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**Committee of Experts on Global Geospatial Information Management**

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**Country Report of Spain \***

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In Spain, geospatial information is seen, from management purposes, as a comprehensive system including the complete cycle of the information, from capturing data to publishing and disseminating final geospatial products and services. Inside this whole process we have all the transformation, analysis and cartographic production task.

This integrated production system includes all the public stakeholders with authority in geographic information in a decentralized and collaborative production model in which take part all levels for administration: local, regional and national. Through a co-funded economic model this cooperative way of producing information is a powerful tool for sustainability, even in crisis times, as we reach the objective of gathering data only once and by the most appropriate agent or group of agents.

The definition of the user's needs, base of the design of the system, is reached by consensus and translated to technical requirements taking in regard the standardization process that is currently taking place in geospatial information at, both, European and global levels (INSPIRE Directive, ISO TC211). This initial orientation allows to successfully integrate projects at regional, national and international levels and improves the technical sustainability of these projects in time.

The system is based on the use of common shared data sources, mostly digital images obtained through a variety of airborne and space sensors, and on working with agreed data models. This contributes to the harmonization of the geospatial information used by all the stakeholders and improves compatibility and interoperability among their projects.

This basis and this approach build up a solid bottom-up national model of producing and managing geospatial information that converges with international top-down approach at the European level, fitting perfectly with current initiatives like the development of INSPIRE Directive, GMES (and GEO at global level) in which Spain participates actively.

These methods of production, management and approaching among administrations are included by Instituto Geográfico Nacional y el Centro Nacional de Información Geográfica (IGN-CNIG) in international educative training programs given in Latin America in coordination with Spanish Agency for International Development Cooperation (AECID) and Pan American Institute of Geography and History (IPGH).

### **Geospatial information system production model**

Starting with the first stages of the process, the acquisition of source data, we have the National Plan for Land Observation (PNOT). Within this plan data is captured using photogrammetry and remote sensing, as well as digital terrain models are produced from aerospace images. In PNOT participate the national administration, via different government departments, and all regional administrations. It is thus a cooperative plan that pools technical, logistical and economic efforts through complex mechanisms of inter-administrative coordination led by the National Geographic Institute (IGN-CNIG)

SPANISH NATIONAL PROGRAM FOR OBSERVATION OF TERRITORY (PNOT)							
1 <sup>st</sup> PHASE: Aerial and satellite image acquisition and processing	National Plan for Aerial Orthophotography (PNOA)			National Plan of Remote Sensing (PNT)			
	Spatial resolution	very high	high	medium	high	medium	low
		10 cm	25 cm	50 cm	Pancro: 1 to 10 m	Pancro: 10 to 15 m	Multispectral: 100 to 1.000 m
	Urban and coastal areas	(Alternate coverages)		Multispectral: 4 - 30 m	Multispectral: 20 to 50 m		
	Update period	4 years	2 years		2 - 12 months	1 to 6 months	2 - 30 days
	Aproximate cost (euros / Km <sup>2</sup> )	350	55 (accuracy methods) 19 (fast methods)	10 (scanning) 72.42 (ortho)	4 (for 2.5 meters)	0.05	0
Examples of sensors	Digital aerial cameras (4 bands) with GPS-IMU Lidar	Digital aerial cameras (4 bands) with GPS-IMU Lidar		SPOT 5, Formosat, IRS, Cartosat, Geoeye, etc. Future INGENIO	Landsat 5 <sup>TM</sup> Spot4 DEIMOS Future Sentinel 2	MODIS Vegetation NOAA	
2 <sup>nd</sup> PHASE Extraction of the information	Theme	Organisations involved	Scales / Projects and databases				
			1: 500 to 1: 2.000	1: 5.000 to 1: 10.000	1: 25.000 to 1: 50.000	1: 100.000 to 1: 200.000	1: 1 Million
	Topography	National			Topographic Database BTN25	BCN200	BCN1000
		Regional		Topographic Maps			
		Local	Topographic Maps				
	Cadastral	National	Urban cadaster	Rural Cadaster			
		World					Globalcover
	Land cover	European				Corine Land cover Land monitoring Core Service	
		National		SIGPAC	SIOSE Agriculture Map Forest Map		
		Regional		Regional Land Cover databases			
Environmental	World European National Regional Academia			Remote sensing biophysical parameters and agri-environmental indicators			
3 <sup>rd</sup> PHASE Dissemination of the information	Spatial Data Infrastructure: INSPIRE, IDEE (Spanish National SDI), regional SDI, Image servers (WMS, WMTS, WMS-3D...) Image servers: Iberpix, SIGPAC,...						

Figure 1: PNOT organization.

In the first phase, the objective of the PNOT is to obtain aerial image coverage and digital elevation models for multidisciplinary applications, with economically optimized resolution and updating periods, as well as to develop applications in which these images are going to be used. This coverage is organized into various levels of spatial resolution and time frequencies, which are materialized into specific plans:



National Plan for Aerial Orthophotography (PNOA), which provides, among other photogrammetric products, periodic coverage (each 3 years) of the entire national territory via very high resolution aerial orthophotography: PNOA25/50 (25/50 cm) and PNOA10 (10 cm).



Figure 2: PNOA data.



National Remote Sensing Plan (PNT), which provides periodic coverage (annual, monthly and weekly) of the entire national territory via medium and low resolution satellite images (2.5 to 100 m).

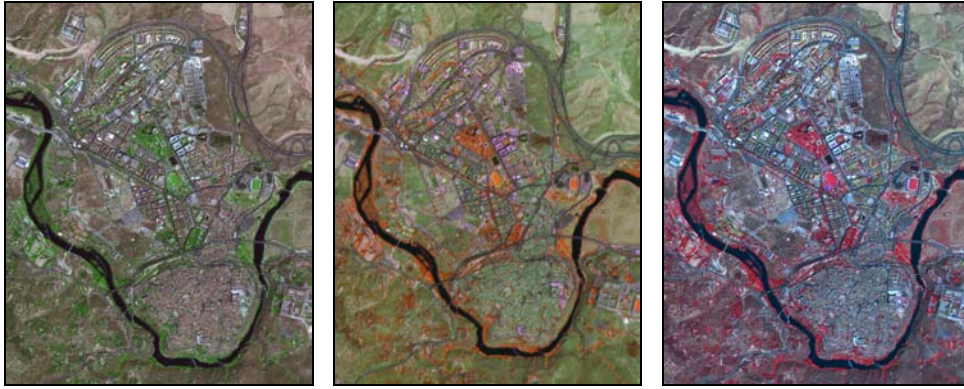


Figure 3: PNT images (SPOT).

From the coverage of PNOA and PNT basic and thematic geographic information is produced in a wide range of scales, from local to national level, by all the cartography producer agents of the country. The key point in this second phase of the process is that the main cartographic projects are based on agreed data models, made up in a cooperative frame in which national and regional administrations cooperate, in order to harmonize all the geographic information produced in our decentralized production model. This enhances interoperability among the different datasets and enables the sharing of geographic information, reducing production costs and making the system more sustainable.

For topographic data bases (basic geographic information dataset) we have the Harmonized

Topographic Base (BTA), which is an object oriented geographic Data Model for Reference Data (INSPIRE Annex I thematic groups) with 1:5.000–1:10.000 reference scale. BTA was built and agreed by Regional Cartographic Agencies and the National Geographic Institute and delivered as a recommendation by the Geographic High Council of Spain. BTA allows to share and exchange information between Regional and State Administrations at these scales and so, the subsequent and coherent production of the National Topographic Base 1:25.000 (BTN25 ), the main national topographic database, by the national authority (IGN-CNIG).



In a similar way, we have a common object oriented data model for land cover and land use information: the Information System on Land Cover in Spain (SIOSE). This data model is the reference for land cover information production at 1:25.000 scale and higher. Semantic and geometric generalization of high resolution Land Cover data produced by SIOSE project is an example of a **bottom-up approaching** for CLC- Global Land cover map production.

All this high resolution information about land cover is the base for preparing the actualization of the coverage and land use CORINE Land Cover data base with reference date 2012 commissioned by the European Commission via the European Environment Agency (EEA) in the frame of the **GMES Land service** of the European Council and Parliament. Here is included the review, improvement and validation from IGN/CNIG and CNR of high resolution raster coverage of the GMES Land program (GMES High Resolution Layers – GMES HRL)

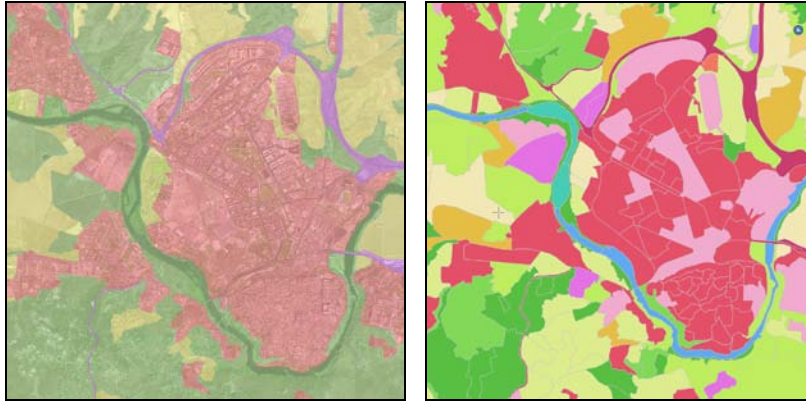


Figure 4: SIOSE database of the city of Toledo.

Globally it is remarkable the participation in international organizations and consortiums through global land cover observation programs:

- **GEO SB-02 Global Land Cover (GEO/GEOS):** Contribution to the GEO Task on Global Land Cover, including Data Model, optical and radar images at different resolutions, and surface parameters, as Essential Climate Variables (ECV) datasets, for the understanding of Climate Change.
- **ESA global Land Cover map/Global Land Cover Network (GLCN):** The GlobCover project is part of ESA's Earth Observation Data User Element (DUE)
- **Global Observation of Forest and Land Cover Dynamics (GOFD-GOLD):** is a international coordinated effort to provide land cover data (vegetation mainly) for sustainable management of natural resources.
- **NASA Land-Cover and Land-Use Change Program (LCLUC)** is a scientific interdisciplinary program.
- **Global Land Cover Facility (GLCF)** is an investigation centre for studying the land cover change dynamics and the causes of these changes.
- **Global Land Project program for terrestrial ecosystem** financed by International Geosphere-Biosphere Programme (IGBP) and International Human Dimensions Programme (IHDP).

These projects (PNOA, BTN25 and SIOSE) make up the reference information set for basic scales products and from them are derived the final cartographic products at 1:25.000 and 1:50.000 scales: National Topographic Map 1:25.000 (MTN25) and National Topographic Map 1:50.000 (MTN50); and geographic information services on the Internet, served by the National Geographic Institute through the Spanish Spatial Data Infrastructure (IDEE).

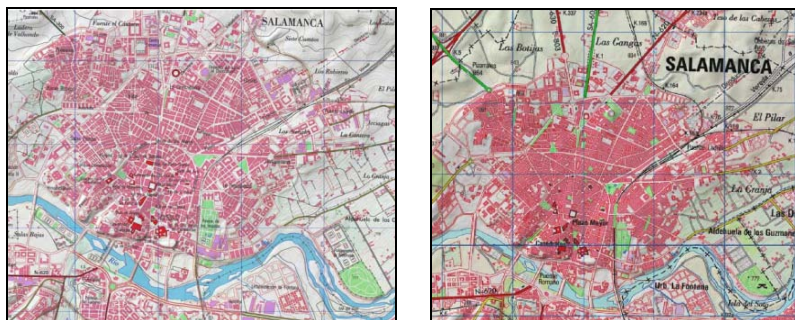


Figure 5: National Topographic Map 1:25.000 (MTN25) and National Topographic Map 1:50.000 (MTN50).

For every topic of geographic information, both reference and thematic ones, the design of the data model is made taking into account the European technical specifications, coming from the development of



INSPIRE Directive, and working with all the agents involved and experts in the topic, coming from different local and regional administrations and also diverse national administration departments. This cooperative procedure ensures sustainability (both technical and economic), integration (both at national level and with international projects) and interoperability (as harmonization and standardization are primary objectives).

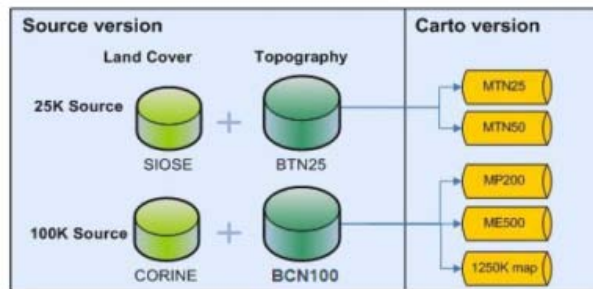


Figure 6: source data and cartographic products schema.

On the same way as in basic scales, we have another reference set of projects for smaller scales, starting at 1:100.000. It is formed by the SPOT satellite images (part of PNT), the National Cartographic Base 1:100.000 (BCN100) and the Corine Land Cover database (European Land Cover reference project). From this set of source information we make, as cartographic final products, the Province Map 1:200.000 (MP200), Spanish Map 1:500.000 (ME500) and the National Map 1:1.250.000 (M1000). All this products are also available in the net for download or as web services as part of the national spatial data infrastructure (IDEE).



Figure 7: Spanish Map 1:500.000 (ME500) and National Map 1:1.250.000 (M1000).

Collaboration and coordination between different administrations is continuous as, for instance, in CartoCiudad project. CartoCiudad is the result of merging together and harmonising information provided by several national public bodies, mainly General Directorate of Cadastre, National Statistics Institute, Post Office and National Geographic Institute, and also regional organisations in some Autonomous Regions. The outcome of this integration process is a Geographic Information System of a national and seamless streets, ways and roads network, topologically structured and complemented with urban cartography, census-based and postal information, covering all the Spanish municipalities, line with the INSPIRE Directive.

As a point of contact with the European Commission for the development of the INSPIRE Directive in Spain is the Geographic High Council (CSG). It is the governing body of the National Cartographic System in Spain and is the advisory and planning of geographic information and mapping officer. The CSG has been responsible for creating the Special Commission on Spatial Data Infrastructure, with the aim of producing, among others, the technical specifications necessary to implement a National Spatial Data Infrastructure.