

SPANISH NATIONAL PLAN FOR TERRITORY OBSERVATION (PNOT)

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ABSTRACT:

The continuous and precise knowledge of the territory is fundamental in order to carry out coordinated decisions about Territorial and Environmental Policy. This Plan, the Spanish National Plan for Territory Observation (PNOT), show the system adopted by close cooperation between all the Spanish Publics Administrations, from Regional to National. In this presentation we present, obtained by consensus, the technical users requirements, analysis of the different phases, methodological approach, dissemination policy, the organisation and necessary founding for the different projects included in this Plan. This Plan are divided in three different phases: Capture of the necessary images, Extraction and Dissemination. For all these phases the Plan are structure in different projects. The first phase "Capture of the necessary images", the information are divided from high to low image resolution, using different sensors on board of aircraft and satellite platform. Corresponding to this phase we are develop two important projects: PNOA (National Plan for Aerial Orthophotography) and PNT (National Plan of Remote Sensing). For the second phase "Extraction" the most important projects are, SIOSE (Land Cover Information System in Spain) and Standard Agro-Environmental Indicators, both using Remote Sensing concepts and techniques. And finally for the last phase "Dissemination" we are obtained and important and innovative agreement between all different stakeholders involved in the Plan in order to obtain an efficient system for this important task. Also it is necessary to stress that this Plan is integrated concerns European (GMES and INSPIRE) and International (GEO) requirements, for a sustainable, collaborative and decentralized observation system.

1. BACKGROUND

Spain has assumed in the beginning of the XXI century very important challenges in sustainable development: the modernization of infrastructures and the attention to the social needs must be compatible with the appropriated management of environmental aspects.

In order to have this, it is necessary to obtain information about the territory with the appropriated exactitude, updated, consistent, adapted to the international geographic standards, shared between all the Administrations, accessible for the users and integrated in the Spatial Data Infrastructures (GSDI, INSPIRE, IDEE,...) and in the European and global networks of Earth Observation (GMES, GEO).

Up to now, the production and dissemination of geographic information in Spain has been decentralized in two aspects: geographically by the Regional or Local Administrations and thematically by the different thematic departments at National or Regional level.

The insufficient coordination in the generation of this information causes problems in:

- Optimization of economic resources: duplicity of efforts; abandoned plans due to lack of budget; distribution of costs not according to the budget capability of the different organisms.
- Information production: Lack of coordination that generates "holes" of information; low rhythm of works that means databases not updated; etc...
- Use of databases and products: incompatibility of the data, difficult interoperability; diversity of data models, scales, resolutions, precisions, dates, formats, etc...

- Data dissemination: Restrictive access to the data due to they are property of different Organisms.

2. PNOT OBJECTIVES

Some institutions of National and Regional levels, keep geographic information databases but this are not integrated: different scales, incomplete cover of Spanish territory (regional databases), different revision intervals, and normally each institution obtains only the information for its own needs. In order to solve it starts this plan.

Taking into account the described problems before the main objectives of PNOT are:

- To apply INSPIRE principles to information on Land Use/Land Cover
- To share costs of information and avoid duplicities, so we can obtain better and more "up to date" information.
- To obtain an integrated Information System (spatially, temporal and semantically) that help different institutions to take coordinated decisions (based on the same information).
- Information obtained must satisfy the requirements of participant institutions, European Union (Corine Land Cover, GMES...) and other social agents.

Also, there are other very important objectives derived from these:

- To improve and optimize the economic resources invested by the participant Organisms in the geographic information capture
- To take advantage of the potential use of data and products, promoting the most diffusion and use by all the social agents

- To support and contribute to the implementation of the Global and European policies
- To take advantage of the convergent interests of the different administration levels (European, National, Regional and Local)
- To promote the cooperative and decentralized production between the different producers instead of competition
- To allow the efficient exploitation of the information by scales and resolutions
- To promote the expansion of the private sector companies in the geographic information sector making them contributing with better quality, efficiency and reducing costs



Figure 2: Natural colour ortho-photo with 50cm spatial resolution

3. TECHNICAL ASPECTS

The PNOT is structured in some components described in the table:

1 st phase: Capture and treatment of aero spatial imagery	Plan name		Regional Plan of Aerial Orthophotography (PNOA)	National Plan of Aerial Orthophotography (PNOA)	National Plan National of Remote Sensing (PNT)				
	Spatial resolution	Temporal resolution	10 cm to 50 cm	50 cm to 100 cm	10 cm to 10 cm	10 cm to 10 cm	10 cm to 10 cm	10 cm to 10 cm	
Examples of used sensors	Digital aerial photography	Digital aerial photography	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	
	Digital aerial photography	Digital aerial photography	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	SPOT 4 (30cm)	
2 nd Phase: Extraction of information	Information Systems		2,000 to 5,000						
	Thematic areas	Urban	Urban	Urban	Urban	Urban	Urban	Urban	
	Topographic cartography	Natural Production of Urban and General Cartography	Topographic and cartographic bases	Topographic and cartographic bases	Topographic and cartographic bases	Topographic and cartographic bases	Topographic and cartographic bases	Topographic and cartographic bases	
	Land cover use	Information Systems of Land cover Land use (SIGC)	Land cover Land use (SIGC)	Land cover Land use (SIGC)	Land cover Land use (SIGC)	Land cover Land use (SIGC)	Land cover Land use (SIGC)	Land cover Land use (SIGC)	
3 rd Phase: Dissemination of information	Other types of information		Spatial data infrastructures INSPIRE, OGC, regional OGC, Image data networks, Spanish, OGC/OGC...						

Figure 1: Structure of the National Plan for Observation of Territory

- Within the Plan we can consider 3 phases:
- Capture and treatment of aero spatial imagery
 - Extraction of information
 - Dissemination of information

4. 1ST PHASE: CAPTURE AND TREATMENT OF AERO SPATIAL IMAGERY

The aim of the first phase is to obtain aerial and satellite coverage with resolutions and optimum rhythms of updating from the economical point of view, and also optimum for the applications in which they would be used. These coverages are organised in different levels of spatial resolution (pixel size) and temporal resolution.

4.1 National Plan of Aerial Orthophotography (PNOA)

The first implementation of this project is in course and goes from 2004 to 2007. The aim is to obtain photogrammetric flights updated each two years. From them it is generated a digital elevation model and a surface model with 2 m precision in high (rmse) and digital orthophotos with pixel size 50 cm and planimetric precision 1 m (rmse).

The production is being done by the Regional and National Administrations with a following financing of the Public Administration:

- 66% National Administration
- 34% Regional Administrations

The second implementation of this project, planned from 2008 to 2011, is more ambitious. The aim is to obtain a rigorous ortho-photo every four years with pixel size 25 cm and a quick ortho-photo with pixel size 50 cm also every four years, but with 2 years of gap, that is to say, it would be produced a rigorous ortho-photo with pixel size 25 cm the first year, two years after a quick ortho-photo with pixel size 50 cm. The plan also provides for the production of an ortho-photo with pixel size 10 cm for the urban areas that will be done the year in which there is no production of ortho-photo.

The production also is going to be decentralised, done by the Regional Administrations with the same structure for the financing.

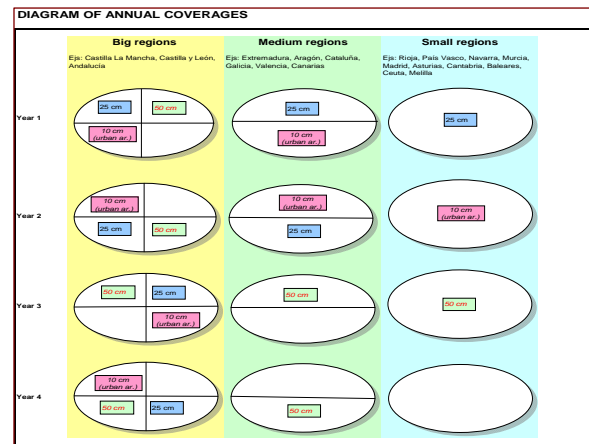


Figure 3 Diagram of annual coverages of orthophoto by regions

4.2 National Plan of Remote Sensing (PNT)

The National Plan of Remote Sensing wanted to coordinate the acquisition and treatment of the coverages of satellite images of our territory, in such way that they would be acquired and processed once, and they could be used by all the Organisms of the different Spanish Administrations that would need them. The responsible of the acquisition is the National Institute of

Aero Spatial Techniques (INTA), dependant from the Ministry of Defence.

These coverages are structured in three levels of spatial and temporal resolution:

4.2.1 High resolution

Coverages with satellites from 2-10m of spatial resolution in panchromatic mode and 10-30m in multispectral mode (satellites SPOT5, IRS, EROS, etc). The planned periodicity is one year with a summer image.

In 2005 the Ministry of Public Works and the Ministry of Environment have acquired a complete coverage of the Spanish territory with SPOT5 HRG (Simultaneous panchromatic 2,5m and multispectral 10m) that will be available for all the Spanish Administrations for different applications

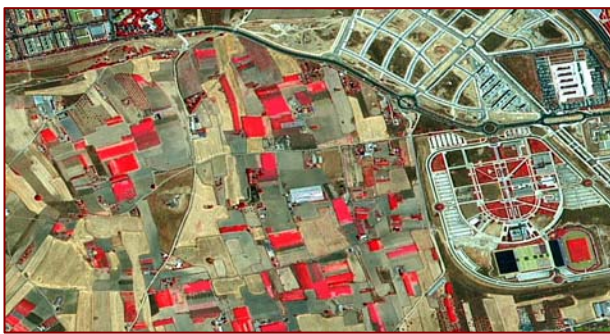


Figure 4: SPOT5 image from the PNT 2005 coverage. Infrared false colour. Pixel size 2,5m ("Pan sharpened")

4.2.2 Medium resolution

Coverages with satellite images from 10 to 15m in panchromatic mode and from 20 to 50 m of resolution in multispectral mode (SPOT4, Landsat5; LAndsat7, IRS, Aster...). The planned frequency of acquisition is 3 or more coverages per year in the different phenological periods. The principal applications are multitemporal analysis, seasonal and year on year, automatic classifications of land covers, crops identification, or detection of irrigated lands. Also it has been proposed a project to compile and to inventory all the historic Landsat images of our territory existing in the different Organisms of National Administrations in order to be shared by all of them.



Figure 5: Landsat 7 ETM+. Infrared false colour. Pixel size: 12,5m ("Pan sharpened")

4.2.3 Low resolution

Coverages with multispectral images from 50 to 1000m of spatial resolution (NOAA-AVHRR, MODIS, SPOT-Vegetation satellites...) and with a periodicity of 1 to 30 days. The principal applications are: extraction of bio-physical and environmental parameters (NDVI, soil temperature, fire risk...), information to obtain the environmental indicators required from different organisations.

Also the National Plan of Remote Sensing the principal contribution to the Spanish strategy of Earth Observation promoted by the group GEO Spain.

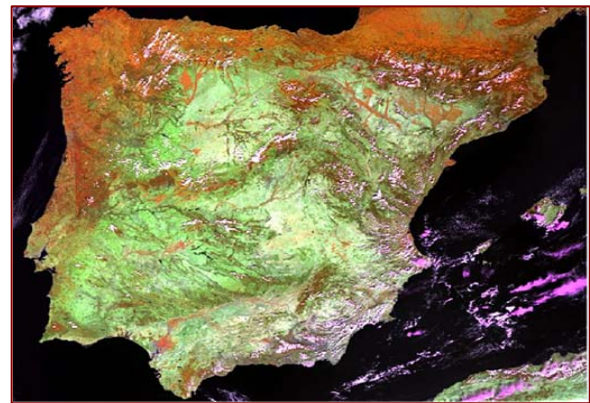


Figure 6: Low resolution image NOAA AVHRR

5 2nd PHASE: EXTRACTION OF INFORMATION

5.1 Spanish Land cover/use Information System (SIOSE)

The objective of this project is to produce a land cover/land use database in a cooperative way between the National and the Regional Administrations with the following characteristics:

- Nominal scale: 1:25.000
- Minimum mapping unit: 1 ha for urban areas and 2 ha for other areas with some exceptions for particular classes of especial interest: humid areas, beaches, riverside vegetation, with 0,5 ha.
- Updating period 5 years (although it is being considered to update urban areas annually)
- Based on images produced by PNT, PNOA
- Common data model:
 - Object oriented (UML description- see figure 7-)
 - multiparameter (multiple attributes possible for 1 polygon)
 - multilevel
 - extensible (for particular needs)

The objectives that the SIOSE data model must comply were:

- Satisfy requirements of the participating organisms in SIOSE
- Consider all the necessary land cover/use data minimizing redundancies.
- Organize data so that different users can access data in a view according to their needs
- Provide a flexible version of the SIOSE Conceptual Data Model, able of being extended in future.

Taking these objectives into account the design guidelines for the SIOSE data model have been:

- Division between Land Cover (biophysical criteria) and Land Use (socioeconomic criteria)
- There is only one geometric entity class in SIOSE (POLYGON)
- Mixed Classes in SIOSE: created by association of singles classes
- Polygon (geometry and topology): must comply with the Geographical Council specifications (based on ISO19107, ISO19137 standards).
- SIOSE Data model will try to keep CLC nomenclature, as long as it contains all the semantic necessary information for the different users. But Mixed CLC classes will not be kept.
- SIOSE Data model will use enumeration type Classes, with prefixed values that could be modified or extended later.
- SIOSE Conceptual Data model: Entity – Relation Data model in UML notation (Unified Modelling Language). It provides normalized notation about classes and relations between them, according to ISO TC211 and Open GIS Consortium recommendations.
- This standardised notation provides flexibility to the model, so that Thematic Working Groups and future users can modify and extend it easily.
- SIOSE Conceptual Data model has considered previous Spanish Land Cover and Use Nomenclatures and Databases, from National and Regional Institutions.

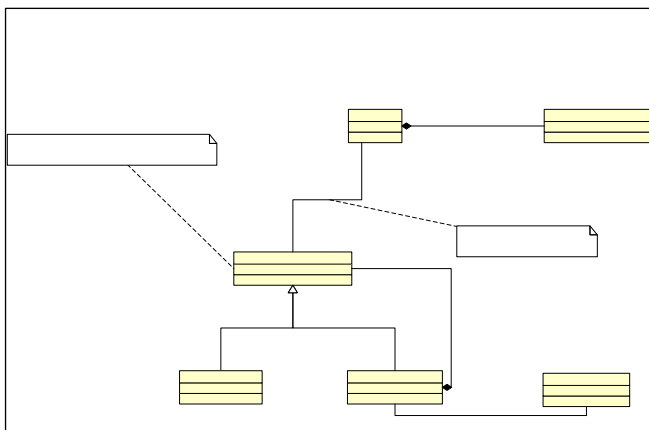


Figure 7. SIOSE core data model

The organisation of SIOSE project is focus on INSPIRE Spatial Interest Communities (SDIC). The SIOSE project team has set up as a (SDIC). Under it we can find the Technical workgroups (created with thematic criteria: agriculture, forest, artificial...) responsible of the elaboration of process methodology, metadata and UML data model and 19 Production groups (by geographic criteria) responsible of the production of SIOSE.

The funding of the project is as in PNOA project:

- o 66% National Administration:
 - IGN (Spanish National Geographical Institute)
 - MMA (Spanish Environmental Ministry)
 - MAPYA (Spanish Agriculture Ministry)
 - MVIV (Spanish Housing Ministry)
 - MEHAC (Spanish Economy and Treasury Ministry)

- MEDUC (Spanish Education and Science Ministry)
- o 34% Regional Administrations

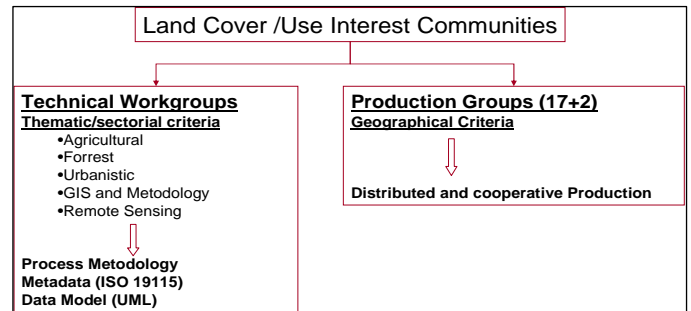


Figure 8. SIOSE project organisation

5.2 National Cartographic System

Its aim is to coordinate the capture of Basic Topographic Information and Data Reference in general (RD1545/07):

- Scales: From 1:10.000 to 1:200.000
- Periodicity: 1 to 5 years
- Based on PNT or PNOA images
- Agreed data model
Decentralised and collaborative production (National and Regional Administrations)
- Generalisation and integration at National level

5.3 National Plan of Indicators (PNI)

Realisation of studies with the collaboration of some Universities, about the bio-physical parameters and variables that can be used to the generation of indicators required by different Regional, National, European or Global Organisations from medium and low spatial resolution satellite data.

6 3rd PHASE: DISSEMINATION OF INFORMATION

All this information is wanted to be available by all the local, Regional and National Administrations and, in the same way, for the rest of social agents that will require it (private companies, universities, etc.)

For this there are planned some mechanisms according to the type of the information to be distributed:

- Data published on data servers connected to the different spatial data infrastructures (GSDI, INSPIRE, IDEE, regional IDEE...) by standards protocols according to the different type of information (wms, wfs, wcs...).
- Publication of data by applications and portals of the different organizations.
- Data transfer between servers of different local networks by ftp.
- Data copies on different hardware (external USB disks, DVD...)
- Distribution to general public in different type of products (books, DVD, CD...)

The data policy have been described in close connection and agreed between National and Regional Administration, but it is foreseen that the data are available directly for all the organism participants in the project and have the major diffusion between

all the agents for which they can be useful with only marginal distribution costs.

7. CONCLUSIONS

As a consequence of all the themes exposed before we can conclude:

- The technological changes promote new challenges in the capture, dissemination and use of the information.
- The European Union acts as a promoter in the assumption of such challenges.
- The new user's requirements need for new strategies.
- It is necessary the collaboration between all the public administrations
- The economic saving achieved with this way of working is significant.
- It is necessary the normalised information in global systems (Sustainable Develop , GMES, Digital Globe, IDE's...)

These plans are initiating a new collaborative and decentralised way of capture and dissemination of the geospatial information in Spain.

