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**Conference papers: invited papers on recent developments
in geospatial information management in addressing national,
regional and global issues**

**Spanish national plan for land observation: new collaborative
production system in Europe**

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SPANISH NATIONAL PLAN FOR LAND OBSERVATION (PNOT)

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At the beginning of 20th century, Spain faces significant challenges for **resource management and sustainable development**, including the need for the modernization and infrastructure, but giving priority to social needs, which has to be made compatible with the proper management of critical environmental issues such as emissions reduction commitments of greenhouse gases (**Kyoto Protocol**), the efficient management and **use of water** (National water Plan), the promotion of **renewable energies**, air pollution control etc. ...

In order to establish appropriate environmental policies, conduct accurate socio-economic studies, environmental impact assessments or planning, there is a need for **objective, accurate, harmonized and constantly updated information** over the territory around us. Furthermore, the intensity and extent of the phenomena that occur over our territory: urbanization, public works, forest fires, reforestation, shifting cultivation, desertification and so on, make it essential to have information on its evolution, especially in areas subject to intense change.

To respond adequately to these challenges, it is necessary that the **different government Agencies share information** and that this information adapted to international geographic data standards (ISO, OGC, etc.), accessible by everybody and integrated into Spatial Data Infrastructures and Earth Observation networks (COPERNICUS, GEO ...).

The most efficient way to obtain this information about the territory is by acquiring **periodic aerial and satellite image coverages** (using photogrammetry and remote sensing techniques) as they provide most of the needed geospatial information. These images also

allow the updating of the geographic information databases such as: topographic mapping, land use, security and defense, geology, surveying, etc.

Spanish National Geographic Institute (IGN) is a government agency, dependent on the Ministry of Public Works and Transports. IGN is the National Mapping Agency (NMA) for Spain, and coordinates the Spanish Spatial Data Infrastructure (SDI). Also, IGN is European Network and Information Environmental Observation Network (EIONET) National Reference Centre for Land Cover and Land Use. According to this mandate, IGN must coordinate the information in Spain related both to Land Cover and Land Use.

IGN is responsible for **Spanish National Plan for Land Observation (PNOT)**. It responds to the need for detailed knowledge of the territory and how it evolves over time. PNOT provides a great amount of geographical information which is essential for the **sustainable management of the environment, agriculture, emergencies and security, among other areas.**

PNOT is comprised of three big nation-wide projects:

1. The National Plan for Aerial Orthophotography (PNOA)

PNOA coordinates the **acquisition of aerial images and digital terrain elevation models**. It aims at obtaining common photogrammetric products with technical specifications agreed upon by all users. The result are several products including: **aerial photos, 25 or 50 cm pixel digital orthophotos, and Digital Elevation Models (DEM).**



Since 2004, PNOA provides such products of the entire territory, with a periodicity of 2 or 3 years. The project is constantly evolving, adapting to the needs of users and the development of new technologies.

In 2009, it was considered necessary, by a high number of users, to cover the whole territory with very **high precision (15 cm) Digital Elevation Models, obtained by LIDAR technology** in order to perform flood prevention, road projects, forest inventories, etc. PNOA is next to finish this complete coverage.

2. The National Plan for Remote Sensing (PNT)

PNT coordinates **earth observation satellite image coverages**. It provides periodic coverages (annual, monthly and weekly) of the entire national territory with high, medium and low resolution satellite images, both current and historical.

PNT has facilitated the **massive use of satellite images on multiple projects** and tasks for all the Spanish Public Administration, Universities and Public Research Agencies.

PNT imagery is structured in three levels of spatial and temporal resolution:

- **High resolution:** Images with **1 to 10m of spatial resolution**. It is planned to acquire a complete coverage every year with summer images. From 2005 to 2013 SPOT5 2.5 m resolution images are selected to provide that type of resolution.

The main applications of these images are: land cover cartography, updating of cartographic databases of medium and small scales, and to obtain environmental and agricultural information, etc. Ready to use Orthoimagery are produced from these high resolution images.



- **Medium resolution:** Images from **10 to 100 m of spatial resolution**. Since 2009 all Landsat 5 multispectral 30 m and Landsat 7 imagery captured over Spain were acquired. In 2011 and 2012 Deimos 1 20 m resolution images have been acquired. In the next future, Landsat 8 together with Sentinel 2 will be used. The repetitive capture of images of the same area is carried out with the aim to allow **multitemporal (inter-annual and intra-annual) monitoring of the environment** and territory evolution. They are also useful for

environmental management, design of prevention and emergency policies to respond to **natural catastrophes, environmental risks**, etc, in which remote sensing is combined with tools like **Geographical Information Systems**.

Other applications are: land cover automatic classification, crop identification, irrigated land detection, forest information, biophysical parameters, etc.

- **Low resolution**: Multispectral images from **100 to 1000 m** of spatial resolution, with a periodicity of 1 or 2 days. In the future, Sentinel 3 will be the main source of this type of resolution. Low resolution data are used mainly to analyze the evolution of phenomena which change quickly along time, through the extraction of biophysical parameters (**vegetation indexes, temperature, quantity of combustible materials and fire risk...**). The daily availability of the images of these sensors and of derivate parameters of them, facilitate the monitoring in nearly real time, directed to the analysis of environmental variables.

3. The “**Information System for Land Cover and Land Use in Spain**” (SIOSE)

Land can be studied from two different (although related) viewpoints:

- **Land cover** (LC) is the categorization and description of the land according to its biophysical properties, such as urban areas, cultivation, forest trees, etc.
- **Land use** (LU) is the characterization and description of the territory in accordance with its functional dimension or socio-economic use, such as industrial, commercial, recreational, etc..

In recent years, thanks to the development of remote sensing and digital image processing techniques, the capture of such geographical information is now much easier, faster and efficient.

IGN has been carrying out management and coordination tasks for obtaining this kind of information throughout the country, fulfilling its role as EIONET’s **National Reference Center on Land Cover and Land Use** as part of the **European Environment Agency** (EEA) EIONET network.

Two major land cover and land use projects are managed and coordinated by the IGN currently:

- The European project **Corine Land Cover** (CLC) at a reference scale of 1:100,000.
- The **Information System for Land Cover and Land Use in Spain** (SIOSE) at a reference scale of 1:25,000.

SIOSE project makes use of the data obtained from PNOA and PNT to **accurately locate and identify urban areas, agricultural areas, forests, wetlands and other natural areas throughout Spain.**



Use of the information

All this information is used by: **citizens, all the Spanish public administrations, European bodies and institutions** such as the European Commission, the European Environment Agency, the Joint Research Centre and **EUROSTAT**, as well as the large-scale European programmes for geographic information based services, such as the **COPERNICUS** programme.

It is used in infrastructure projects, agriculture, forest management, environmental risk prevention and in emergencies.

Organization

PNOT follows a **decentralised management model based on consensus, coordination, joint financing and collaboration** between the various administrations.

It follows the **'bottom up' model**, as it co-ordinates the flow of information from the autonomous communities to the Spanish Central Administration, the European Commission and the United Nations.