- EuroGeosurveys