# NATURE-SDI*plus*: towards the implementation of the European SDI in nature conservation

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**Abstract.** Natura 2000 and the new EU approach for protected sites management have enforced the link between nature conservation and geo-information. This has generated the need for accessible, interoperable and harmonised datasets, also addressed by the INSPIRE Directive (2007/2/EC) that pursues a European Spatial Data Infrastructure (SDI) to support environmental policies.

The NATURE-SDI*plus* Network started in October 2008. It aims to enable and improve the harmonisation of national datasets on nature conservation, making them accessible and exploitable. Thus, it supports the implementation of the INSPIRE Directive in this field. The considered data themes deal with Protected sites (Annex I), Biogeographical regions (Annex III), Habitats and biotopes (Annex III), Species distribution (Annex III).

NATURE-SDI*plus* analyses the usability and accessibility of data within a wide European context. The results of this analysis are used to develop the NATURE-SDI*plus* European metadata profile and data model for datasets on nature conservation.

The project defines as well common multilingual and multicultural approach for a simpler and standardised access to spatial data.

A demonstration infrastructure, compliant with the INSPIRE principles and supported by web services, provides the data accessibility through a dedicated geoportal: the main gateway to available datasets and services.

The first NATURE-SDI*plus* results will be presented; including outcomes form users needs study at European level, the analysis of the data models in different EU countries, together with the analysis of the usability and accessibility of data for nature conservation. An example of national level, based on situation in Czech Republic, will be also outlined.

In order to get a broad view on actual user needs throughout Europe, the relevant use groups were identified and a comprehensive questionnaire was designed. This survey gathered the relevant information for implementing a user-centred SDI, taking that a spatial data infrastructure ultimately is conceptualised to support users to efficiently handle spatial data, i.e. to acquire process, distribute, use, maintain and preserve spatial data. Only if all SDI components (data, metadata and tools) are well-orchestrated and have a user-centred design, the SDI can unfold its real value for the user. The questionnaire was implemented as online-survey and disseminated to the target stakeholder groups throughout Europe in collaboration with the project partners.

Series of datasets from different Countries were used with the aim to verify the compliance of those actual datasets (features, attributes and models, when existing) with the INSPIRE Data Specifications. The testing has considered the Data Themes of Annex I - protected sites. In the call for testing, two types of testing were identified, for “transformation” and for “application”. The transformation testing was addressed to the technical feasibility and the work needed to transform local data into the draft INSPIRE model. The application testing was addressed to evaluate the benefits of harmonising data specifications from the point of view of an end-user working on application.

Identifying current data policies and initiatives plays a significant and important role in re-using and sharing environmental information, as well as analysing how and if they are implemented at the EU level. Data policy survey brings together reports form 17 countries which participate within the project. The survey tracks best practices in data polices, positive impact of data policies on data use, and highlights examples of remaining data access and use barriers.

**Keywords:** GIS, SDI, INSPIRE, nature conservation, data policy, IPR, geoportal

## 1 Introduction and project objectives

Recently, there has been a strong need linking nature conservation with geoinformation in Europe. The INSPIRE Directive (2007/2/EC) has been an answer to the necessity of interoperable, accessible and harmonised datasets. It also addresses EU Spatial Data Infrastructure (SDI) to support environmental policies.

The approach of the NATURE-SDI*plus* network is to:

- share data experiences and good practices;
- improve exploitation of datasets;
- re-use information on nature conservation.

NATURE-SDI*plus* contributes to the implementation of the INSPIRE Directive with targeted reference to the following cluster of data themes of the INSPIRE Annexes:

- Protected sites (Annex I)
- Biogeographical regions (Annex III)
- Habitats and biotopes (Annex III)
- Species distribution (Annex III)

The mission of the NATURE-SDI*plus* project is to establish a network on geographical information for nature conservation, to stimulate the community of nature conservation stakeholders improving the harmonisation, the exploitation and the accessibility of their datasets.
In such a view, NATURE-SDI*plus* aims to support the implementation of the INSPIRE Directive at EU level through the evaluation of common metadata profiles and data models for the addressed data themes, compliant with the INSPIRE provisions and data specifications.

NATURE-SDI*plus* analyses the usability and accessibility of data. The results of this analysis are used to develop the NATURE-SDI*plus* European metadata profile and data model for datasets on nature conservation.
The project defines a common multilingual and multicultural approach for a simpler and standardised access to spatial data.
A demonstration infrastructure, compliant with the INSPIRE principles and supported by web services, provides the data accessibility with a dedicated geoportal: the main gateway to available datasets and services.
The final target of NATURE-SDI*plus* is to establish a long-term sustainable network of stakeholders dealing with geo-information for nature conservation.

## 2 First project outcomes

The paper summarises achievements, arising from the project activities, describing the first results after a year of the project life. Necessary analyses have been carried out to support further activities in the implementation phase of the Nature-SDI*plus* project.
The discussed results include data analysis and systematisation, user needs survey, and data policy survey. Furthermore, the links with other already initiated tasks, such as (metadata, thesaurus, and geoportal), are explained.

Synchronous start of the project and the launch of the INSPIRE testing of Data Specification (v 2.0) for the Annex I data themes resulted in

- taking benefit from the outputs of the INSPIRE Data Specification Team to properly use the INSPIRE specification as a starting reference model for analysing and comparing the available data sets of the different countries participating into the project
- contributing and supporting the INSPIRE implementation
- establishment of a project working group ‘TWG-INSPIRE’ for the definition of the methodology and of templates to be used by the partners providing the data sets planned for the project in the different Countries.

Results from the NATURE-SDI*plus* testing have been taken into consideration in the new version (3.0) of the INSPIRE Data Specification for Protected Site.

After that start-up activity, the NATURE-SDI*plus* project was oriented to the development of the first technical tasks and to the finalisation of the cognitive phase planned in the first project period and carried out under the "User needs and data analysis" work-package. In particular, this commitment concerned the following issues:

- a survey on the user needs has been carried out towards the target user Community, through an on-line questionnaire the structure and test of which was defined in the first months of the project. The activity led to collect and to analyse the answers from more than 400 stakeholders from around 20 Countries, allowing the identification of users profiles and needs;
- in parallel to the survey above, after the conclusion of the data sets analysis (linked to the INSPIRE testing) related to the data theme "Protected Sites" (131 datasets from 17 Countries), the analysis of the datasets for the NATURE-SDI*plus* Annex III data themes (Bio-geographical Regions, Habitats and Biotopes, Species Distribution) has been carried out;
- moreover, a study at National level about the data access policies has been carried out with the support of the NATURE-SDI*plus* National Coordinators, leading to a synthesis at European level that includes also a study about the access to the NATURA 2000 data. The study was also the occasion to assess IPR issues and access constraints for the analysed data sets, that are going to be the core of the data available for the validation of the data model and the implementation of the NATURE-SDI*plus* geo-portal;

The 1st year activity has allowed consolidating a profitable interaction among the technical partners, the partners playing the role of National Co-ordinators and the data providers in the different countries, allowing as well starting the networking actions and the stakeholder involvement, especially at a national level.

### 2.1 Datasets analysis

The INSPIRE testing of Data Specification Annex I (Protected Sites) represented the main first activity and outcome of NATURE-SDI*plus* dealing with data analysis.
To carry out the Annex I Data Specification testing, a methodology consisting of three steps was followed. An initial request (**Step 1**) was sent out to each data provider, asking for the full list of their datasets, their contexts, the list of attributes and other useful information (reference systems, geographic boundaries etc.). The list of attributes listed by the data providers was then matched with the attributes by the INSPIRE Data Specifications (**Step 2**).

| | | | | ProtectedFeature | | | | | | | ProtectedSite (=Protected Area) DA | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | Name of data layer | Database profile | protectedFeatureType (for | objectIdentifier (PF) | globalAssessment | percentageOfSiteCovered | percentageOfNationalTerri | beginLifespanVersion | endLifespanVersion | objectIdentifier (PS) | categoryType (eco, geo, a | siteCode | siteCodeScheme | geometry (implicit) | geometry (explicit x & y c | IUCNCategory | activitiesAndImpactsOnSi | accuracy | accuracyUnitsOfMeasure | designationType - eco (SA | designationType - geo | designationType - archeo | designationType - cultural | nationalDesignationType ( | siteDescription |
| | Profile: 0=non-compliant, A=simple, B=full, C=Natura 2000 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Yellow = Simple Profile | | | | | | | | | | | | | | | | | | | | | | | | |
| | Suggested additions | | | | | | | | | | | | | | | | | | | | | | | | |
| | Suggested deletions | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 = existing attribute, 2 = found in metadata, but not in attributes | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 = not in attributes or metadata but available to responsible agency either online or offline | | | | | | | | | | | | | | | | | | | | | | | | |
| Austria | Berchtesgaden National Park | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 1 | | | | 3 | 2 |
| | RAMSAR | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 3 | | | | 3 | |
| | UN Weltkulturerbe | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | | 3 | | | | |
| | Nat2k Vogelschutzrichtlinie | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 3 | | | | 3 | |
| | Nat2k FFH Richtlinie | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 1 | | | | 3 | |
| | Protected Landscape S | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 3 | | | | 3 | |
| | Landscape Protection Area | 0 | | | | | | | | 1 | 3 | | | 1 | 1 | 3 | | 3 | | 3 | | | | 3 | |

**Fig. 1** A matching table where the columns are made up of the items from the Protected Sites feature list (INSPIRE required attribute and ref system/metadata). The rows are made up of the 131 Protected site data layers [NSDI+_T2.3].

In addition, the **Step 3** was carried out by submitting to the Nature-SDI*plus* data providers some questions by the INSPIRE Testing template. The questions were selected to better consider issues

appearing difficult to derive from the two above illustrated steps and to offer to data providers the possibility of better exposing their specific cases.
The activity above represented the kernel of the task “data analysis and systematisation” related to the Protected Sites data theme.
After the participation and contribution to the INSPIRE testing for the Annex I Protected Sites a similar approach has been adopted for the analysis and systematisation of the Annex III data sets (Species Distribution, Habitats&Biotopes and Biogeographical Areas) that will be available for the project.
Up to now, for the Annex III data themes, 123 datasets have been collected coming from 15 different EU Countries.
As already quoted, data collected and considered for the datasets analysis and systematisation task relates to the four INSPIRE data themes selected by the project (Protected Sites, Bio-geographical areas, Habitats&Biotopes, Species Distribution).
For Annex I Protected Sites (defined by INSPIRE as areas designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives) the collection of data consists of protected areas boundaries, where protected areas are:

- Natura 2000 sites
- Protected Areas instituted by national legislations
- World Heritage Sites
- Sites instituted by International conventions (RAMSAR, OSPAR, Barcelona, Helsinki)
- UN Geoparks

For the Annex III data themes, the data collection allows to have the information on nature features that are crucial for ecological study, that is:

- **Bio-geographical Areas:** regions showing the extent of areas with common characteristics usually based on climatic, topographic and geobotanical information. Bio-geographical regions show areas with relatively homogeneous ecological conditions. Included in this theme is vegetation map data. Datasets with a scale larger then requested by INSPIRE (e.g. 1:50 000) have been provided, including also information on vegetation.
- **Habitats and Biotopes**, defined as Geographical areas characterised by specific ecological conditions, processes, structure, and 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. In most cases, habitats in the datasets are represented as a mosaic of habitats into an area or expressed as percentage of that area.
- **Species distribution**, defined as Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit. As requested by INSPIRE, most of provided datasets on fauna and flora species are composed of grid data or sample point data.

In the end of this work Feature Lists (data fields and metadata elements) were released both for the Annex I and the Annex III themes

### 2.2 User needs survey

In order to get a broad view on actual user needs throughout Europe, a user survey was designed to gather the relevant information for implementing a user-centred SDI. A spatial data infrastructure ultimately aims at supporting users to efficiently handle spatial data, i.e. to acquire process, distribute, use, maintain and preserve spatial data. Only if all SDI components (data, metadata and tools) are well-orchestrated and have a user-centred design, the SDI can unfold its real value for the user. [NSDI+_D2.1]

In a quantitative survey approach, a comprehensive questionnaire was developed with a web based survey tool. After a pre-test phase, the questionnaire was disseminated to the target stakeholder groups throughout Europe in collaboration with the project partners. The collected data on user needs is based on a sample of 314 valid responses from 23 countries. These data were statistically analysed with descriptive and univariate statistics. [NSDI+_D2.1]

The target users in Nature-SDI*plus* project are all people, who work in the domain of nature conservation respectively who work in other domains using data about nature conservation.
In conclusion, a wide range of stakeholders exists, who produce, hold and use spatial data relevant to nature conservation, mirroring people and organisations working in different nature conservation application domains and operate at different scales – from the local to the EU-wide level. Taking this

into account, as well as the experience gained from the project Nature-GIS [KANELLOPOULOS] and the guideline of the Nature-SDI*plus* [NSDI+] project itself, a characterisation of Nature-SDI*plus* target users was developed (Fig. 2).


**Fig. 2** Nature-SDI*plus* target user groups [NSDI+_D2.1]

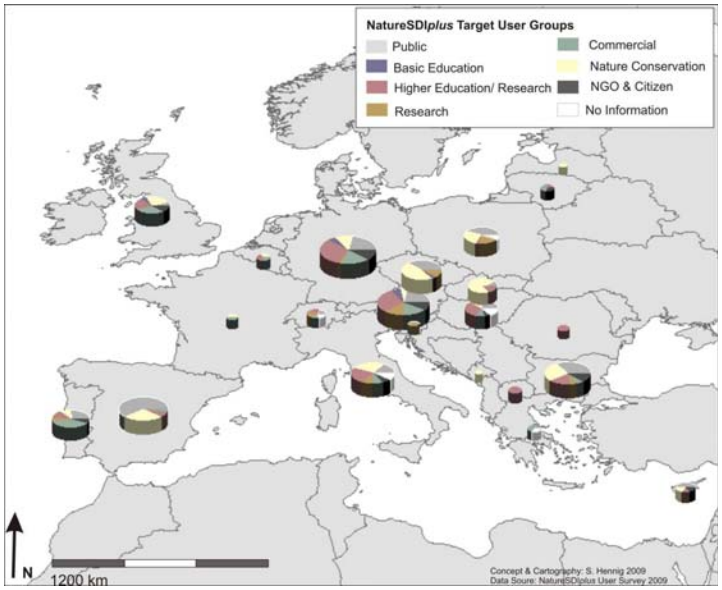


**Fig. 3** Responses to the Nature-SDI*plus* User Survey categorised according to the target user groups displayed for every country [NSDI+_D2.1]

The scope the "survey of target-user needs" was to structure the actual needs of NATURE-SDI*plus* targeted users, in terms of data harmonisation and accessibility. The survey looked for the needs of users in respect to a European SDI for nature conservation and it has provided the input to the technological activities in the Nature-SDI*plus* project.

In the survey of user requirements, it was sought for getting a representative number of each target group in each country and through all levels (local to international). It was accomplished through awareness and dissemination actions addressed by the NATURE-SDI*plus* national coordinators.

Most of the responses belonged to either public authorities or nature conservation authorities, including e.g. national park administrations; about one quarter were dedicated to education and research, others stated a commercial interest and just a limited number of persons answered as NGO representatives or citizens.

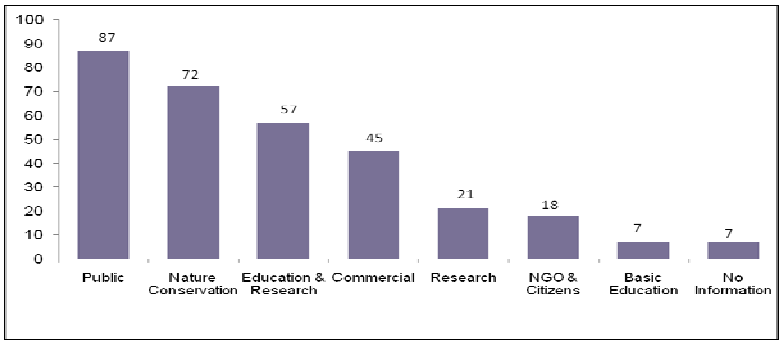


**Fig. 4** Nature-SDI*plus* target user groups distribution within the user needs survey [NSDI+_D2.1]

User needs imply demands for the implementation phase of the Nature-SDI*plus* SDI in terms of data modelling, metadata profiling and geoportal. In table below (Fig. 5) a selection of specific user needs is juxtaposed with the according affordances on a user-centred SDI. These demands can be also used as benchmarks for the validation phase.

| User need | Demand for the Nature-SDI*plus* SDI |
|---|---|
| In all target user groups (except for basic education) stakeholders also provide data. | The geoportal should be open to data provision for all user groups (not only public administration). |
| Although a majority of users (80%) have at least some experience with spatial data handling, experience with SDIs is low. | The geoportal / SDI should be easy-to-use. |
| All target user groups have a strong need for additional information on e.g. land-use, soil type or climatic conditions together with classical nature-conservation themes, i.e. the four Nature-SDI*plus* themes. | The Nature-SDI*plus* themes should be linked to and compatible with all other INSPIRE data themes and they should be provided together in the same portal (link to geoportals of other EU-Projects?). |
| About one half of the users at least sometimes need time-series data. | In the geoportal not only current, but also historic data should be provided. |
| Almost 60% of the stakeholders use desktop-GIS tools. | A possibility for data download should be provided. |
| A majority of users need advanced analysis tools for spatial data handling (e.g. modelling, statistical analysis). These tools are used almost as often as basic ones (e.g. querying, viewing). | A geoportal should provide geoprocessing tools and / or a downloading possibility for further analysis. |
| Users most frequently search by keywords. | A comprehensive Thesaurus is essential. |
| Access to the project and contact information are needed in addition to classical geoportal functionalities (querying, searching, downloading). | To each dataset reference information to the data provider should be given. |

**Fig. 5** In the left column key user needs are given with the corresponding demands for the implementation of the Nature-SDI*plus* SDI in the right column [NSDI+_D2.1]

### 2.3 Data policy and data accessibility survey

The survey, concerning an analysis on data policies and data accessibility in the frame of nature conservation/environmental data, involves:

- **Part [A],** centred on the main issue of identifying good practices in data policies, the positive impacts of data policies on data use, and the examples of remaining data access and use barriers within particular country;
- **Part [B],** concentrated on the concepts and background of the Natura 2000 network, for which reporting is a complex process with multiple data flows between the Member States and the European Commission;
- **Part [C],** an indication about the IPR and access constrains of the datasets on nature conservation have been provided. The datasets represent those that have been already analysed as mentioned in chapter 2.1 Dataset analysis.

In the frame of the **PART A**, to obtain a good picture on data policies and data access in each of the 17 countries represented in the project by partners with the role of National Coordinators (NCs).
The questionnaire was structured in three parts [NSDI+_D2.2]:

- **Good practices in data policies:** This part is to clarify the conditions for data access among stakeholders by distinguishing, on the one hand, nature conservation data and on the other hand, geographic reference data. In this view, concerning nature conservation data, legal regulatory parameters (laws, agreements, and restrictions), technical parameters (visualisation, download, transfer) and financial parameters is discussed. Concerning geographic reference data, only financial parameters according stakeholders and the types of reference data is addressed.
- **Positive impact of data policies on data use:** This section illustrates how data policy may have a positive influence on efficiency, participation of new users and management processes and how problems of access limitations have been resolved.
- **Examples of remaining data access and use barriers:** The final section tries to identify other issues not previously raised regarding data access and use.

The survey process needed successive interactions and versions of the questionnaire, since this task, besides required expertise in spatial data and nature conservation, required also expertise on legal aspects, which is rarely available with the partners.

For all countries interviewed, there is no specific data policy for nature conservation. Existing laws are about environmental information and often derived from European Community Directives (Directives 2003/98/EC, 2003/4/EC, 2007/2/EC). Nevertheless, most countries have regulation means for access and use of nature conservation data for third parties. The restrictions put in place mainly concern issues of security or sensitiveness, Intellectual Property Right and confidentiality. Filters using an authentication system or a degraded georeferencing using a grid system are used for limitations of access. Regarding the technical aspects for access to nature conservation data, Biodiversity Information System are often centralised and provided by public authorities, Universities and NGOs. Natura 2000 data are often integrated in a national or a regional geoportal. Standard data forms and the localisation of sites on detailed map with administrative and land cover information can often be viewed on the website but are not downloadable. The financial conditions of access to geographic reference data and nature conservation data vary from one country to another. As a matter of fact data are often free or at reduced prices for Public institutes and Universities whereas data are in most cases at production cost or market cost for private or commercial users. Positive influence of data policy on access and use of nature conservation data through open source system were observed whether in terms of efficiency, accessibility for new users and improvement of management processes. The other problems regarding access to and use of nature conservation data are mainly technical (compatibility, quality) and organisational (harmonisation, availability, validation). In many cases, data documentation does not exist or existing data documentation is available in a variety of formats. [NSDI+_D2.2]

Although the discussion on access to Natura 2000 is still ongoing at the European level, we can already draw some conclusions from the **PART B findings** [NSDI+_D2.2]:

- Natura 2000 is a reporting mechanism based on two European Directives, the Bird and Habitat Directive, to describe and assess the status of nature conservation in Europe.
- The data/information that is generated within this framework is needed by many and should be made available to other stakeholders and the public at large.

- Not giving access at all (an in general terms) to the whole Natura 2000 database is not an option because of several pieces of European legislation are in place that guarantees access to environmental information, although sensitiveness of nature conservation data is an important issue and should be taken into account.
- Protection of sensitive information can be guaranteed through the correct application of filter mechanisms.
- The future lies in the application of the INSPIRE and SEIS principles with the aim to give access to the non-sensitive Natura 2000 information to a maximum number of people through the web.

**PART C** resulted in a live document that will be continually (where is necessary) updated during the project life time. It deals with the IPR issues related to the datasets that will be made available for the NATURE-SDI*plus* project by the Data Providers of each country within the NATURE-SDI*plus* Network. It represents a list of the datasets analysed within the task 'Datasets analysis and systematisation' (see chapter 2.1 Data analysis). The information given in the list is structured into sections according to the INSPIRE data themes relevant for the project, as follows [NSDI+_D2.2]:

- Protected Sites (INSPIRE ANNEX I)
- Biogeorgraphical Regions (INSPIRE ANNEX III)
- Habitats and Biotopes (INSPIRE ANNEX III)
- Species Distributions (INSPIRE ANNEX III)

Each section holds information separately for each country;

- Protected sites (15 countries, 131 datasets) – AT, BG, CY, CZ, FR, GR, HU, IT, LT, PL, PT, SK, ES, SE, UK;
- Biogeographical regions (7 countries, 11 datasets) – BE, CZ, IT, SK, ES, SE, UK;
- Habitats and Biotopes (14 countries, 43 datasets) – AT, BE, BG, CY, CZ, FR, HU, IT, LT, PT, SK, ES, SE, UK;
- Species distribution (12 countries, 68 datasets) – BG, CZ, FR, DE, HU, IT, LT, PT, SK, ES, SE, UK.

For each dataset, the IPR information is given. It includes information about dataset name, provider/distributor, metadata, data accessibility (web access, ordering), copyright, and data access and data use constrains (see Fig. 6). [NSDI+_D2.2]

| *Country* | |
|---|---|
| DATASET(S) NAME | |
| PROVIDER/DISTRIBUTOR | |
| METADATA | |
| **WEB ACCESS** | |
| URL | |
| WEB SERVICE(S) | |
| DOWNLOAD SITE | |
| **ORDERING** | |
| E-MAIL | |
| FEE(S) | |
| LICENSE, AGREEMENT | |
| OTHER | |
| COPYRIGHT | |
| **CONSTRAINS** | |
| ACCESS CONSTRAINS | |
| USE CONSTRAINS | |
| OTHER | |

**Fig. 6** IPR information form [NSDI+_D2.2]

## 2.4 Metadata and data model

In the first year of the project a key activity concerned the definition of a metadata profile for evaluation and use and a common data model for nature conservation data, to be produced starting from the provided datasets and INSPIRE data specification and upon the basis of the user needs analysis and of the analysis of these datasets.

The objective of this task was to provide specification of metadata profiles for the datasets of the project. It implies:

- Analysis of INSPIRE IR
- Implementation of a web metadata platform
- Tests and evaluation of metadata profile specifications

The current metadata profile's specifications (version 0.2) incorporate modifications after the analysis of the partners' comments, the choice of fixing the scope of the application of the metadata to the level of dataset and of spatial services, the inclusion of modifications resulting from v 3.0 of the data specifications on protected sites.
For the phase of validation and testing of the metadata profile version 0.1, a platform was put in place using a free web tool (MDweb).
Finally, on the basis of the results of Dataset analysis and systematisation, a first analysis of metadata for datasets of annex III was initiated. It was undertaken in two steps: a cross analysis between the project proposals and the already existing specifications, a subsequent mapping between the metadata proposals and the standard elements.
The project original approach for the production of the data models for the addressed themes was to have the existing data and data models from the partners and the INSPIRE reference material as a starting point, and the results from the user needs analysis as input to define feature types and attributes.
Taking into consideration the activity of the INSPIRE Thematic Working Group and its findings after the submission of the project proposal (i.e. the release of the Protected Sites data specification) the project approach was slightly reviewed to cope with these ongoing developments. Moreover it became clear that very few elaborated (UML) data models exist for the project data sets and the data analysis focused more on the existing feature classes and attributes, rather than on the analysis of data models as such.
However the objective is all the same to come as close as possible to a complete data specification that can be further used as input for the formal process of elaborating implementing rules and guidelines.
The chosen process for implementation includes:

- a matching table for the comparison of the original data set with the target Data set (INSPIRE or Nature-SDI*plus* Data Model),
- analysis of the differences – similarities between the present DM and the target DM,
- creation of the rules for transformation.

### 2.5 Thesaurus

The common thesaurus framework implemented in the project is a controlled vocabulary which defines standard technological and scientific terms about nature conservation data understandable by different user communities operating in the domains of the four data themes considered in NATURE-SDI*plus*.
At the state of the art, different thesauri, vocabularies or taxonomies about Nature Geographic data are already available such as GEMET, EARTH, CORINE, EUNIS, NATURA2000, etc. Each of them represents a partial solution covering specific aspects in the four domains. The approach for the implementation of NATURE-SDI*plus* thesaurus is based on the integration of some of these solutions with the intent of providing a comprehensive result for the four data themes. The main idea is to identify a core thesaurus and the additional related thesauri of the different domains to be linked with. The general thesaurus has to satisfy the requirements of modularity (a module for each theme), openness for further extension, ability of interconnection to other thesaurus and exploitability from other systems. For this purpose it is encoded in SKOS (Simple Knowledge Organization System) formal languages developed within the W3C framework. Linked Data method is adopted to enable an easy publication of the thesaurus on the web.

Moreover the thesaurus is implemented taking into account the "guidelines on multilingual thesauri ISO 5964" and the standardization in the field of digital geographic information ISO/TC 211 for Multi-lingual glossary of terms.
The common thesaurus framework has pursued the properties of *modularity* to add new thesauri, *openness* for further thesaurus extension, *ability of interconnection* to other thesauri and *exploitability* from other systems. In fact the outcome of the overview activity about existing thesauri for Nature Geographic data has highlighted that different thesauri, vocabularies or taxonomies about Nature

Geographic data are available (as above said GEMET, EARTH, CORINE, EUNIS, NATURA2000, etc) but that each of them represents only a partial solution for specific aspects in the four domains. Hence, the decision to create a common thesaurus framework for NATURE-SDI project that assembles and integrates some of these solutions, properly selected by an expert group within the consortium.

### 2.6 Geoportal

The main activity in this period has been focused on the identification of the technical specification of the Nature-SDI*plus* infrastructure, identifying the SDI needs, the SDI architecture and the operational processes, the available technologies
The definition of needs for the users has been mainly based on the INSPIRE "Discovery-Bind-View" paradigm, base of every spatial data infrastructure.

Starting from the NatureSDI*plus* geoportal the aim is to let possible for the user to discover the available information about Nature conservation datasets via a metadata searching. The discovery process will address the research to all the catalogues linked to the NatureSDI geoportal, either at national or at regional/local level (a preliminary identification of the national, regional and local catalogues has been done in this first phase of the project).

The research on metadata will exploit the multilingual and multicultural functionalities put at disposal by the Thesaurus defined and developed in the project. A set of customised services has been identified and will be integrated to the NatureSDI*plus* Geoportal (and in case in the National/Regional/local geoportals) either to support the editing and the validation of the metadata or to discover the information in the infrastructure. In this context, the project partner IRD has proposed to implement a thesaurus web service for providing a controlled vocabulary for multilingual searches and the editing of metadata for the project's spatial data infrastructure.
The identified infrastructure architecture is described by the following figure (Fig.7):

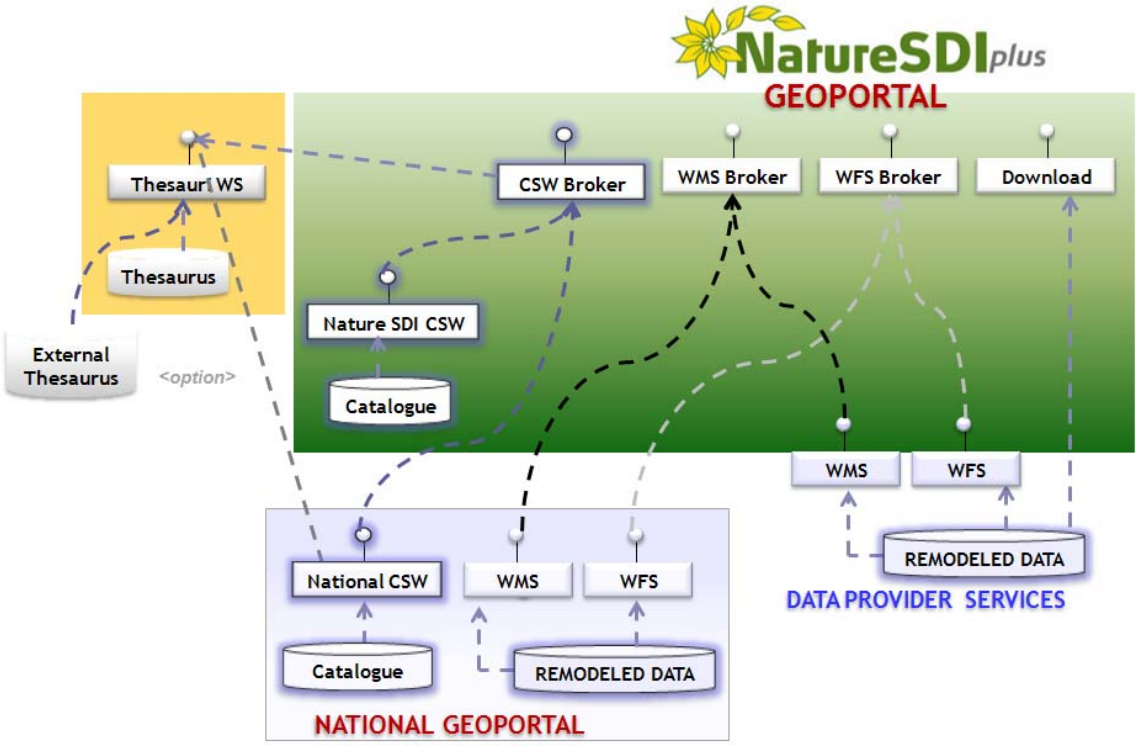


**Fig. 7** NATURE-SDI*plus* geoportal schema [NSDI+_WP4]

# 3 National Example – Czech Republic

## 3.1 Nature Protection Maps in the Czech Republic

The environment protection is shared by several bodies. The central one is the Ministry of the Environment of the Czech Republic. Next level of the hierarchy is ranked by the Agency for Nature Conservation and Landscape Protection of the CR (AOPK CR). AOPK CR manages the next level - the Administrations of Protected Landscape Areas. The Administrations of National Parks are subordinated directly to the Ministry. Nature protection at the regional level, except national parks and Protected Landscape Areas, is also managed by Regional Authorities and other lower authorities (e.g. Memorial Trees are declared by Municipalities with extended authority). Regional Authorities, besides areas of NPs and Protected Landscape Areas, declare Natural Parks, Natural Reservations and Natural Relicts. In territories of NPs and Protected Landscape Areas this activity is performed by administrations of the large protected areas. National Natural Relicts and National Natural Reservations are declared by the Ministry of the Environment [114/1992 Sb.].

## 3.2 Nature Conservancy Central Register (ÚSOP)

This register is managed by the AOPK CR. ÚSOP contains specially protected areas, i.e. National Parks, Protected Landscape Areas, Natural Relicts, Natural Reservations National Natural Relicts, National Natural Reservations and Memorial Trees. Additionally, this database comprises protected areas in frame of Natura 2000 - Special Protection Areas. It contains not only territorial extension, but also records to the protected areas. The geographical data are provided in the vector shapefile format (ESRI file format) and are processed in the national coordinate system S-JTSK, based on the Fundamental Base of Geographic Data (ZABAGED®) and cadastral data. The large protected areas are documented on the base of technical-economic map [AOPK].

The attribute part of the geographical data contains basic information about the protected area (area, name, category, reason of protection, UICN category) and other information like affected parcels, map sheets, and documentation. Also some characteristics of the territory are inserted [DRUSOP].

The areal extension of the protected areas is displayed in ZABAGED®, which is a digital terrain model created on the accuracy level of Basic Map 1:10,000 [ZABAGED]. It is published as WMS at the geoportal of Czech Office for Mapping, Surveying and Cadastre, http://geoportal.cuzk.cz. The original data layers are published also by majority of the nature protection bodies. It means the central one - AOPK CR at http://mapy.nature.cz. The spatial information to the data found in ÚSOP database can be displayed in the map application. Similar information is also accessible by individual Regional Authorities at their web pages [Vaniš] or individual National Parks. There is also a central general server for Civil Services that contains also a map part. There are accessible many maps from different human activities including nature protection. Also not only elements from ÚSOP can be found, but also e.g. zonation of NPs and Protected Landscape Areas [CENIA].

## 3.3 Biotopes Survey and Its Outputs

From 2001 to 2004 the biotopes survey was carried out. The output was a polygonal vector layer and database of biotopes segment characteristics that are used for analysis in GIS. There are more than one million biotope segments. The area of mapped natural biotopes is about 16 % of the state territory [ISOP] and accessible are interpreted results only [Hošek].

## 3.4 Species Distribution - Occurrence Database

The database is established to monitor the distribution of the significant species and to analyse eventual changes. There was no unified system for management of this information up to year 2008 and all the data were in specialized or local and regional databases. This problematic approach is connected also with biotopes and habitats and with creation of the Natura 2000 network. The species are monitored on permanent localities and extensively also at the whole territory of the state in case that the specie distribution of the specific specie is not known. The unified system for data acquisition

is a client-server based technology that makes possible on-line data inputs to the central database. There are several applications - for biotopes mapping update, for monitoring of biotopes and species and for reporting of unsystematic findings. The system is not public but access for external subjects can be obtained for the part for unsystematic findings. The online access to the Occurrence Database is provided for the Civil Service bodies, branch bodies of the Ministry of Environment and other bodies dealing with nature protection, academic bodies (e.g. universities, research institutes, museums), other expert non-governmental bodies (e.g. Czech Society for Ornithology etc.), private researchers and other public. The access to the database is based on the application and its approval (and limitations) by AOPK CR. The general public can access only interpreted results [Hošek] e.g. species distribution in 10x10 km grid [BIOM].

## 4 Conclusions

The experience that the NATURE-SDI*plus* partners are gaining in the project has resulted in a wealth of knowledge and methods suitable for the harmonisation of GI in Europe and to underpin the INSPIRE process in the field of nature conservation.
In this regard, the NATURE-SDI*plus* project establishes a Community of data and service providers and users in the addressed field, representative of the different European levels, from local to EU: the NATURE-SDI*plus* Network, a first attempt towards the continuation and the sustainability of the initiative after the project conclusion.
To achieve such a result, during the first project year the issue of the "Network Implementation Plan" has been carried out, with its start on an operational point of view.
The plan for the implementation of the network foresees a series of activities developed in parallel and concurrent with the project dissemination and awareness and aimed at the network enlargement and the recruiting of new stakeholders. In particular, the NATURE-SDI*plus* Network is developed through:

- Collection of Good Practices in data management for nature conservation. Good Practices are collected and organized in a database according to a template, and also available for training purpose. Good Practice Workshops are organized in the framework of the project by inviting selected stakeholders to present and share their experience;
- Training initiatives and the developing of an on-line Training Framework. These training initiatives are addressed to the partners and the network members to transfer the project know-how and provide the knowledge needed to understand and exploit the project outcomes.
- NATURE-SDI*plus* services organisation: this task is planned in order to organise the maintenance and the provision of Nature-SDI*plus* services for interoperable datasets. It is accomplished according to a specific business model and the IPR of data providers. This activity starts with the definition of the services and links with other initiatives that are related to service provision such as the new ICT-PSP project BRISEIDE (BRIdging SErvices, Information and Data for Europe) expected to start beginning 2010.
- Finally, Nature-SDI*plus* clustering activities, carried out to seek for the co-operation with other eContent*plus* projects and other EU initiatives that support the INSPIRE Directive implementation process.

The European dimension of the project and its representativeness at European level are ensured by the numbers of Countries represented in the Network (18 Countries) and by the policy adopted by the project for an open participation to the network by relevant stakeholders it the field.
As to the expected impact, a great interest is growing around the project, also because its time-alignment with the INSPIRE implementation process and because there is an increasing demand for knowledge and operational procedures for harmonising, and making data interoperable and consistent. In this respect, the following main issues are considered ad regards the expected impact:

- The “**harmonisation**” of spatial data sets. This means the compatibility of data and implies the adoption of known transformation rules in application schemas, co-ordinate reference systems, classification systems, identifier management.
- The “**interoperability**” of the spatial data sets. This means the ability of the data to be combined and interact and implies the adoption of a common framework and network services that enables them to be linked up from one to another.
- The “**consistency**” between spatial data sets. This means that the representations of different objects which refer to same location, or of the same objects at different scales, or of objects spanning the frontier between different MS, are coherent. In practice it means that data sets

coming from different levels of authority, or from different countries can be easily used together by any type of user.

As regards the running and future activity the work for the Annex III data themes is complex, with several multifaceted aspects. Scientific and operational issues arise, related to a shared understanding of the addressed content and actual topics to be covered. As example of the discussion among the partners, we report some considerations about problems which, even if out of the scope of the project, however impact on the work to be done:

- for Biogeographical regions, data specification needs to be aligned with the current scientific analysis aimed at the assessment of the concept of Biogeographical regions and at a proper consideration of its granularity, able to adapt the data theme to the management requirements. This reflects into the evaluation of the proper geographical scale(s) to work on and on the features of this theme.
- for Habitats and biotopes, it is mainly the need of matching database structures and data, and the related features/attributes, with the complexity of defining habitats and biotopes, again for different required scale(s) and objectives of work (e.g. mixed habitats and biotopes reflecting very different ecological conditions);
- for Species distribution, it is a proper consideration of what is ecology, and then observation, of animal and plant life. In this case as well the scale (and grid) of observation, the update frequency and the measurement criteria are very important. As well as it is crucial the problem of aligning the database with new observations and scientific evolution in taxonomy.

So the challenge for NATURE-SDI*plus* is also to provide input for INSPIRE on the above issues.
Operationally the next steps of the project will be then devoted to the definition of the NATURE-SDI*plus* data model for the Annex III data themes and to the implementation with the Common Thesaurus Framework for nature conservation.

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