

## **CADASTRAL MODELS IN EU MEMBER STATES**

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### **Abstract**

Cadastrals are always related to land: they are a creation of man as effect of his relationship with land. The different conditions of the Cadastre in 14 EU Member States, including the former EU Candidate States (that nowadays are also EU members), are shown in this paper. Half of EU countries store cadastral and registration data in the same database. Basically two original models of cadastral system exist in the EU, related with systems of land registration: 1) in the Central European model (beyond the area of the Germanic “Grundbuch”) Cadastre emerges as a graphic basis (map) of land registration (Land Registry), so that physical changes must be reflected in the Cadastre and legal changes in the Land Registry, by maintaining a perfect parallelism; 2) in the Latin model the Cadastre emerges only as a taxation instrument, useful for collecting land taxes. The Land Cadastre in the EU is almost always parcel-based and contains an urban Cadastre (of buildings) only in a few countries. Moreover, the European Land Information Service (EULIS) is shown as result of a project carried out by nine partners of eight EU Member States. The knowledge of the cadastral models in EU Member States is a fundamental condition for the harmonisation of Soil Cadastre at EU level as an inventory for environmental, social, economic, legal and taxation purposes.

**Keywords :** *ground cadastre, landRegistry, GIS, INSPIRE, EULIS.*

### **Introduction**

Cadastrals are always related to land: they are a creation of man as effect of his relationship with land.

“We know that the white man does not understand our ways. One portion of land is the same to him as the next, for he is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his brother, but his enemy, and when he has conquered it, he moves on. He leaves his father’s graves behind, and does not care. He kidnaps the earth from his children, he does not care. His fathers’ graves and his children’s birthright are forgotten. He treats his mother, the earth, and his brother, the sky, as things to be bought, plundered, sold like sheep or bright beads. His appetite will devour the earth and leave behind only a desert”.

“How can you buy or sell the sky, the warmth of the land? This idea is strange to us. If we do not own the freshness of the air and the sparkle of the water how can you buy them?”

“This we know: the earth does not belong to man; man belongs to the earth. This we know. All things are connected like the blood which connects one family. All things are connected”.

These words were said to have been uttered by Chief Seattle in 1854 when the President of the USA made an offer for the purchase of a vast territory populated by Indians, by giving a reservation for the Indians.

We know now that the text is a speech made in the late 70s by Ted Perry, scriptwriter, for a film called “Home” produced by the Southern Baptist Convention in the USA.

Environmentalists have largely mentioned this speech, only a few parts of which have been mentioned here, as one of the most noble and profound ones made for the defence of nature and native culture. When this was revealed to be a fake, some environmentalists stated that Chief Seattle at least should have spoken like this.

After man settled down and started farming, it was needed to show who controlled which land and who could be levied taxes based on ownership. It was the beginning of the centuries-long development of land holding, that led to build up the modern Cadastre. Agriculture bound the people to the land.

The feudal system prevailing in Europe watched over it. Only the Industrial Revolution broke this strong physical tie with the land: it made the land itself a commodity and created the land market. The land was changed into capital in the balance sheet. Cadastres made this development possible. The rebuilding after the Second World War, strong economic growth and increase in population made it necessary to plan land use, both regional and urban. This rapidly led to concern over the environment state and quality. More information was required on the land and its use. Once again, Cadastres played significant roles in specifying the objectives of environmental protection measures or the regions that need it. In the last two decades, the importance of Cadastres as a basis for LIS (Land Information System) and GIS systems has grown and thus contributed to a better environment management (Ratia, 2002).

Even if different countries interpret the term “Cadastre” in different ways, this term was defined in the FIG (Fédération Internationale des Géomètres or International Federation of Surveyors) Statement on the Cadastre/No.11/1995 (Kaufmann, 2002). In this context Cadastres record data on human interests, both public and private, regarding each area of land, e.g. information on the owner of a parcel, geometric data (coordinates and maps), land use. Cadastral data may be used to support land transactions and markets, assist in administration of different sections of the economy, e.g. agriculture, environmental protection, fishery, forestry, housing, land use management and zoning, public utilities and transportation.

Cadastres and land administration have developed in the same way and have followed the same trends: at first, land was an object of utilisation, then it changed into an exchangeable commodity and capital and finally into an object of planning and protection.

The data collected from cadastral surveys and included in the Cadastres are no longer enough. In order to satisfy the new expectations, the data context of the Cadastres must be broadened. Data covering land use, rights and restrictions, e.g. zoning, environmental protected areas, historical monuments, are also essential.

The data should be collected and updated by different organisations, i.e. authorities and possibly private companies, whose databases should be able to communicate with each other (Ratia, 2002).

In Italy the cadastral certificates of 1960s included the district, that was removed at the end of 1980s. In the new Italian cadastral certificate (Raimondi, 2017) the above district was included again. In 1988 the computerisation of the Ground Cadastre determined the development of the related maps from raster to vectorial ones. During this process some errors were generated, because of the wrong reading of the parcel numbers written in the old cadastral books and maps.

The old Ground Cadastre is only a ground and land inventory, while the new Soil Cadastre is aimed at environmental, social, economic (territorial/rural and urban development), legal and taxation purposes. In fact, it is possible to develop a structure, derived from the processing and integration of Ground Cadastre, where all soil characteristics are described. The soil is considered as divided according to the updated concept of cadastral parcel (soil and topographic uniformity of ownership and municipality). The land use is also assessed with reference to sustainability, taxation and environmental risk prevention. The structure of Soil Cadastre can contribute to the bureaucratic simplification of agricultural policies and environmental emergencies, as well as product presentation and traceability and re-traceability. Through the updating of some characteristics by professionals, the Cadastre can become evidentiary and fundamental for consultancy and statistics (Raimondi, 2017).

### **Different conditions of the Cadastre in EU Member States**

Works on the soil Cadastre of various EU countries were written by several authors (Clergeot, 2003). In some EU countries (e.g. UK) the electronic processing and delivery of soil Cadastre data to customers was accomplished (Collis et al., 2002).

Many EU countries felt the need of updating their cadastral system and computerising it (Cadastral Information System), in order to improve the services for customers. In the recent years the updating of Cadastre was accomplished through the collaboration of many professionals external to the Cadastre itself (Conejo Fernandez, 2003).

Yet, in most EU countries the soil cadastral certificate includes many topographic data but no reference to soil characteristics.

For example in Germany, Austria and Switzerland very complex inventories have been established, in order to guarantee the land security (Hawerk, 1996).

The EU15 adopted the following systems :

- agricultural field level (Belgium and Northern Ireland);
- cadastral and Land Registry parcels (England, Italy, Spain and Luxembourg);
- lot level (Austria, Finland, France, Germany, Ireland and Scotland);
- bloc level (Denmark, Greece, Portugal, Sweden and Netherlands).

A single cadastral model does not exist in the EU: each country originally applied whatever model it preferred and the “acquis communautaire” does not require any reform.

Recent reforms in the Cadastral Registration systems have been done independently in some countries, in order to satisfy domestic objectives and needs.

The Cadastre and Land Registry in EU Member States can be classified by the following concepts :

1) administration responsible for Cadastre (throughout the EU the Cadastre is considered as an instrument of economic policy in the national interest and, therefore, its competence corresponds to the central administration of the country, unless Germany, where the responsibility resides in the “lander” (federal states);

2) responsible ministry (ministerial responsibility for Cadastre is largely related to the main use for which the Cadastre was conceived; in countries where the origin is mainly for taxation purpose (Belgium, Spain, France, Italy and Luxembourg), cadastral responsibility resides in the Ministry of Finance; a second important group of countries is formed by those where the Cadastre is governed by ministries such as Agriculture, Environment or Territory (Greece, Finland, Netherlands and Portugal); the third group is formed by countries such as Denmark and Sweden, having highly independent cadastral organisations related to a Ministry (Housing and Environment, respectively); in Austria the cadas-

tral responsibility corresponds to the Ministry of Economy, while in Ireland and UK a Cadastre does not exist but rather a highly autonomous institution responsible for national cartography and geodesy (Ordnance Survey);

3) relation of the Cadastre with geodesy and general cartography; EU countries are divided into two almost equal groups: those having a single geographic and cadastral institution (Austria, Denmark, Finland, Luxembourg, Portugal and Sweden) and those having separate institutions for Cadastre and general cartography, i.e. also the larger countries (Germany, Belgium, Spain, France, Greece, Netherlands and Italy); Ireland and UK have an exclusively geographic institution;

4) identification of real estate; all EU countries have a parcel-based Cadastre (unless Ireland and UK) and, therefore, have a single identifier for each parcel, equivalent to what in Spain is called "referencia catastral" (cadastral reference);

5) type of cartography; all EU countries are in the process of completing the transition from conventional to digital cartography, by using different processes, from simply scanning conventional maps to the generation of new vectorial maps based on orthophotography;

6) relation with the Land Registry; the majority of EU countries select the registration of rights, which are guaranteed in almost all cases: the registrar examines the documents that sustain the right being registered; only in a few countries of Latin tradition (Belgium, France and Italy) the Registry is a mere collection of deeds.

With regard to the effect of registration, two main groups exist :

1) basically in Germanic countries (Germany, Austria, Greece, Netherlands, Ireland and UK) the Registry confers a legal status to the right of property: the right does not exist if it is not registered;

2) in the rest of EU countries the main effects are publication and protection from third parties; registered rights prevail over unregistered rights.

All Registries in the EU use (or will use in the next future) cadastral mapping. The type and intensity of use in each country depends on the type of registration defined in the respective legal base, which also affects the degree of integration between the cadastral and registration institutions. There are four different situations :

1) integration in the same institution or co-existence as separate organs depending on the same administrative entity, as it is Belgium, France, Netherlands and Italy (the integration mostly occurred in these countries in recent years) and will be in Greece in the next future;

2) Cadastre and Registry are independent institutions but share the same database, such as in Austria, Finland and Sweden;

3) Cadastre and Registry are different institutions which formally communicate updates of their respective information (in very different degree, frequency and intensity), such as in Germany, Denmark and Spain;

4) a formal relationship between Cadastre and Registry cannot exist, because the Cadastre does not exist, such as in Ireland and UK, where only the cartography contained in their respective Ordnance Surveys is used.

In summary, an important degree of integration exists, unrelated to a given registration model or a specific geographical area, to the extent that half of EU countries store cadastral and registration data in the same database.

Basically two original models of cadastral system exist in the EU, related with systems of land registration :

1) in the Central European model (beyond the area of the Germanic “Grundbuch”) Cadastre emerges as a graphic basis of land registration, so that physical changes must be reflected in the Cadastre and legal changes in the Registry, by maintaining a perfect parallelism;

2) in the Latin model the Cadastre emerges as a taxation instrument, useful for collecting land taxes; the registration of rights is not compulsory and initially does not have a cartographical basis, so that no parallelism exists until the reforms recently carried out in some countries.

The Land Cadastre in the EU is almost always parcel-based, has no formal distinction between rural and urban land and contains an urban Cadastre (of buildings) only in a few countries. In fact, in some countries the urban Cadastre is the responsibility of a different ministry or administration rather than the Land Cadastre, e.g. the local authority in Finland (Mirón Pérez, 2002).

**Austria.** The Austrian Land Cadastre, in connection with Land Registry, provides maps and certificates (UN-ECE, 2002a).

In Austria there is an inventory of city and town properties and related maps, where items are shown with different colours (Auer, 2013).

Moreover, paper documents can be converted into digitalised ones to be used by notaries and customers by means of CyberDoc system, that was developed at EU level (Brunner, 2002).

**Czech Republic.** The content of Cadastre should generally be arranged according to real needs. Land policy and management will need a more a more reliable and complex information for a correct decision-making. This is also a reason of the continuous pressure to include other needed data in the content of the Cadastre, even if nowadays each sector of State administration runs its own registers and databases including data belonging to their competencies and responsibilities. The current state of IT enables to link individual public registers (or databases) of different ministries and to create a wider distributed Land Information System (LIS), to be used by both public administration and private sector.

Also in the Czech Republic the advantages of such a unified Information System of public administration are the following :

- easy access to the data kept in IS for everybody with limitation only due to law (probably some personal data);
- clear responsibility and legal validity of the stored data;
- multiple use of data once kept enables to minimise costs and creates better conditions for cost recovery (within the whole IS);
- the net of individual interconnected databases (Unified Distributed IS of Public Administration) corresponds to the distribution of duties and responsibilities of individual administration bodies and creates the basic conditions needed for reliability, relevance and validity of the data stored in IS;
- the whole IS can be gradually build up and extended, according to real needs and economic possibilities;
- the special and indispensable role of the Cadastre, as a general provider of unified localisation data for the whole IS, raises its importance;
- even the interconnection of several basic registers can bring significant results.

Basic registers as a backbone of the whole system should be preferred :

- Cadastre and Land Registry;

- register of citizens;
  - register of economic subjects;
  - register of taxes;
  - register of territorial planning;
  - register of environment;
- etc.

These principles enable to gradually build up a wide IS of the whole public administration, that will provide all users with all the above advantages (Pesl, 2003).

Illustrative examples of rural applications of the Cadastre in the Czech Republic are the following :

- 1) supporting Land Registry (POZEM, i.e. GIS support for land registration and consolidation, used in 60% of districts in the Czech Republic; ZRUIN, i.e. pilot project and law preparation concerning the authentic/basic register on spatial identification and real estate);
- 2) providing cadastral mapping and service;
- 3) implementing CAP (LPIS and CwRS) and other policies, e.g. AEMS and RURAL21;
- 4) agrostatics, land use/land cover, i.e. IACS implementation, BPEJ (digital maps on soil and ecological rating and the country-wide spatial units related to the Cadastre);
- 5) land protection and valuation, i.e. digitalisation of the vineyard sections in the district of Znojmo and dissemination of the produced maps to the end users (by means of CD-ROMs); information on land valuation and/or land value maps accessible via Internet at <http://muris.mepnet.cz/public/menu/cpm2002/htm> or [http://www.cscm.cz/start\\_flash.htm](http://www.cscm.cz/start_flash.htm);
- 6) land privatisation and consolidation, i.e. a land consolidation pilot project in Kardasova Recice (carried out by COSMC and the district authority of Jindrichuv Hradec, together with the Dutch Cadastre).

**Finland.** The basis for foundation of the Cadastre in Finland, as well as in other parts of Europe, has been taxation reasons, i.e. compilation of taxation catalogues (Kokkonen, 2002).

**France.** As exhaustive, permanent, descriptive and evaluative inventory of landed properties, the French Cadastre reflects the civil status of built and undeveloped properties. Its main purposes are :

- taxation (evaluation of real estate, determination of the basis for property taxes, identification of the taxable owners),
- legal and property-related (identification and physical description of properties),
- technical (establishment of the cadastral plan and keeping it updated; the topographical pictures are essential for the identification and physical description of the properties).

The valuation is responsibility of the Ministry of Economic Affairs through the Land Offices. The property valuation and land taxation are considered to be extremely complicated in France. The local taxation evaluation system is based on the profit instead of the value of a considered property. The concept is the same as the one still used in Spain, although the evaluation method operates in a very different way.

To use the profit as a criterion supposes that a system ensuring the taxation equality is selected without the disadvantage of a frequent updating due to the spatial and temporal variations of market values. The taxation system on real estate weights the potential income that the property could produce. Thus, a higher emphasis is placed on the fair repartition of the taxation burden among the owners rather than on the collection of a tax proportional to the real market value of the property (General Tax Directorate, 2002).

**Germany.** According to the German law, independent and self-employed land valuation boards support the transparency in the real estate market by means of a digital purchase

price collection. Some derived data of the purchase price collection are the real estate market reports and price contour maps having standard land values. The German government is currently discussing how price contour maps can be used for land taxation. Even if German valuation methods generally stand up to the international comparison, the developments in the current real estate market require an increasing knowledge.

Automatic valuation tools, demographical development and global risks are some aspects of the research in the field of valuation (Seidel, 2006).

**Greece.** In 1970 the project for the implementation of a nation-wide Cadastre started with the production of cadastral tables through simple information and cadastral maps filled in by copying enlarged air photos. The cadastral maps were analog, vector maps of a scale of 1:1,500 for the urban areas and 1:5,000 for rural land. The cadastral tables were in digital form. Even if until 1974, 5,800,000 land parcels have been registered for an area of 28,700 km<sup>2</sup>, which approximately represent the 22% of the total country area, the project was left not finished. During that time the new era of technological development started. Yet, the initial benefits of this development had very little effect on the public administration.

In Greece forest lands approximately cover 8,400 km<sup>2</sup> (64% of the total country area) and mostly belong to the State. Efforts for establishing a forest inventory have started in 1938, even if the real work began in 1976: the boundaries of forest lands were marked out on air photos taken in the '30s, '40s and '70s, forest maps, having a scale of 1:5,000 were produced and disputes were examined by the courts. Until 1987, when the project was stopped, 2,000 km<sup>2</sup> have been mapped and 20,000 disputes have been submitted to the courts. This large volume of disputes made the courts unable to finish the job. Nowadays the forest maps are produced again through the "National Cadastre" project, even if they are still being filled in. The environmental protection of forests both from big fires, especially during summer, and informal building, either on State owned forest lands or private owned forest lands is still a hot issue, creating conflicts between the citizens and the State. The missing clear definition of the forest land boundaries and the applied strict restrictions create a high compromise among the land owners and the public employees, so that a lot of disputes are still submitted to the courts. This creates a high mistrust to the Ministry of Agriculture and negatively affects the land market (Potsiou and Ioannidis, 2002).

Reforming a traditional cadastral system, together with the analogue maps, into a modern multipurpose digital Cadastre and the needed collection of new cartographic data is a complicated and laborious task. This is true above all in countries like Greece, where the institution of Cadastre is newly introduced as a successor of deed registration system, which has been operating for almost 150 years. The most appropriate approach for the collection of cadastral maps in urban areas could be the combination of modern recording methods, including digital photogrammetry and GPS, and the use of isolated existing cartographic data. Thus, both the cost and the collection time for the cadastral surveys can be significantly decreased, while the public acceptance of Cadastre institution increase (Ioannidis, 2003). Therefore, also in Greece the conversion of the old Cadastre into a multipurpose one only recently started. In Greece the cadastral certificate includes three parts :

- 1) information on rightholder;
- 2) real property;
- 3) rights (Balodimos, 2018).

**Ireland.** A LIS called Cadastre was developed also in Ireland, by focusing on land characteristics, e.g. location, area, property and encumbrances. The legal Cadastre for Ireland is the Registry of Titles maintained by the Land Registry (Clancy, 2002).

**Italy.** In Italy the Soil Cadastre is managed by the Territory Agency, while the Soil Registry is managed by the Office of Property Registries or “Conservatoria dei Registri Immobiliari - C.RR.II.”. The Territory Agency belongs to the Ministry of Finances, while C.RR.II. belongs to the Ministry of Justice.

**Lithuania.** The Lithuanian Law on Real Property Register states that “Immovable items, real rights to them, encumbrances of these rights and legal facts shall be considered registered when the respective data is recorded into the Real Property Register. Confirmation from the Central Registrar about the recording of data into the Central Databank shall be considered the moment of recording the data”. In order to ensure the management and administration of real property, ownership, create favourable conditions for the development of land and crediting markets and promote the development of information society, the institutions dealing with the Land Administration and having these tasks are very important. The Ministry of Justice is also responsible for supervising the activity of the State Land Cadastre and Register (SLCR), the Central Mortgage Institution and Notary Offices. The Information Society Development Committee under the Government of the Republic of Lithuania deals with the development of the Information Society, implementation of electronic signature, e-government and other related tasks.

SLCR, that is an important institutions in the area of land administration, currently supervised by the Ministry of Justice, is responsible for the registration of immovable objects, real rights to them and legal facts and, from the 1<sup>st</sup> of July 2002, also for the registration of legal entities, collection and storage of information on real property Cadastre and Register and supply of official information thereof. The basic institutions preparing the data and documents for the registration of immovable objects, real rights to them and legal facts, that are tightly related to each other and observe single methodological regulations and instructions, are the following :

- administrations of County Managers, that administer the documents for the restoration of ownership rights to the existing real property and prepare the files of land parcels designed during the land reform subjected to registration;
- city and District Municipalities, that prepare documents for the privatisation of buildings, make decisions regarding address changes, administer the municipal flat stock, etc.;
- mortgage Register Institutions (mortgage judges), that register mortgages, provide information about mortgages on real property, registered in the Mortgage Register;
- surveyors for land parcels, that survey them and prepare their files and provide them to SLCR for the registration of cadastral data;
- notaries, that act on behalf of the State and in conformity with laws and ensure that there is no illegal transaction or document; they validate transaction contracts, contracts of gift and other transfers, as well as they notify SLCR about the concluded transactions on real property transfers.

The changing society, increasing customer needs and demands and advancing technologies highly affect the development of Public Registers and the information infrastructure, as well as they require a higher integration of information.

The linking of registers, information systems and cadastres is a fundamental step towards the creation of "E-Government", leading to improved services for citizens and reduced demand upon public resources and budgets. All real property market participants, including State and private sector, as well as citizens, will benefit from the efficiency improvement

achieved through the linking of registers. The integration of the registers and information systems improves the information infrastructure of the country, ensures better administration and exchange of data and contribute to improve the quality and expand the range of information required by customers. However this area requires a very elaborated, clear and comprehensive legal, technical and administrative regulation. As far as the integration and linking of the registers and information systems, the State policy, strategy and the issues of standardisation are more and more important, above all after the introduction of electronic signature. The Real Property Cadastre and Register, being one of the base registers, is closely linked to other information stored in other public Cadastres and Registers. The information from the following public Registers and Cadastres is used for the operation of the system :

- population Register, i.e. personal code, first name and surname of a natural person;
- register of Legal Units, i.e. code and name of a legal person;
- forestry Cadastre, i.e. cadastral address of forestry land parcel;
- entrails Cadastre, i.e. restrictions on real property use, related to underground resources;
- cadastre of Protected Areas, i.e. restrictions on the use of real property, related to protected areas;
- register of Cultural Heritage, i.e. restrictions on the use of real property, related to the objects of cultural heritage;
- address Databases (Register), i.e. unique address of a property object, unique number of a building, postal address of a land parcel and (or) building and other address data and geo-data;
- mortgage Register, i.e. data on mortgage bonds;
- register of Territory Planning Documents, i.e. data about approved territory planning documents.

The Real Property Cadastre and Register has a very tight co-operation with the notary system. On the 1<sup>st</sup> of July 2001 an agreement between SLCR and the Chamber of Notaries was signed for involving the notaries in updating the real property register data.

The structure of SLCR consists of three levels :

- 1) Central Headquarters
- 2) Branch Offices in every county and in one more town
- 3) Client Service Bureaux

The Central Headquarters administer Real Property Cadastre and Register, real property valuation for taxation, design, install and use the information system of the Real Property Register, supervise and monitor the work of the Branch Offices.

11 Branch Offices, located in county centres and one district centre, collect Cadastre and Register data, carry out cadastral surveys, property valuation and market research, as well as they register immovable objects, collect cadastral GIS data and keep the archive of property formation. In order to ensure a better service for customers and a convenient access, 35 Client Service Bureaux are located in district centres and towns. They accept the documents for the registration of real property, register immovable objects and rights to them, issue documents proving the right of ownership or possession of immovable items, as well as they provide information services to owners or users of real property. The customers have the right to choose: the real property register system is oriented towards a quick supply of the information needed by customers to make transactions. The Lithuanian Law on Real Property Register states that “The application to register the right of ownership to an immovable item must be examined, decision made and data recorded to the

database of the Real Property Register within 10 workdays after the day of submitting the application. The application to register other real right to an immovable item must be examined, decision made and data recorded to the database of the Real Property Register within five workdays after the day of submitting the application". Certificates on the immovable object and rights to it, registered in the Register, designed for real property transactions, must be prepared within seven working days after the day of submitting the application by the customer (UN-ECE, 2002b).

**Netherlands.** The Dutch Kadaster is an independent public agency. An important part of the organisation of Kadaster is the User Council. This council consists of representatives of the main customer groups of Kadaster and advises the Executive Board on all aspects of the services of Kadaster itself (Laarakker, 2002).

**Portugal.** The Portuguese Geographic Institute (PGI), recently created by the Decree Law 8/2002, is the consequence of the merge of the National Centre of Geographic Information (NCGI) and the Portuguese Institute of Cartography and Cadastre (PICC), assuming their attributions, competencies and responsibilities.

The main missions of the PGI are the following :

- to exercise the role of national cartographical authority;
- to produce official geographic information;
- to develop and coordinate a national system of geographic information;
- to carry out research and training in the area of geographic information science and technology;
- to promote the development of the Information Society.

With specific reference to the Cadastre, the PGI is responsible to :

- establish references for all real estate (rustic and urban);
- identify the referenced properties;
- issue Real Estate Cards;
- obtain and graphically reflect the geometric characteristics of all real estate;
- provide support for the evaluation of real estate property;
- ensure the maintenance and updating of cadastral data;
- certify the cadastral elements of each property.

In Portugal, until 1994, the geometric Cadastre was only practiced on rustic property, representing approximately 55% of the country surface area and only 12% of its 18 million existing properties.

The main aim of this Cadastre was taxation: it constituted an inventory, not concerning with the legal ownership of individuals.

As of 1995, the PICC (now PGI) changed over to a real estate Cadastre, meaning the package of data that characterises and identifies all existing rustic and urban real estate property in the country.

In accordance with Cadastral regulations, a real estate is characterised by :

- its administrative location, i.e. District or Autonomous Region, municipality and "freguesia";
- its geographic location, i.e. the position of its vertices on the applicable coordinate system;
- its geometric configuration, i.e. the mapping of a closed polygonal line, joined at the ends;
- its area.

Moreover, a real estate is identified by a unique numerical code called the Real Estate Identity Number (Número de Identificación del Predio or NIP), which is included in the Identity Card of each property (Dias Veigas, 2002).

**Spain.** The conditions for the distribution of EU agricultural aids, in application of the EU Common Agricultural Policy (CAP), have significantly changed in recent years, as far as both the structure of the aids themselves and the requirements of the related Integrated Administration and Control System (IACS). From the aids directly linked to production the system evolved to area-based subsidies and later from a simple alpha-numerical identification of the agricultural land parcel to a more accurate identification based on a Geographic Information System (GIS), compulsory since the 1<sup>st</sup> of January 2005. The new Land Parcel Identification System (LPIS) is an inventory similar to the cadastral inventory and is applied to the administration of agricultural aids. In the few countries where it has been possible, including Spain, the Rural Cadastre has been used as the basis for building the LPIS. In other countries, all of which are new EU members, the LPIS has been built together with the Cadastre. The majority of countries have adopted alternative solutions that generally exclude cadastral information, that is used for other purposes.

The GIS for the management of CAP aids implemented in Spain (called as SIGPAC, that is its Spanish acronym) has adopted the cadastral parcel, representing a point of departure at which the two inventories contain identical information at a similar stage of updating. It also represents a significant challenge: to maintain a coherence between two inventories containing identical objects but used for different purposes and managed by different Administrations. Since 2000, all EU countries, including new members, are required to establish a LPIS, that forms part of the IACS of agricultural aids and must be implemented within the 1<sup>st</sup> of January 2005. Each country has been allowed to establish the LPIS in the way it considers appropriate, within the terms imposed by EU regulations.

The technical requisites of LPIS are the following :

- the information it contains must include the parcel identification number, its area and use, by specifying the uses entitled to aids;
- it must cover the whole rural area in a consistent way, under a single system;
- in terms of cartographic precision, it requires a scale of at least 1:10,000 and an indeterminate field between 0.5 and 1 m, as well as a maximum pixel in orthophotos of 1 m;
- the system and its connection to the GIS of IACS must allow the connection between graphic and alpha-numerical databases, as well as an efficient use of graphical information in all IACS procedures, the massive distribution of information to farmers, administrative cross checks with immediate cross-referencing of each information and the use by local offices or field inspectors or control operators by means of remote sensing;
- the system must be regularly updated, at least once a year; ortho-photos should be updated in order to ensure that the general quality of the information remains consistent; the updating period varies between three and seven or more years, according to the stability of the land use.

The need for building a LPIS to support the IACS for agricultural aids was established by EU Regulation 1593/2000.

Of the 15 EU Member States, 13 had a Cadastre, in widely different situations of updating. Ireland and UK did not have a Cadastre strictu sensu but they have cartography in their respective Ordnance Surveys, allowing an accurate identification of any piece of land. Therefore, all EU countries have a Cadastre or “equivalent system”, unless Portugal (where

the Cadastre exists only for the Northern part) and Greece (where Cadastre is presently being established and only a very fragmentary Cadastre exists on Rhodes Island).

In addition to cadastral information, seven countries (Belgium, Denmark, Finland, Greece, Ireland, Italy, Portugal and Spain) have also orthophotographic coverage, allowing the superposition of the cadastral parcel map. In some cases, e.g. Italy, orthophotography had not been performed by the Cadastre but by the administration responsible for IACS and olive GIS. In Spain orthophotography does not cover the whole country but only its olive growing areas. France has orthophotography for a small part of its territory, corresponding to olive growing areas in its Mediterranean regions.

As for the use of cadastral information in the IACS, this is already a reality in Austria, France, Germany, Italy, Spain and UK. In all cases it is merely used as back-up information for the location of agricultural parcels eligible for EU subsidies.

Spain is the only country where cadastral information includes data on land use, in enough detail to determine whether or not a given portion of a parcel is entitled to EU subsidy. Moreover, in Spain the IACS accurately identifies the agricultural parcel with the cadastral parcel.

In 2000 all Integrated Systems already had a LPIS, based on digital or paper cartography, in some cases supported by orthophotography. In Spain the Integrated System uses alphanumerical cadastral information for identifying parcels and their use, paper maps to delimitate the agricultural use in certain cases and the orthophotography of the Olive GIS.

Until 2000 each EU country used the best information (cadastral or not) available to it, for managing its Integrated System, within the wide range of models allowed by EU regulations in force since 1992 (Mirón Pérez, 2005a).

The distribution of EU CAP subsidies has recently undergone important changes, in relation both to their structure and IACS requirements. The scheme has evolved from a simple alphanumeric identification of parcels to a new LPIS based on a GIS, compulsory since the 1<sup>st</sup> of January of 2005.

The new LPIS is a sort of “Cadastre” focused on agriculture management purposes. As there is an overlapping between a modern multi-purpose Cadastre (existing in several European countries) and LPIS, it is important to find paths for co-ordination between both systems, in order to avoid expenditure duplication. Countries having Cadastres and LPIS under construction (some accession countries) have the chance to build an integrated system, a multi-purpose Cadastre fulfilling LPIS requirements.

Being the Spanish Rural Cadastre firmly based on agricultural uses, its information was suitable to be one of the pillars of the new LPIS for IACS (Mirón Pérez, 2005b).

In recent years, the General Directorate of Spanish Cadastre has made enormous efforts to computerise the management of cadastral databases and processes, in order to guarantee the availability of a complete and updated data bank and improve the service quality for citizens, companies and other public entities. These efforts have been weighed down by many factors: complexity and peculiarities of the Cadastre; level of technology in the different phases of the process; diversity of the flow and interchange of information with external agents collaborating with the Cadastre for maintaining the cadastral databases; territorial spreading of data sources; updating of data and customer service procedures.

The urban cadastral cartography is geo-referenced with a scale of 1:500 or 1:1000, while the rural cartography has a scale of 1:5000 or 1:2000 (Conejo Fernandez, 2003).

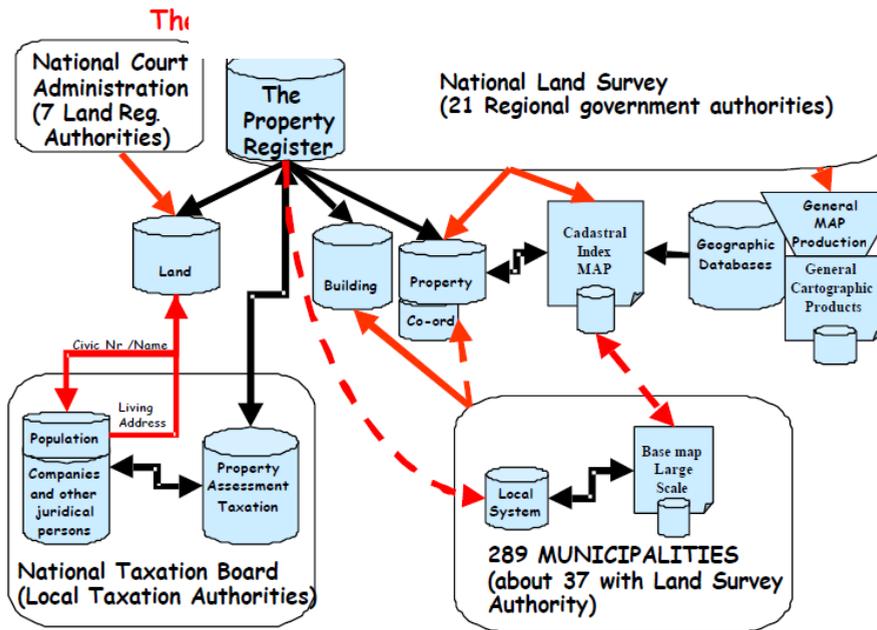
Also the Spanish Cadastre has made a determined effort to supply the information it administers to public administrations, citizens and corporations through Internet. This decision, which implies substantial changes in the culture of the organisation itself and even in the public service strategy, is only aimed at satisfying the expectations of the

customer/citizen, i.e. the end user and beneficiary of cadastral information. This aim requires changes regarding which cadastral products should be offered and how. Above all, it is the best way to achieve an adequate level of public service in the medium term, based on the following three general premises :

- 1) to include the best cadastral information as possible;
- 2) to satisfy the expectations of citizens;
- 3) to achieve the above two premises at the lowest cost as possible.

The Ensenad@ project is the strategic initiative adopted by the Spanish General Directorate of Cadastre in order to satisfy the requirements for cadastral information in the next future. It will mean the definitive incorporation of Internet as the backbone of the relationship between the Cadastre and its customers, by facilitating universal access to the information, immediately and at the lowest cost. When the project is completed, the Spanish Cadastre will have reached its full extent as a useful public service (Durán Boo, 2003).

**Sweden.** Sweden has a very long history of mapping, cadastral and land registration activities, going back to 1628. Swedish Lantmäteriet has a long experience in the field of using updated technology and working methods. Swedish organisations within the different fields of land administration have been pioneers in developing and using LIS systems (e.g. through the introduction of the Land Data bank system) and GIS, as Lantmäteriet was one of first customers of ESRI. As part of Swedish experience in developing tools for carrying out the tasks of Lantmäteriet, an in-house software for topographical and cadastral mapping (Arccadastre) was developed at a very early stage (Kjellson, 2002). Lantmäteriet is a governmental authority responsible for a number of registers, including all basic relevant information concerning land in Sweden, i.e. descriptive information, maps and archived purchase deeds. The information in the registries is open for use and can easily be accessed by authorised people. The use of the information is regulated by two laws, the Swedish Data Protection Act and a special law about the Swedish Real Property Register. It is up to Lantmäteriet to look after the customers and how they fulfil these laws. Even if the registers are structured as one common database, there is a number of different technical solutions that are transparent for the users. The users have one single interface for accessing the database. The most important factor is the use of common identifiers and definitions in every register throughout the database, e.g. a building is described in the same way regardless if it is on a map or in a ownership register. The information in the database is updated and maintained by the organisation that is responsible for the data, e.g. municipalities for property addresses, banks for mortgagors and the National Tax Board for the assessment value (Fig. 1).Lantmäteriet is responsible for the contents, the maintenance and the dissemination of land information (Ljunggren, 2002).



**Figure 1.** *The integrated Cadastre of Sweden (Ljunggren, 2002).*

**United Kingdom.** The word Cadastre is generally used to describe “a methodically arranged public inventory of data concerning properties, within a certain country or district, based upon a survey of their boundaries”. However there are several models for its use and implementation throughout Europe. By using the land parcel as its foundation, the Cadastre is used to record information about land rights, valuation, use, etc.

For historical reasons in the United Kingdom the development of Land Administration institutions has taken place in a different way from the rest of Europe. In fact, there is neither Cadastre nor a single organisation responsible for the Cadastre, as well as the word Cadastre is not one commonly used. Yet, mapping remains the basis for those activities considered as “cadastral”.

Ordnance Survey, as a national mapping agency, maintains large scale mapping for England, Scotland, and Wales, while Ordnance Survey Northern Ireland has the same responsibility for Northern Ireland. The detailed digital mapping maintained by these two government agencies provides the definitive framework upon which other organisations can “hook” and manage their data. Another difference with most mainland European countries is that the base mapping in the UK is topographic: it shows features existing on the ground but not the fixed boundary points and monuments usually associated with a Cadastre (Probert, 2002).

The institutional structure in the UK for all aspects of Land Administration (that is the term established by the United Nations Economic Commission for Europe – UN-ECE to describe that group of activities related to land including national mapping, land registration, land valuation, land use and land information) include those activities carried out by cadastral agencies in mainland Europe.

In the UK there is a long tradition of the public administration of those functions which are normally undertaken by cadastral organisations in mainland Europe.

Systems of National Mapping, Land Registration, Land Valuation and Land Use are all well established. Together these public and statutory services underpin the social and economic well being of the country. But the cadastral tradition, commonplace in many countries of Europe, is not to be found in the UK. These public services effectively function through well established institutional structures. They are independent but co-ordinated.

At a technical and operational level, the functions of national topographical mapping, land rights registration, land valuation and land use are the responsibility of separate agencies accountable to different departments and ministries.

A further feature of the position in the UK is that for some of these functions the responsibility is separately and independently directed in England and Wales, in Scotland and in Northern Ireland. Each of these jurisdictions have Parliaments or Assemblies with devolved and independent law making powers and departments responsible for particular aspects of public administration.

There is, nevertheless, substantial consistency in the technical practices and procedures across the UK and close co-operation and co-ordination among agencies.

As far as Land Valuation, i.e. the work and developments in the Land Registry of England and Wales and its coordination with other agencies in the UK and Europe, the responsibility for maintaining a record of property valuation rests with the Valuation Office, which is a public Agency of the Treasury (Ministry of Finance).

The Chief Valuer is directly accountable to the Board of Commissioners of the Inland Revenue, who are answerable to the Minister. The Chief Valuer and his staff maintain, by survey, inspection and from other sources, authoritative information on the “annual value” of commercial and residential properties. These assessments take account of ground area, use, location, market value, etc. The Valuation Office uses the large-scale topographic map produced by the Ordnance Survey as an essential element in its valuation records. The valuations are used by Municipalities as the basis for raising local land taxes to finance local services (Manthorpe, 2002).

The Registry pioneered the development of the National Land Information Service (NLIS), whereby customers can access on-line the computerised land information, that is held by a number of public agencies.

The NLIS is a practical example of inter-agency co-ordination among national public sector land agencies. Moreover the delivery of the service partly depends on the channels of access for users being provided by private sector companies. In co-operation with others, the Land Registry financed and its Computer Division developed the prototype system that enabled access to live information, held by a number of key organisations.

NLIS uses the new technologies to bring together on-line and to make available via one portal, all information on particular land and property titles likely to be of interest to intending purchasers and others. The information includes not only that of Land Registry but also that from municipalities on planning applications and other matters, that from the Valuation Office on 10 taxable land values and that relevant from other sources, cross referenced to topographical and address information, held by the Ordnance Survey.

NLIS is now a developing operational system providing live land information to many users. As municipalities progressively apply unique property reference numbers to the properties in their areas so increasingly the coverage of the NLIS is extending.

The responsible agencies have complete control over the maintenance and accuracy of their land information records. The 'Independently Managed Hub', run by a private sector partner, provides the gateway through which the three contracted independent channel companies can provide on-line added value land information services to customers (Collis et al., 2002).

### **Former EU Candidate States**

In the process of institutional approach prior to the integration of EU Candidate States (that nowadays are also EU members, i.e. from 01/05/2004 Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia, from 01/01/2007 Bulgaria and Romania, from 01/07/2013 Croatia), they are implementing, developing or updating their Cadastres, in most cases by using funds provided by EU itself, and need to satisfy the following three requirements :

- 1) to establish a simple model based on territorial properties that generates income from public institutions, above all local governments;
- 2) to advance in the assignment and distribution of the real estate property, by facilitating the access of the occupiers to real estate (that under the previous model of the socialist economy were public properties) and building up a Land Registry;
- 3) to build up an authentic market of real estate, in order to promote the flow of capital and foreign investment in these countries (Durán Boo, 2002).

### **European Land Information Service (EULIS)**

Built up on its NLIS initiative, the UK HM (Her Majesty's) Land Registry for England and Wales is that of one of the nine countries who are founder members of a new initiative to establish a European Land Information Service (EULIS) (Manthorpe, 2002).

Among the objectives of the initiative is to improve access to and expand the use of public sector information about land throughout Europe. The EULIS initiative will address those issues which at present may be a barrier to the free interchange of land information. By so doing the way will be cleared for developing the cross European property and mortgage markets for the benefit of the citizens (Collis et al., 2002).

The objectives of the EU environmental policy are to preserve, protect and improve the environment, protect human health, prudently and rationally use natural resources and promote international efforts aimed at improving the environment itself. The EU environmental policy has gradually been strengthened and the Amsterdam treaty stipulates that sustainable development is a general objective of all Community policies. Nowadays the information hold in land registers is already highly important for environmental protection and control. The Aarhus Convention and the proposal from the Commission for a new Directive on the public access to environmental information, which was presented on 29<sup>th</sup> of June 2000, implies that more of the environmental related information should be presented in the LIS systems. Examples of this are the information about areas created within the Nature 2000 initiative and the information on the impact from radon in different areas at real property level.

The EULIS project will compare how the existing national LIS systems handle environmental-related information and determine the needs, costs and benefits for improving such an information at European level (Ollén, 2002).

EULIS is carried out by nine organisations from different parts of Europe. The project partners are :

- 1) Lantmäteriet (Sweden);
- 2) National Land Survey (Finland);

- 3) HM Land Registry (England and Wales);
- 4) Registers of Scotland (Scotland);
- 5) State Land Cadastre (Lithuania);
- 6) Kadaster (Netherlands);
- 7) Ministry of Justice (Austria);
- 8) Norsk Eiendomsinformasjon as (Norway);
- 9) University of Lund (Sweden) (Kjellson, 2002).

The proposed Directive suggests to build up a legal framework for the establishment and operation of the “Infrastructure for Spatial Information in Europe” (INSPIRE), aimed at formulating, implementing, monitoring and evaluating EU policies, as well as supplying the public sector with territorial information. A key objective of INSPIRE is to increase and improve the spatial data available for EU policymaking and implementation of its policies in Member States. INSPIRE focuses on environmental policy but is also dedicated to other users of territorial information (Durán Boo, 2004a,b).

Similar to what already occurred with the approval of Directive 2003/98/EC of 17 November on the re-use of public sector information, the “proposal for a Directive of the European Parliament and of the Council establishing an infrastructure for spatial information in the Community (INSPIRE)” will deeply influence the activities carried out by the Cadastre in the Member States. Therefore it is advisable that the authorities responsible for cadastral information prepare their institutions for the entry into force of the Directive, by anticipating its effects prior to its approval. This preparatory work should address, at least, to the following aspects :

- the authorities responsible for Cadastre in the Member States should make their information available to all potential users via Internet as soon as possible;
- a review of the definition of the basic cadastral objects, above all the cadastral parcel, used in national laws, should be carried out, based on those unanimously included in several public documents and aimed at achieving a shared one;
- the various existing data models should be studied, in order to reflect on how well they adapt to the new strategies established in the proposed Directive;
- it is needed to review the procedures and criteria established to limit the access, download and re-use of information and, above all, the fee and licence policies, as well as the intellectual property rights and the limitations to data access (this aspect of the project is commonly known as “business model”).

The Annex III to the “proposal for a Directive of the European Parliament and of the Council establishing an infrastructure for spatial information in the community (INSPIRE)” contains the following spatial data themes referred to in articles 9(B) and 14(B) of the proposal itself :

- 1) statistical units, i.e. units for referencing census or other statistical information;
- 2) buildings, i.e. geographical location of buildings;
- 3) soil, i.e. soils and subsoil characterised according to depth, texture, structure and content of particles and organic matter, stoniness and, eventually, mean slope and forecasted water storage capacity;
- 4) geology, i.e. geology characterised according to composition and structure; it includes bedrock and geomorphology;

- 5) Land Use, i.e. territory characterised according to its current and future functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry and recreational);
- 6) human health and safety, i.e. geographical distribution of occurrence of diseases directly (e.g. epidemics, spread of diseases, health effects due to environmental stress, air pollution, chemicals, depletion of the ozone layer and noise) or indirectly (e.g. food, Genetically Modified Organisms and stress) linked to the environment quality;
- 7) government service and environmental monitoring facilities, sites for governmental services, location of hospitals and medical treatment locations, schools, kindergartens, etc.; they include sewage, waste and energy facilities, production sites and environmental monitoring facilities operated by or for public authorities;
- 8) production and industrial facilities, industrial production sites; they include water extraction facilities, mining and storage sites;
- 9) agricultural and aquaculture facilities, farming equipment and production facilities (including irrigation systems, greenhouses and sheds);
- 10) population distribution - demography, i.e. geographical distribution of people aggregated by grid, region, administrative unit or other analytical unit;
- 11) area management/restriction/regulation zones & reporting units, i.e. areas managed, regulated or used for reporting at European, national, regional and local levels; they include landfills, restricted areas around drinkable water sources, nitrate vulnerable zones, regulated (golf) fairways at sea or large inland waters, OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) areas for the dumping of waste, noise restriction zones, digging and mining permit areas, river basin districts, OSPAR reporting units and coastal zone management areas;
- 12) natural risk zones, i.e. vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity and frequency, can seriously affect the society), e.g. floods, landslides, avalanches, forest fires, earthquakes and volcanic eruptions;
- 13) atmospheric conditions, i.e. physical conditions in the atmosphere; they include spatial data based on measurements or models or a combination thereof, as well as measurement locations;
- 14) meteorological geographical features, i.e. weather conditions and their measurements, i.e. precipitation, temperature, evapo-transpiration, wind speed and direction;
- 15) oceanographic geographical features, i.e. physical conditions of oceans (e.g. currents, salinity, wave height);
- 16) sea regions, i.e. physical conditions of seas and saline water bodies divided into regions and sub-regions having common characteristics;
- 17) bio-geographical regions, i.e. areas having relatively homogeneous ecological conditions and common characteristics;
- 18) habitats and biotopes, i.e. geographical areas characterised by specific ecological conditions and physically supporting the organisms that live there; they include terrestrial or aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural, as well as small features of the rural landscape (e.g. hedgerows and brooks);

- 19) species distribution, i.e. geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit (EU, 2007).

## **Conclusions**

The knowledge of the cadastral models in EU Member States is a fundamental condition for the harmonisation of Soil Cadastre at EU level as an inventory for environmental, social, economic, legal and taxation purposes.

An unique Cadastre at EU level would allow to address the CAP according to the implementation of the following best practices by land owners :

- agricultural mechanisation aimed at environmental protection, i.e. prevention or remediation for soil compaction (Carrara et al., 2003, 2005a, 2007, Comparetti et al., 2013) and/or erosion (Raimondi and Interrante, 2014);
- precision agriculture aimed at reducing crop inputs and, therefore, environmental impact (Carrara et al., 2004, 2005b, Comparetti, 2011);
- prevention from fires or reforestation (Raimondi and Cangelosi, 2013).

During the “First Congress on Cadastre in the European Union” (15-17 May 2002), the “Declaration on Cadastre in the European Union” was presented as a project aimed at assembling in a single document the common elements that would allow the definition of a future EU cadastral model.

This Declaration consists of the following twelve principles or groups of ideas, each addressing a specific aspect of the cadastral model desirable for Europe, among which there is the following :

9) the authorities responsible for the Cadastre in Member States will work together for promoting the increased use of cadastral information in the application of EU policies in each country, that should be based on territorial information; the new CAP will be aimed at providing farmers who are environmental protectors with a prize (tax deduction) and charging the expenses of the increased environmental impact to farmers who damage the environment (tax addition), according to the updated Italian cadastral certificate proposed by Raimondi (2017).

In this perspective the owner of each cadastral parcel will be promoted as a sustainable agricultural and/or livestock and/or forestry producer, i.e. an environmental protector of the current society.

On the other hand, for urban areas the concepts of sustainable use and sustainable green were conceived as deriving from that of sustainable development (Brundtland, 1987): it, in summary, considers the environmental, economic and social aspects of the development, i.e. a development coherent with the current and future needs of inhabitants.

The sustainable urban green is defined as a green area whose natural or artificial (as consequence of green operations, e.g. pruning) development produces wealth and/or does not cause damages to people, animals, plants and movable and immovable assets. For this purpose the sustainable urban green integrates the information on cadastral map and certificate, by including everything is above and below (e.g. electricity lines, communication networks, pipes of drinkable water, drainage water and sewage sludge) the ground surface, and the parts of hydrographical network (i.e. lakes, narrow valleys, streams and rivers) (Raimondi, 2018).

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## MODÈLES CATASTAL DANS LES ÉTATS MEMBRES DE L'UE

### Résumé

Les cadastres sont liés au sol et sont une création de l'homme comme effet de sa relation avec la terre. Les différentes conditions du cadastre dans 14 États membres de l'UE, y compris les États candidats de l'UE (qui sont actuellement également membres de l'UE), figurent dans ce travail.

La moitié des États membres de l'UE conservent les données cadastrales et d'enregistrement dans la même base de données.

Dans l'UE, il y a deux modèles de registre foncier :

1) le modèle de l'Europe centrale (au-delà de la zone du "Grundbuch" germanique), dans laquelle le cadastre émerge comme base graphique;

2) le modèle latin, dans lequel le cadastre est seulement comme un instrument fiscal.

Le cadastre foncier de l'Union européenne est surtout constitué de particules et seulement quelques États Membres il y a un cadastre urbain.

**Mots-clés:** *Cadastre agricole, Land Registry, GIS, INSPIRE, EULIS.*

## MODELLI CATASTALI NEGLI STATI MEMBRI DELL'UE

### Riassunto

I Catasti sono sempre relativi al terreno: sono una creazione dell'uomo come effetto della sua relazione con il terreno. Le diverse condizioni del Catasto in 14 Stati Membri dell'UE, compresi gli ex Stati Candidati UE (che attualmente sono anche Membri UE), sono mostrate in questo lavoro. Metà degli Stati membri dell'UE conservano dati catastali e di registrazione nello stesso database.

Fondamentalmente nell'UE esistono due modelli catastali originari, correlati con sistemi di registrazione dei terreni (Land Registry):

1) modello dell'Europa Centrale (aldilà dell'area del "Grundbuch" germanico), in cui il Catasto emerge come una base grafica (foglio di mappa) della registrazione dei terreni (Land Registry), per cui le modifiche fisiche devono essere riflesse nel Catasto e quelle legali devono essere riflesse nel Land Registry, mantenendo un perfetto parallelismo;

2) modello latino, in cui il Catasto emerge solo come uno strumento fiscale, utile per raccogliere tasse sui terreni.

Il Catasto dei Terreni (Land Cadastre) nell'UE è quasi sempre particellare e comprende un Catasto urbano (dei fabbricati) soltanto in pochi Stati. Inoltre lo European Land Information Service (EULIS) è mostrato come il risultato di un progetto condotto da nove partners di otto Stati Membri UE. La conoscenza dei modelli catastali negli Stati Membri dell'UE è una condicio sine qua non per l'armonizzazione del Catasto del Suolo a livello UE come un inventario per scopi ambientali, sociali, economici, legali e fiscali.

**Parole chiave:** *Catasto Terreni, Land Registry, GIS, INSPIRE, EULIS.*