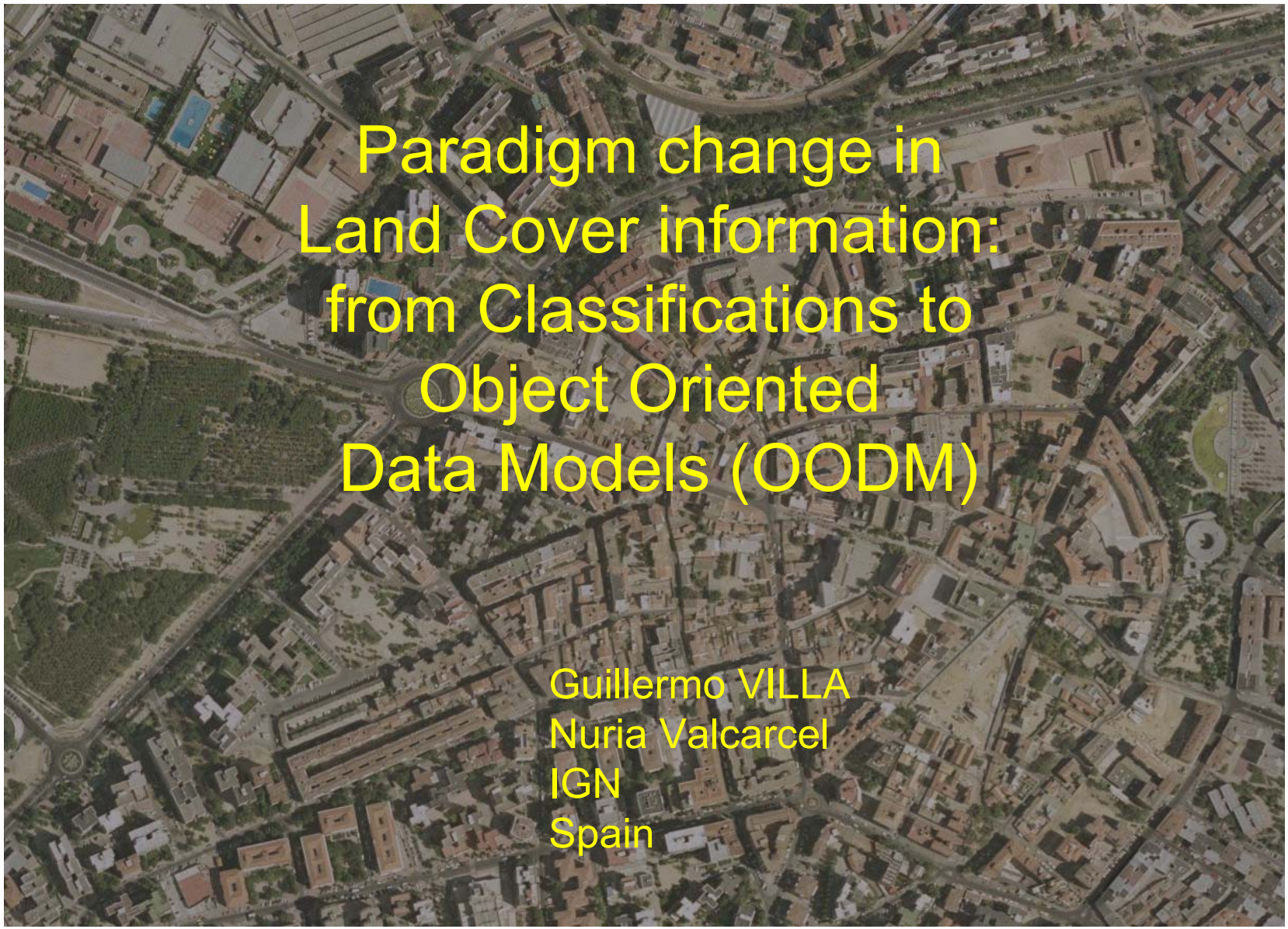

Paradigm change in Land Cover information: from Classifications to Object Oriented Data Models (OODM)

Guillermo VILLA
Nuria Valcarcel
IGN
Spain

CISIS Roma, 10 November 2009

❖ Outline

1. **Preface: Database of "people"**
2. Problems of Land Cover classifications
3. New solution: Parametric Object Oriented Land Cover databases
4. Can OO-LU/LC DB help the Bottom-Up approach?
5. Adequacy to Inspire and GMES needs

Suppose we need to build a database of “**people**”,
and we decide to **use a classification**

❖ 3 characteristics considered for “people”:

Characteristic	Possible values	Number of possible values
1. gender	- man - woman	2
2. height	- tall - medium height - small	3
3. weight	- fat - medium weigh - thin	3

Characteristic	Possible values	Number of possible values
1. gender	- man - woman	2
2. height	- tall - medium height - small	3
3. weight	- fat - medium weigh - thin	3

Classification ⇨ **Number of classes = 2 * 3 * 3 = 18**

❖ "Classification" of people

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Nomenclature with: 2 * 3 * 3 = 18 classes

1. **Men**
    - 1.1. **Tall** men
        - 1.1.1. Tall and **fat** men
        - 1.1.2. Tall and **medium-weight** men
        - 1.1.3. Tall and **thin** men
    - 1.2. **Medium height** men
        - 1.2.1. Medium height and **fat** men
        - 1.2.2. Medium height and **medium-weight** men
        - 1.2.3. Medium height and **thin** men
    - 1.3. **Small** men
        - 1.3.1. Small and **fat** men
        - 1.3.2. Small and **medium-weight** men
        - 1.3.3. Small and **thin** men
2. **Women**
    - **2.1.Tall** women
        - 2.1.1. Tall and **fat** women
        - 2.1.2. Tall and **medium-weight** women
        - 2.1.3. Tall and **thin** women
    - 2.2. **Medium height** women
        - 2.2.1. Medium height and **fat** women
        - 2.2.2. Medium height and **medium-weight** women
        - 2.2.3. Medium height and **thin** women
    - 2.3. **Small** women
        - 2.3.1. Small and **fat** women
        - 2.3.2. Small and **medium-weight** women
        - 2.3.3. Small and **thin** women

But there are many other possible characteristics to be considered:

- nationality
- age
- study level
- work
- residence
- eyes color
- hair color
- diseases
- marital status
- number of sons
- hobbies
- religion
- etc, etc, etc…..

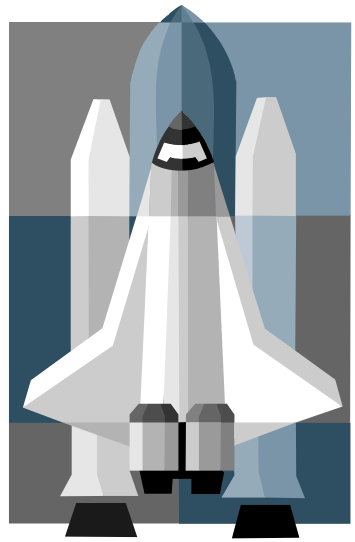
What would be the **number of classes** needed to store all this information ?

$250 * 100 * 4 * 100 * 250 * 5 * 4 * 20 * 4 * 10 * 20 * 10 =$

$250 * 100 * 4 * 100 * 250 * 5 * 4 * 20 * 4 * 10 * 20 * 10 =$

$= 8{,}000{,}000{,}000{,}000{,}000$

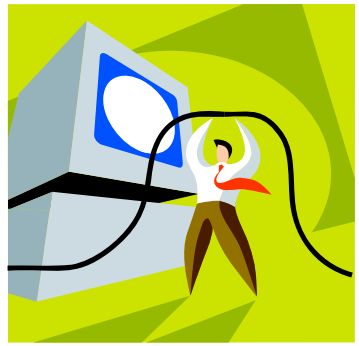
$= 8 * 10^{15}$ classes !!



- Would these classes be **useful** in practice?
- Would it be possible to **implement** them in an information system?

$\Rightarrow$ **NO !**

❖ This is called by computer engineers the ‘class explosion’ problem



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❖ "Classification" of people

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Land Cover Classifications

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1. ARTIFICIAL AREAS	1.1. Urban fabric:	1.1.1. Continuous urban fabric: Most of the land is covered by structures and transport network. Buildings, roads and artificially surface areas cover more than 80% of the total surface. Non-linear areas of vegetation and bare soil are exceptional	1.1.1.1 Residential continuous dense urban fabric. Residential structures cover more than 80% of the total surface. More than 50% of the buildings have three or more stories.
			1.1.1.2 Residential continuous medium dense urban fabric. Residential structures cover more than 80% of the total surface. Less than 50% of the buildings have three or more stories.
			1.1.1.3 Informal settlements
		1.1.2 Discontinuous urban fabric Most of the land is covered by structures. Buildings, roads and artificially surface areas are associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. Between 10% and 80% of the land is covered by residential structures.	1.1.2.1 Residential discontinuous dense urban fabric. Buildings, roads and artificially surface areas cover between 50% and 80% of the total surface area of the unit.
			1.1.2.2 Residential discontinuous sparse urban fabric. Buildings, roads and artificially surface areas cover between 10% and 50% of the total surface area of the unit. The vegetated areas are predominant by but is not land dedicated to forestry or agriculture.
			1.1.2.3 Residential urban blocks
			1.1.2.4 Informal discontinuous residential structures

This is the same methodology used in Land Cover Classification databases. E.g: Corine LC, Moland, Anderson,…

❖ Problem 1: Information lost

Information stored in the database is **much less** than information acquired by the photointerpreter:

*E.g.: The **photointerpreter** evaluates a certain polygon's **trees percentage** as **75 %**, and in consequence he labels it as Corine 3.1.1. "Broad-leaved forest".*

*… But **the user only receives** the information that trees are "**more than 30 %**"*

❖ Problem 2: Spatial variations not registered

Important **spatial variations** in certain parameters values **do not appear** in the database if this variations do not “cross” the “threshold line”

- *E.g.: Urban areas with **very different levels of building densities** (as **10 %** and **50 %**) have to be assigned to the **same Moland class** (1.1.2.2. Residential discontinuous sparse urban fabric.)*

❖Problem 3:
Temporal changes not registered

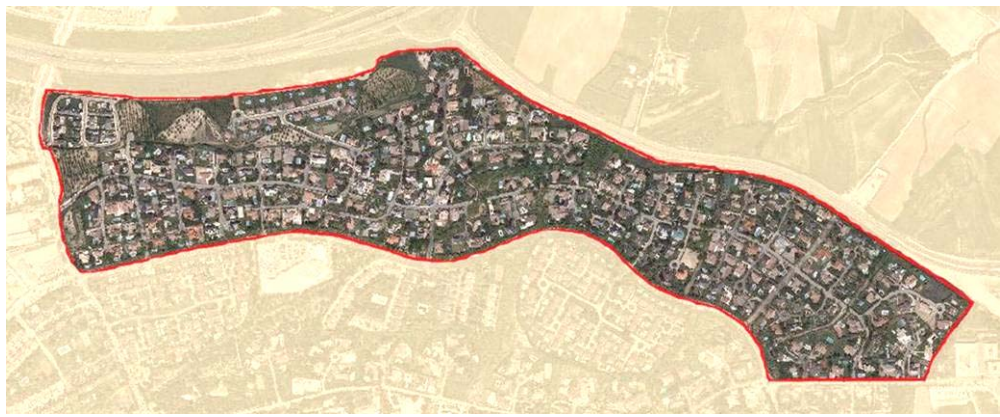
- If these changes do not “cross” the “**definition rule**” threshold.

*E.g.: If the **building density** of a polygon has **increased from 11% to 79 %** this polygon is labeled as Corine´s 1.1.2. “Discontinuous urban fabric”, in both databases, and so*

no change is registered.

and/or:

- These changes are “hidden” in polygons assigned to **dominant classes** or to **mixed classes**.



Change not registered !!

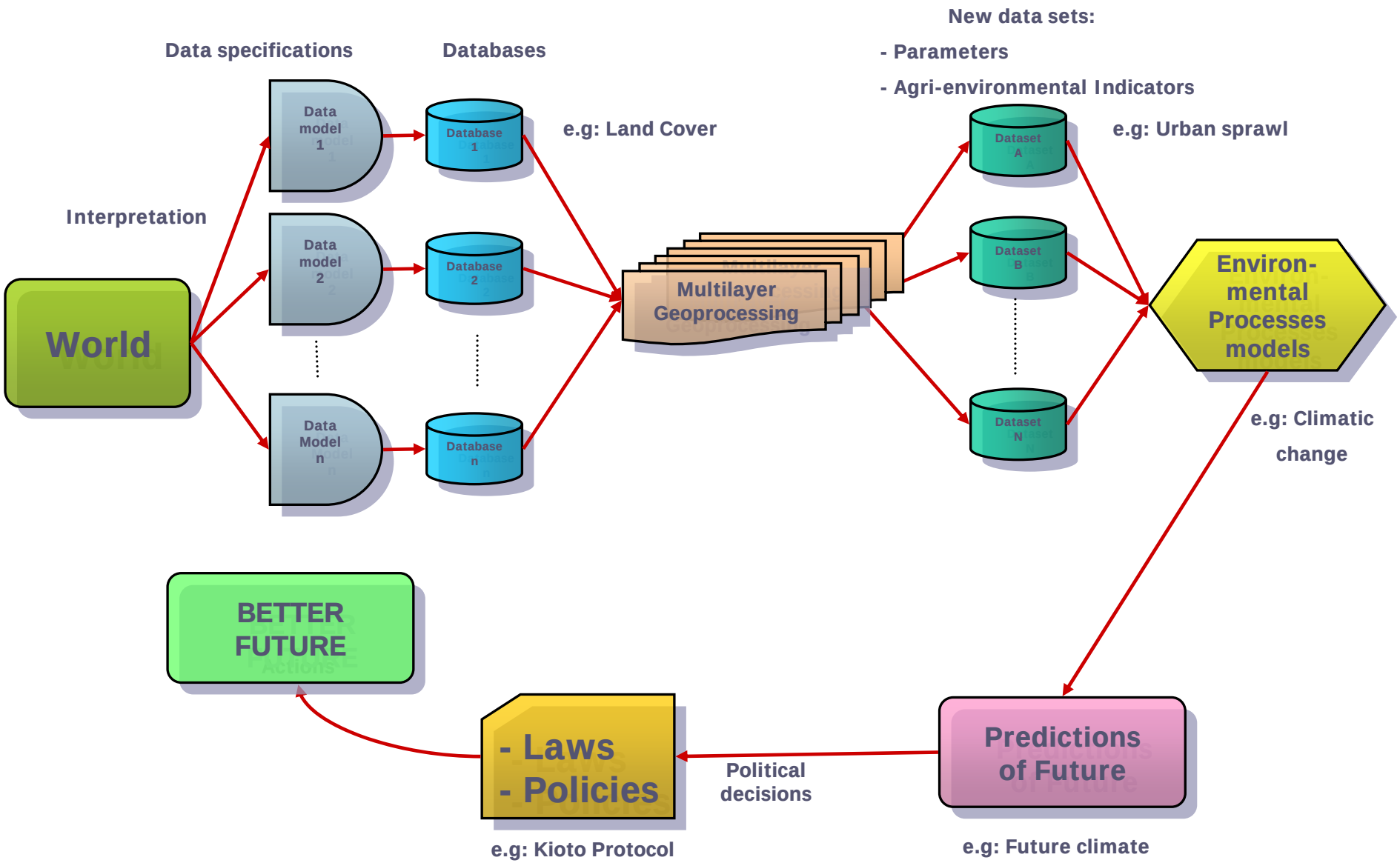
❖ Problem 4: Parameters and Indicators calculations not possible

Many **parameters** and "**Indicators**" could be **calculated from the values** of the parameters appearing in class definitions (sometimes "crossing" them with exogenous information such as population, etc…). *Eg:*

- ***building density*** *(m^3/m^2)in an area*
- *m^2 of* ***building per person*** *in an area*
- ***average height*** *of buildings in a town*
- *% of* ***impervious surface*** *in an area*
- ***% of trees*** *in a forest*
- *m^2 of* ***green areas per person*** *in an area*
- ***land take by*** *transport infrastructures in a city*
- *etc…*

Land Cover Classifications **do not allow calculating** these indicators, because de **real values** of the different parameters are **not stored in the database (only "intervals")**:

❖ Need for calculation of parameters and Indicators



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❖ **Parametric** database of “people”

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People

- **Gender**: controlled list (man, women)
- **Height** (m): real
- **Weigh** (Kg): real
- **Nationality**: controlled list (country table)
- **Age** (years): integer
- **Study level**: controlled list
- **Work**: controlled list
- **Residence**: text
- **Eyes color**: controlled list
- **Hair color**: controlled list
- **Diseases**: controlled list
- **Married**: boolean
- **Number of sons**: integer
- **Hobbies**: controlled list
- **Religion**: controlled list

❖ One **instance** of “people”

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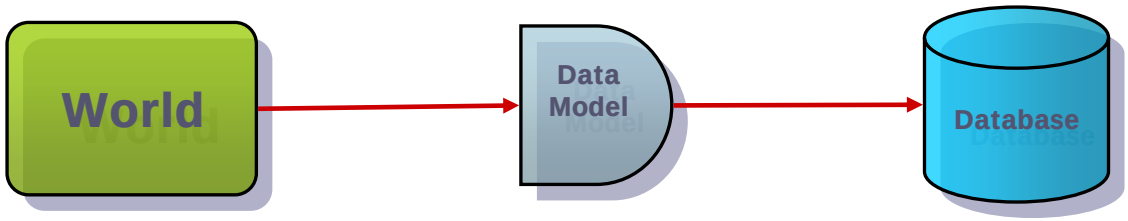
John Smith

- **Gender**: man
- **Height** (m): 1.77
- **Weigh** (Kg): 82.6
- **Nationality**: USA
- **Age** (years): 52
- **Study level**: University
- **Work**: Engineer
- **Residence**: San Diego, CA
- **Eyes color**: brown
- **Hair color**: blond
- **Diseases**: none
- **Married**: yes
- **Number of sons**: 2
- **Hobbies**: golf, sailing
- **Religion**: protestant

❖What is a Data Model ?

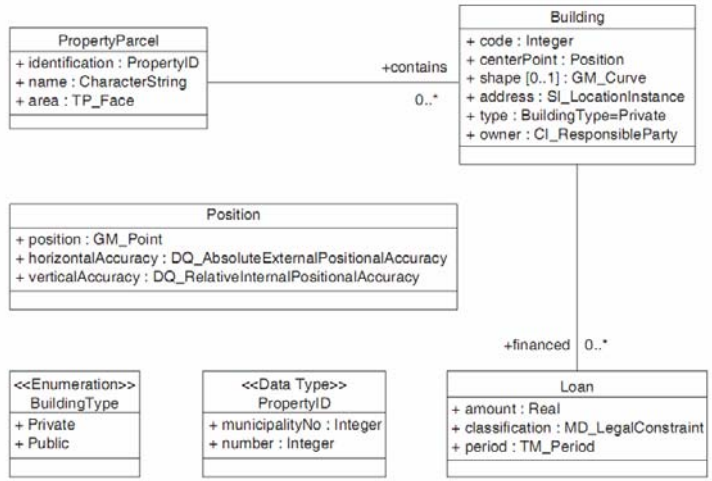
- A **data model** is the description of what we are storing in a database and how.
- It is the "**link**" between reality and the Database



What is a Object Orientation ?

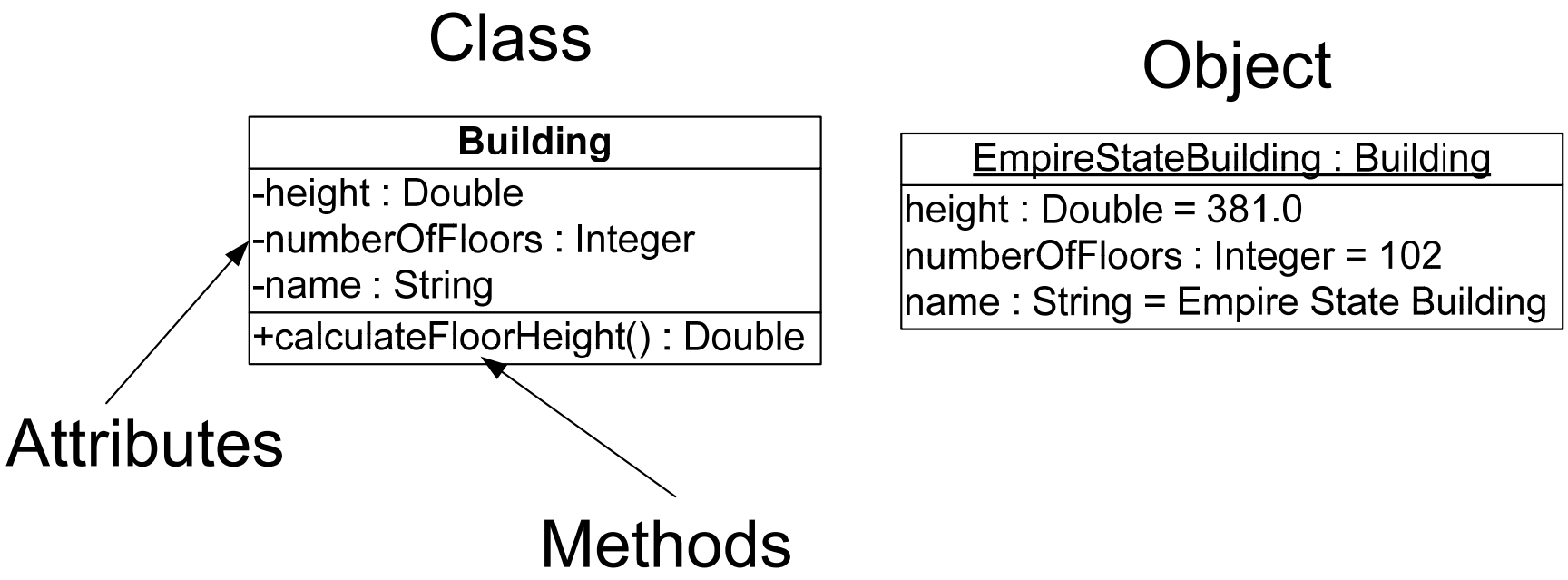
- "**Object Orientation**" is the standard in Computer Science today
- **Parametric Object Oriented Data Models** (POODM) are used extensively in every type of databases and **Information Systems** (airports, hospitals, production facilities,..)….

….including "some" **GIS** databases



UML (Unified Modeling Language)

- The standard for Object Oriented Models
- Used by ISO in its standards



- Principal relationships between classes:
  - **Inheritance** (Generalization / Specialization): A class **inherits** (or specializes) the **state** and **behavior** of another class
  - **Aggregation**: allows to capture the **structural relationships** among entities in the real world (part-of)
  - **Association**: allows to capture other kinds of relationships among entities in the real world

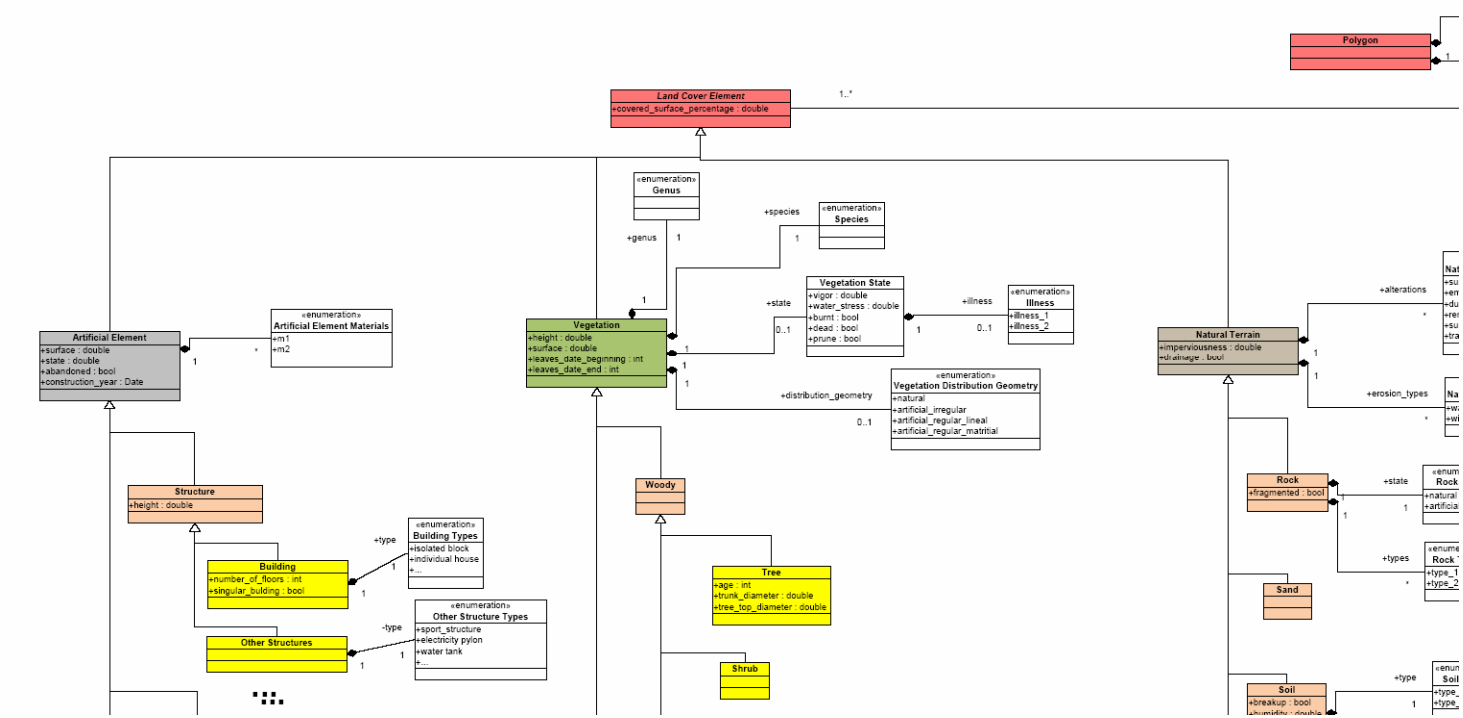
❖ International Geographic Standards:

ISO International Organization for Standardization

- Object-Oriented, Feature Data Models are mandatory in ISO 19109 (called “Application Schemas”)

- They are also mandatory in Inspire INSPIRE “Generic Conceptual Model” (Document 2.5 v3.1)

INSPIRE - Infrastructure for Spatial Information in Europe



- ✓ **UML** (Universal Modeling Language) lets us express, store, modify, extend,… this structure easily and make it understandable by anybody

❖ Object Orientation for Land Cover Information

- Land Cover has been **traditionally** modeled (**Corine**, **Moland** Andersons,…) using classifications, legends, nomenclatures….

- Up to now OODM **have not been used** for Land Cover Information

Land Cover Classifications (Moland legend)

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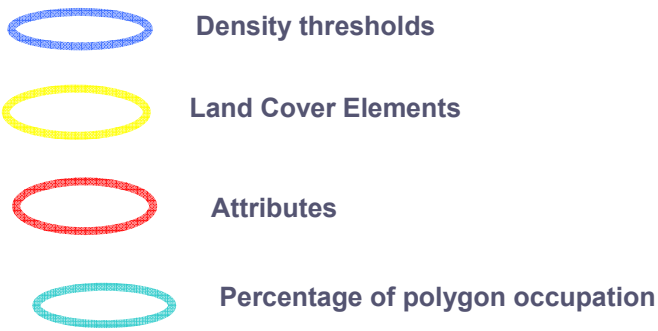
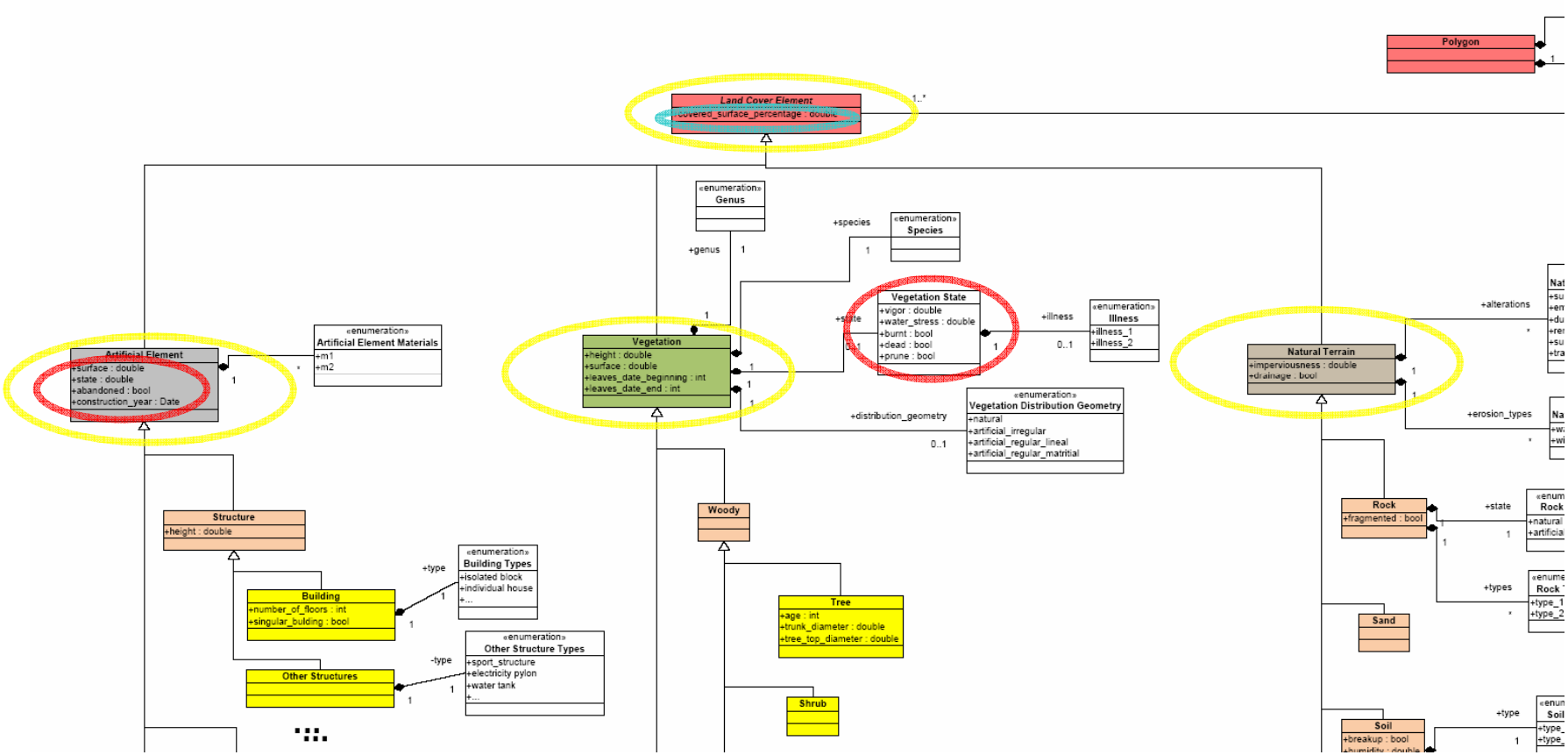


Parametric object oriented data model



Land Cover elements:

- complete
- structured
- explicit
- extensible

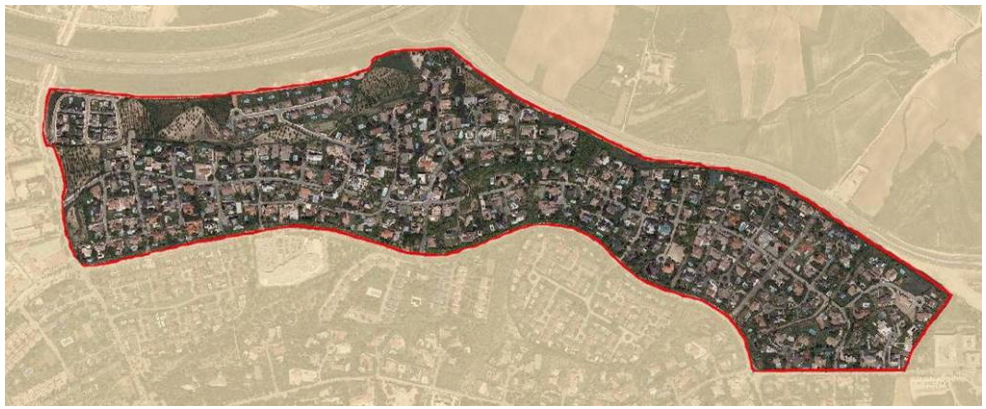
Attributes:

- complete
- structured
- explicit
- exact values measured and stored in database
- extensible

Percentage of polygon occupation:

- explicit
- expressed rigorously:
  (type: real, integer, boolean, list,…)
- exact values measured and stored in database

❖ Basic principles of Object Oriented Land Cover Databases:



- We do not "**classify**" polygons. We **describe** polygons
- Each polygon has one or more "**Land covers**" (LC)
- We store in the database the **% of the polygon occupied** by each "Land cover"

❖ Examples

1 homogeneous polygon:

Land cover 1.1.2: Artificial areas. Urban fabric.

Discontinuous urban fabric

(100 % of polygon's surface)

Land Cover Elements in it:

- Buildings (50 %)
- Roads (15 %)
- Trees (deciduous) (20 %)
- Herbaceous vegetation (10 %)
- Swimming pools (5 %)

❖ Ejemplo de Determinación de los “LC Elements”

Airborne Laserscanning data - DSM

© ALS Daten zur Verfügung gestellt vom Amt der Kärntner Landesregierung. Ausschnitt Klagenfurt

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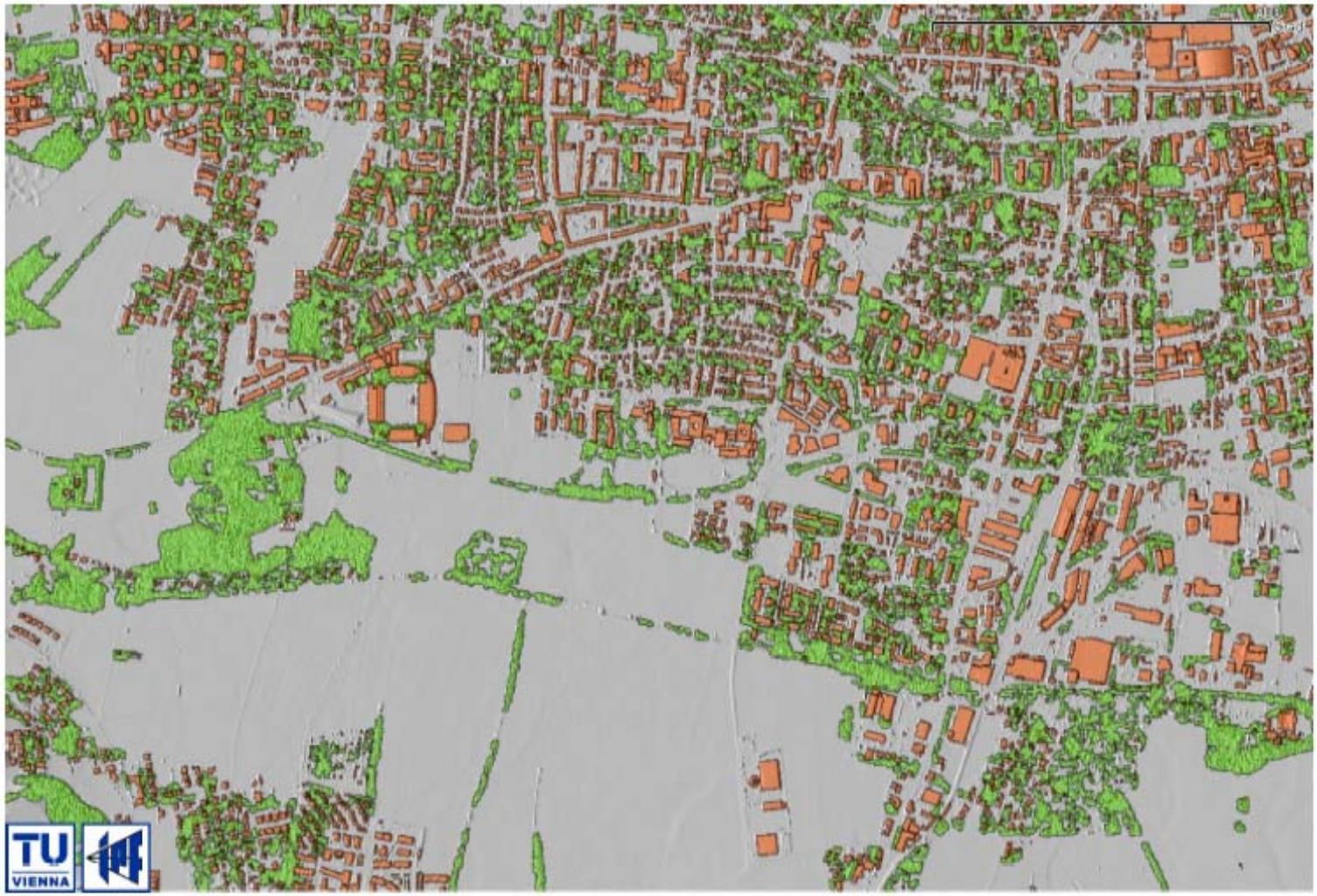
❖ Ejemplo de Determinación de los “LC Elements”

Building and vegetation layer



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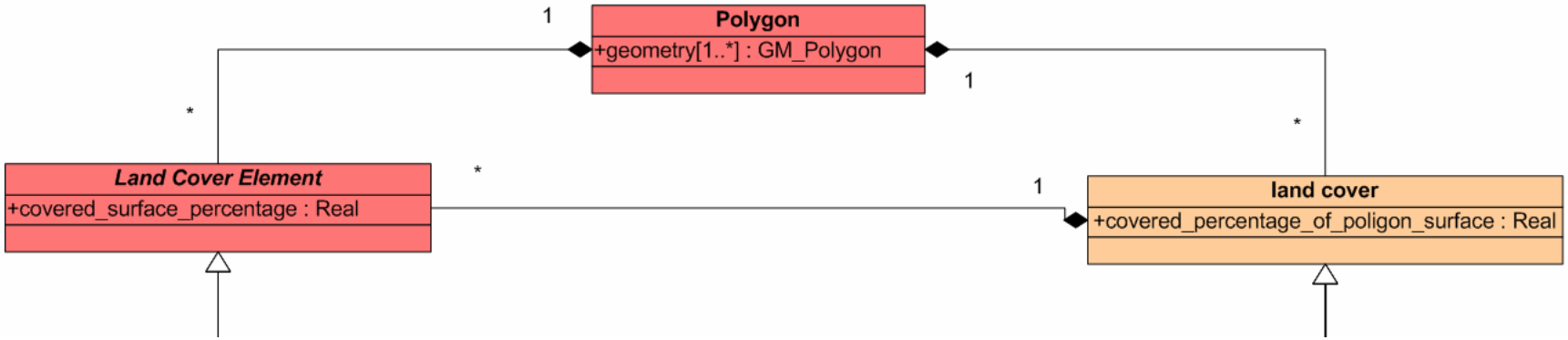
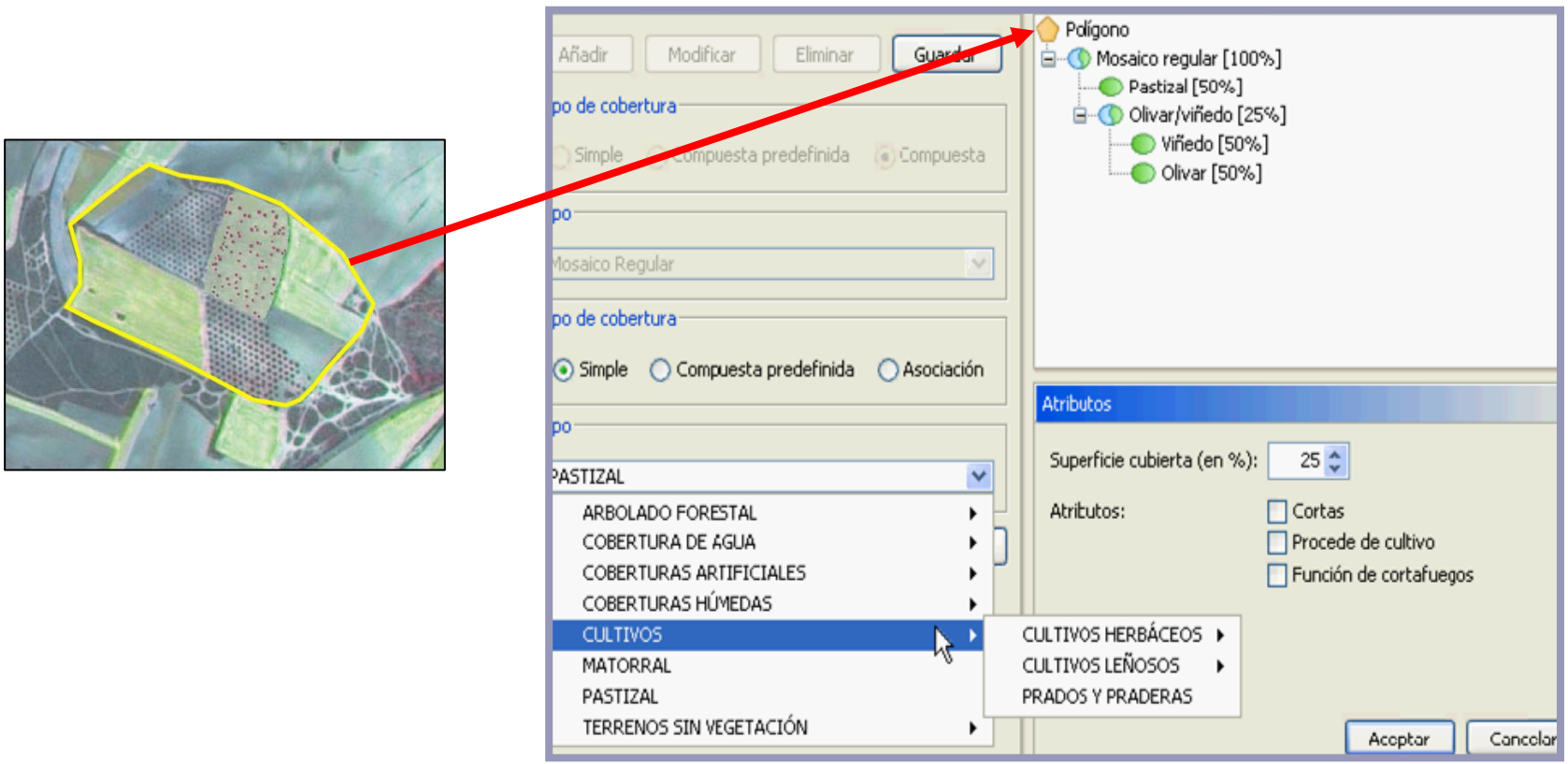
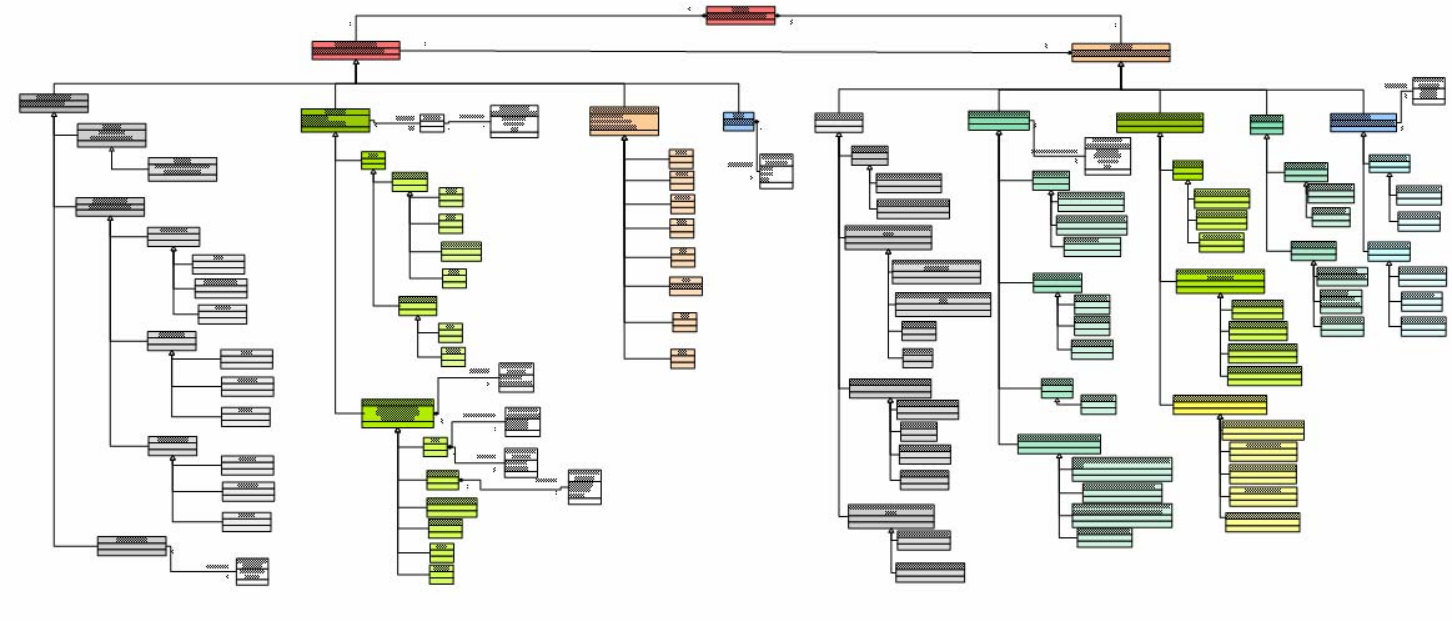


- Land Covers are made up of "**Land Cover Elements**" (**LCE**)
- We store in the database the **% of each land cover** occupied by each LCE.
- Each LC and LCE can have "**attributes**"
- The **actual values** of all attributes for each LC and LCE are **stored** in the database

- The use of POODM for Land Cover Information has been developed, tested and is working in the Spanish SIOSE Project, which is in advanced production phase
  (finishing by end of 2009)



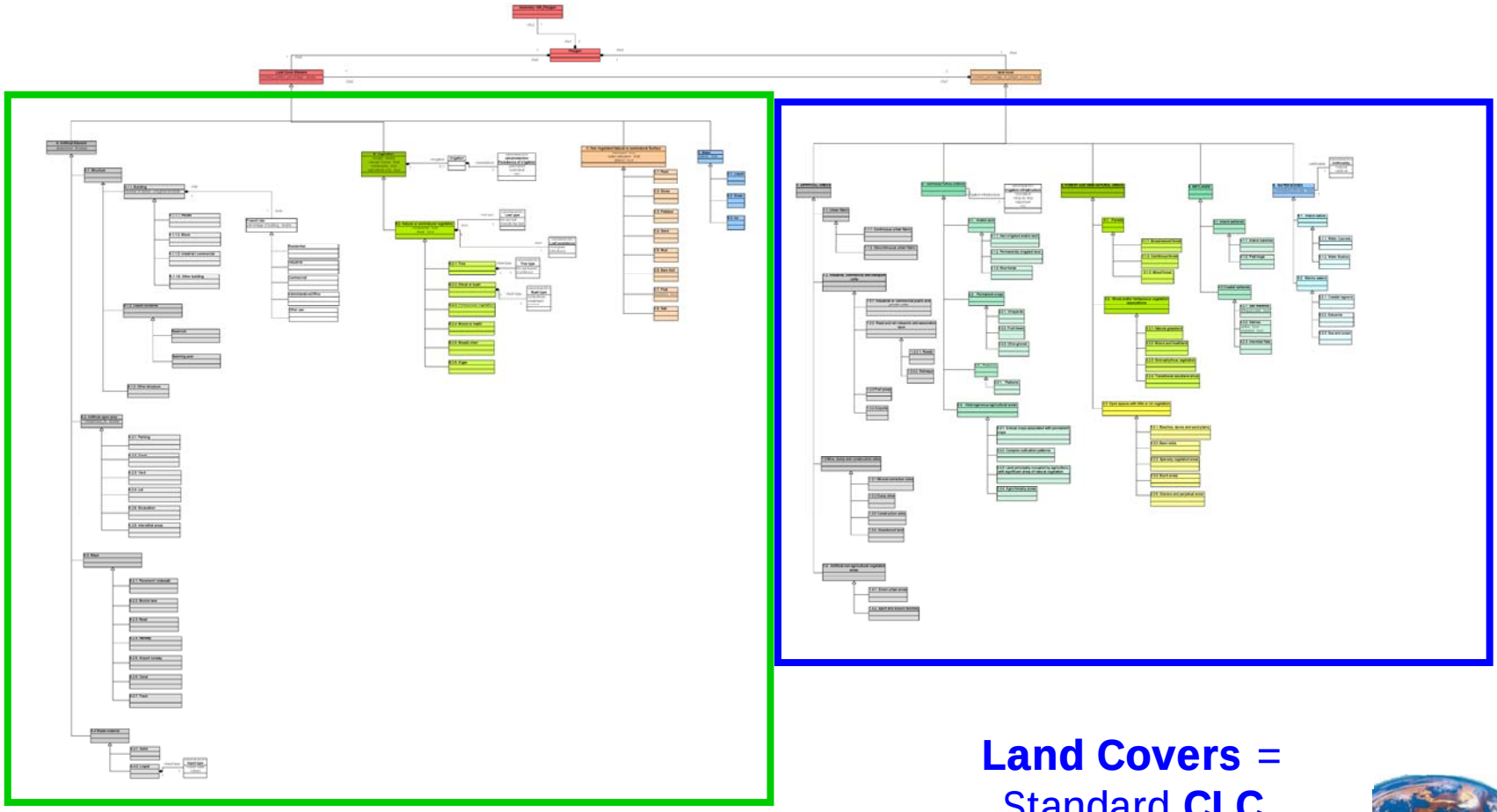
A physical implementation (Relational **Database** and an **Application to fill it**) according with data model specifications have been developed and are in use in SIOSE production



We are presenting here an “evolution” of SIOSE Data Model, “Corine Land Cover Object Oriented Data Model” CLC-OODM designed to allow for:

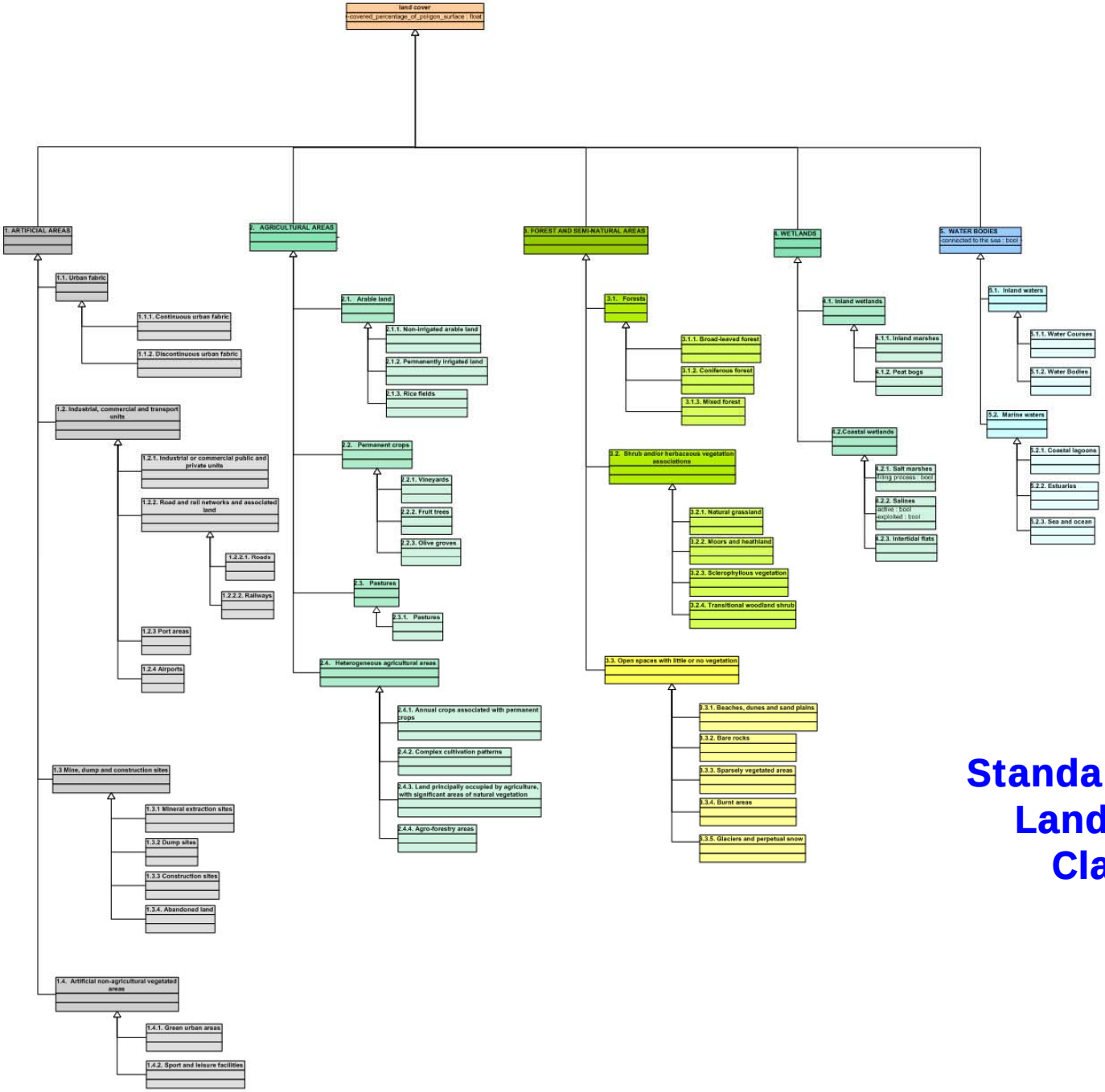
- Maximum compatibility with standard Corine Land Cover Databases
- Maximum reuse of existing information
- Easy migration path from CLC classifications to Parametric databases

Corine Land Cover –Object Oriented Data Model

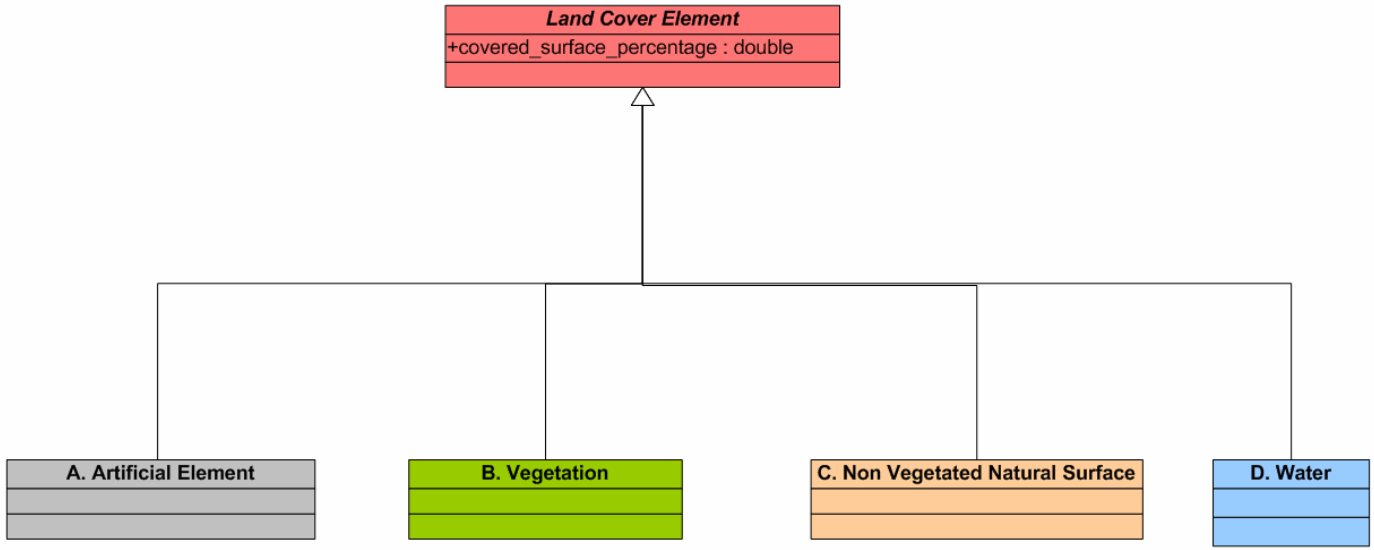


Land Cover Elements: features of other Inspire theme(with reduced semantic level of detail)

Land Covers = Standard **CLC** Nomenclature, in **UML**

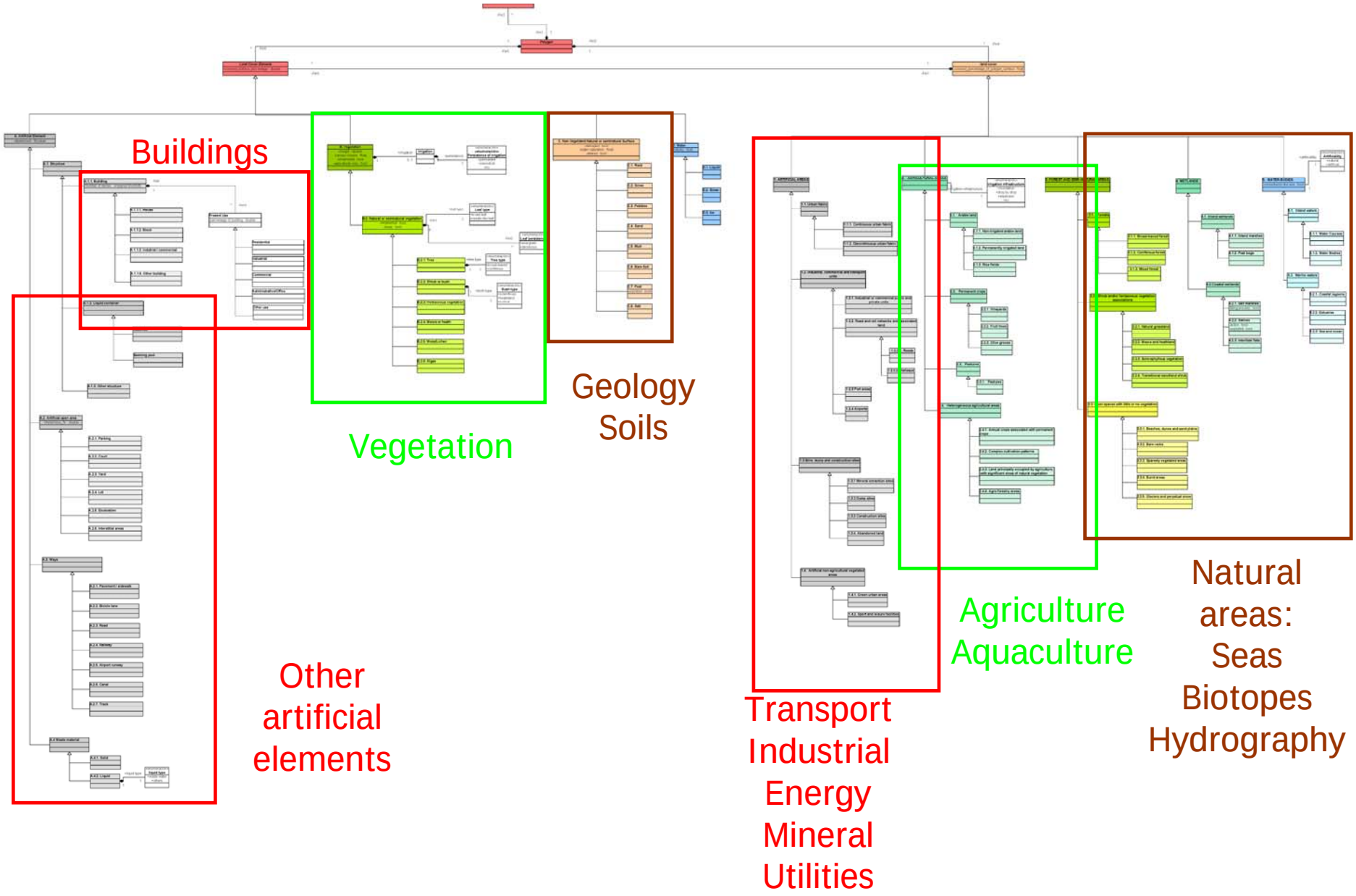


Standard Corine Land Cover Classes



Land Cover Elements (only 1st level presented)

❖ Land Cover overlaps with most other GI Themes



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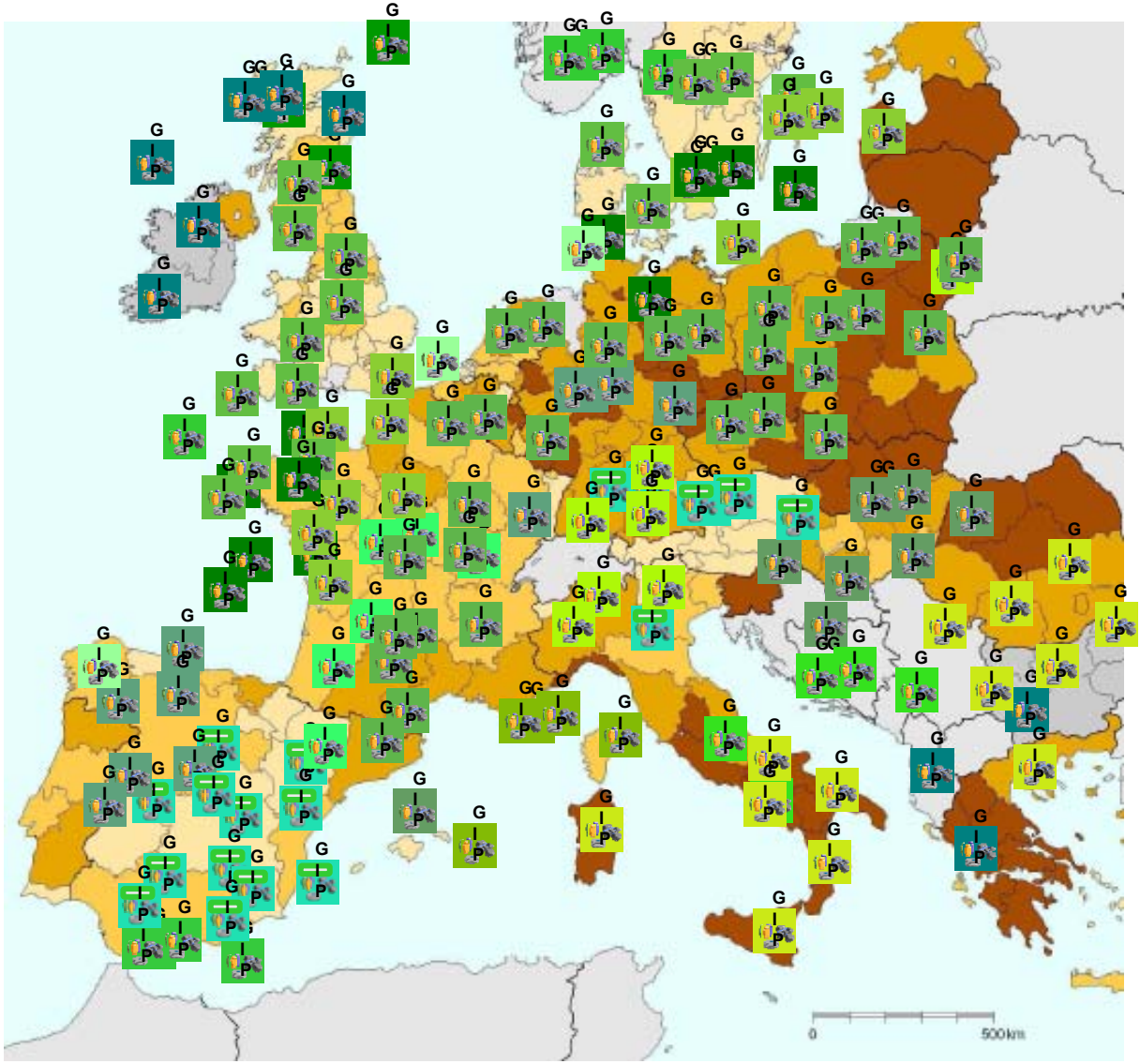
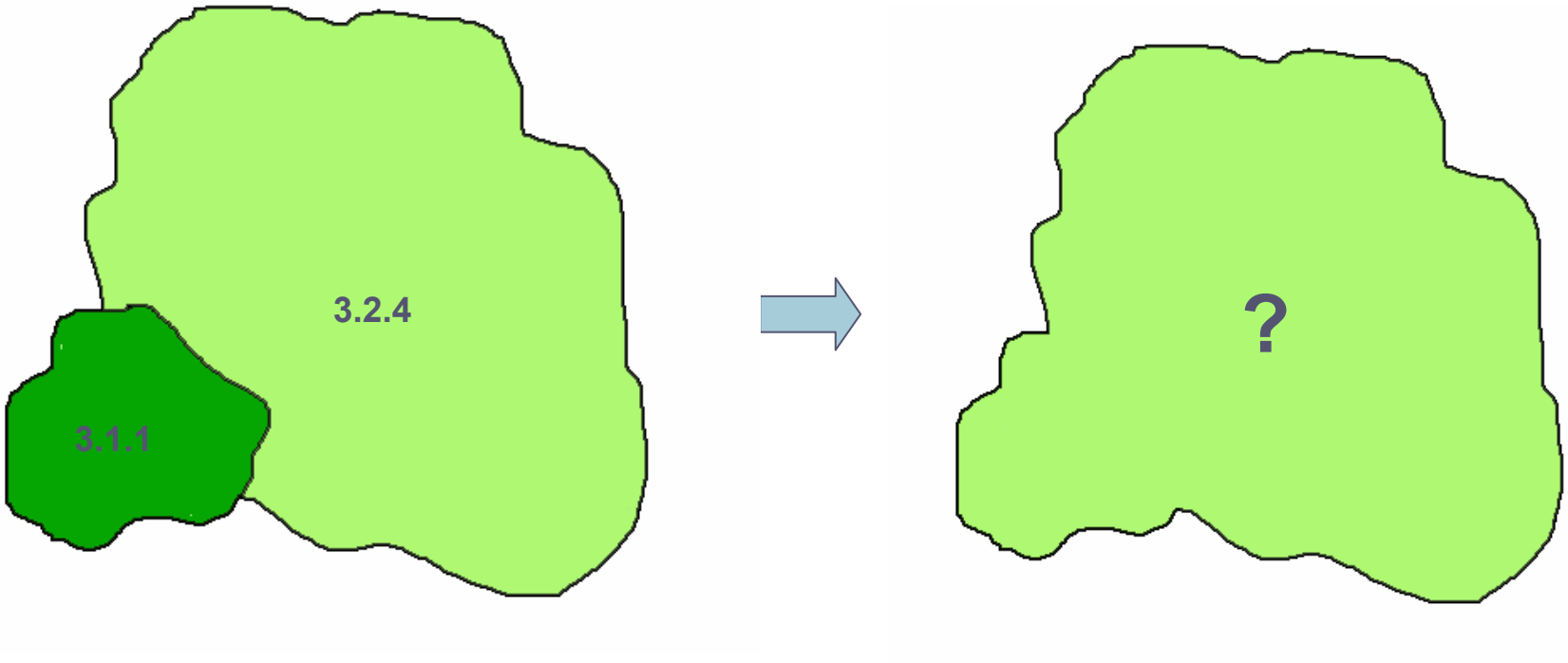


19 * 39 ≈ **741** **Regional LU/LC** Databases in Europe

LU/LC Classifications

Generalization problem:



3.1.1. Broad leaved forest (**Trees ≥ 30 %**)

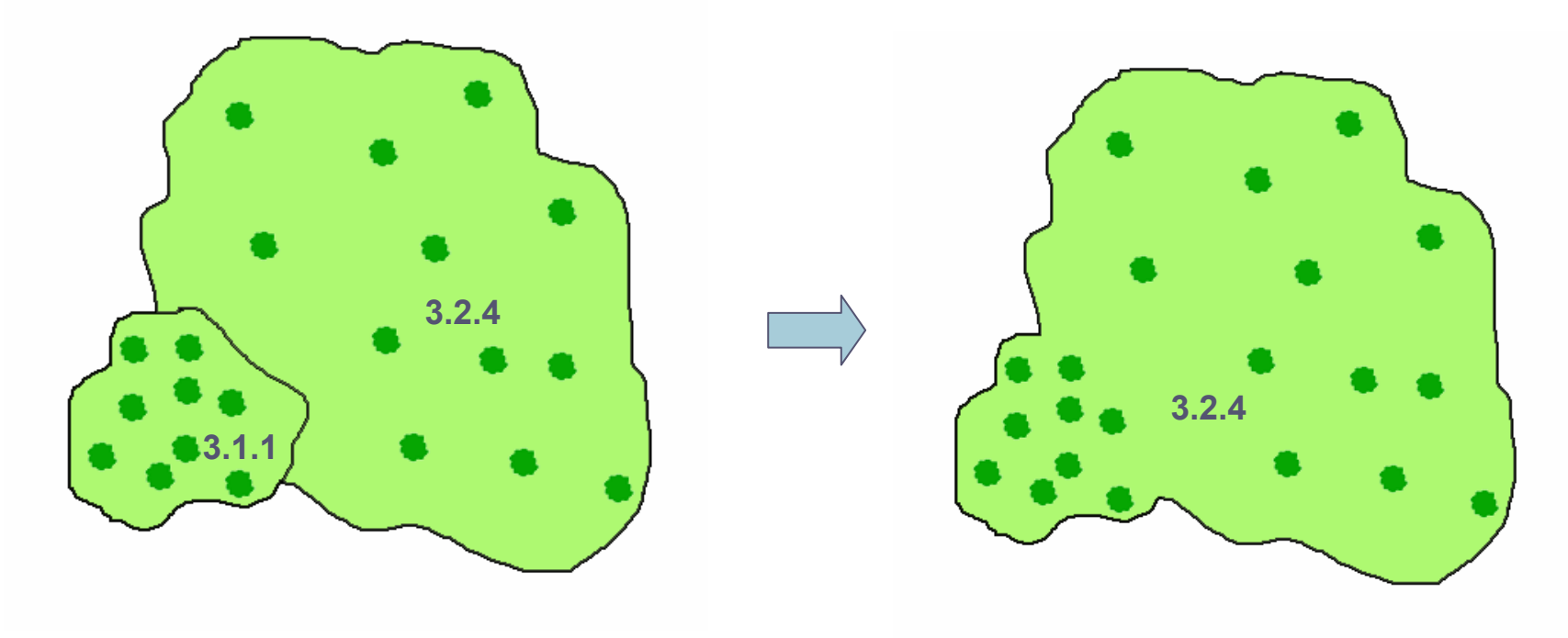
3.2.4. Transitional woodland (**Trees < 30 %**)

The merged polygon is of **unknown class**.

We have to **repeat the Photo interpretation**

Object-Oriented LU/LC Databases

Generalization possible: e.g: CLC-OO Databases



3.1.1. Broad leaved forest (**Trees = 48 %**)

Polygon surface = 15 Ha

3.2.4. Transitional woodland (**Trees = 14 %**)

(Polygon surface = 60 Ha

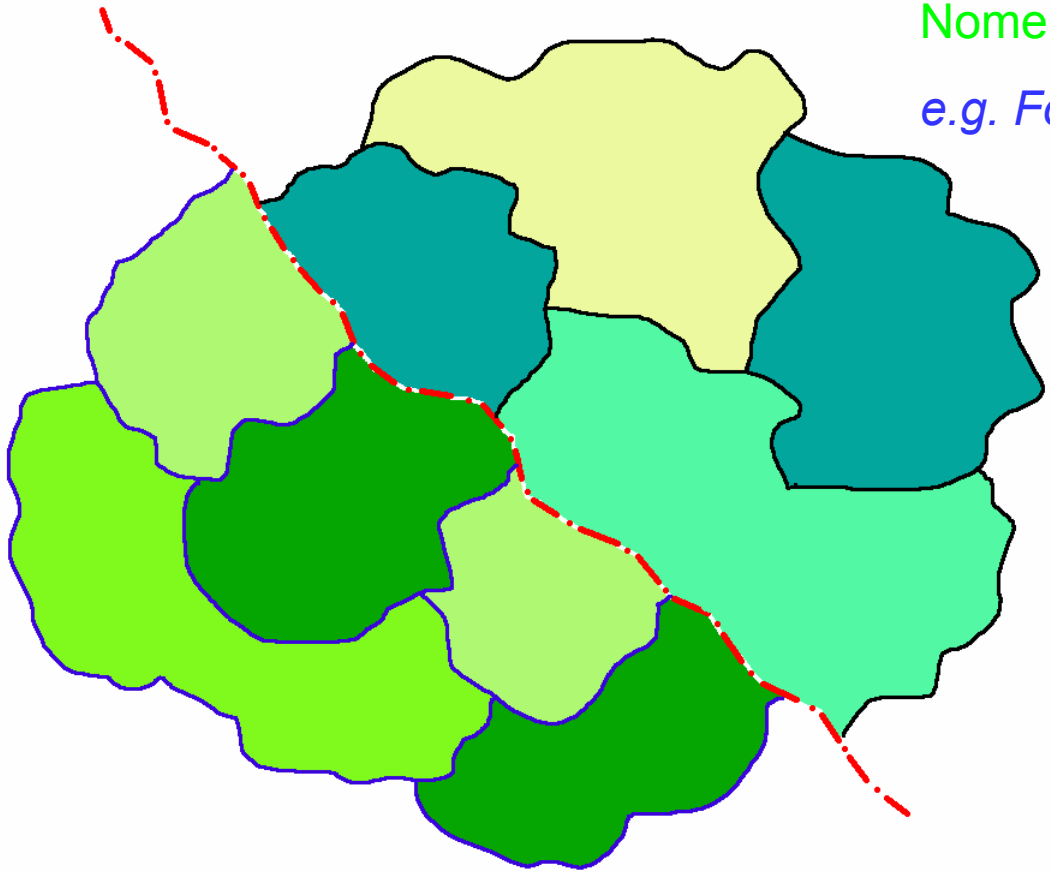
Merged Polygon surface = 15 + 60 = **75 Ha**

% Trees = (15*48 + 60*14)/ 75= **20.8 %**

→ **3.2.4. Transitional woodland with Trees = 20.8 %**

LU/LC Classifications

Mosaicking problems:



Region 1:

Land Cover Nomenclature 1

e.g. Forest = trees ≥ 30 %

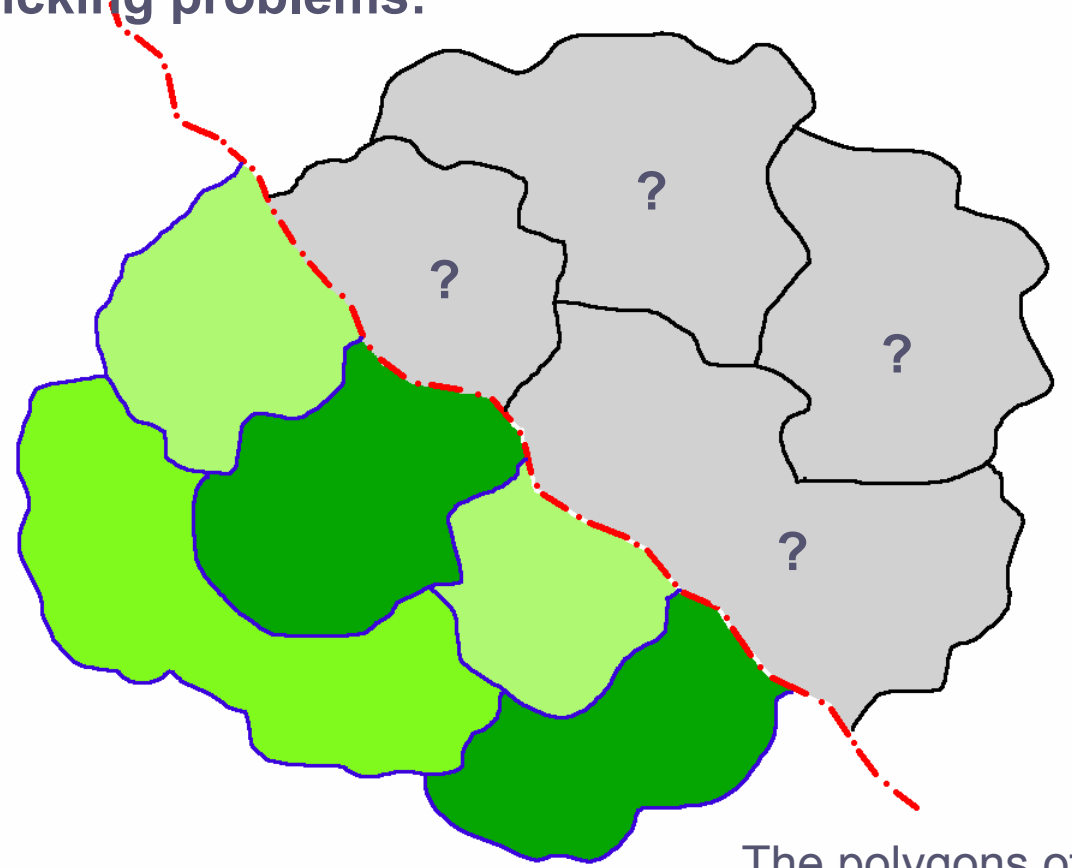
Region 2:

Nomenclature 2

e.g. Forest = trees ≥ 50 %

LU/LC Classifications

Mosaicking problems:



The polygons of the database with a different nomenclature are of unknown class

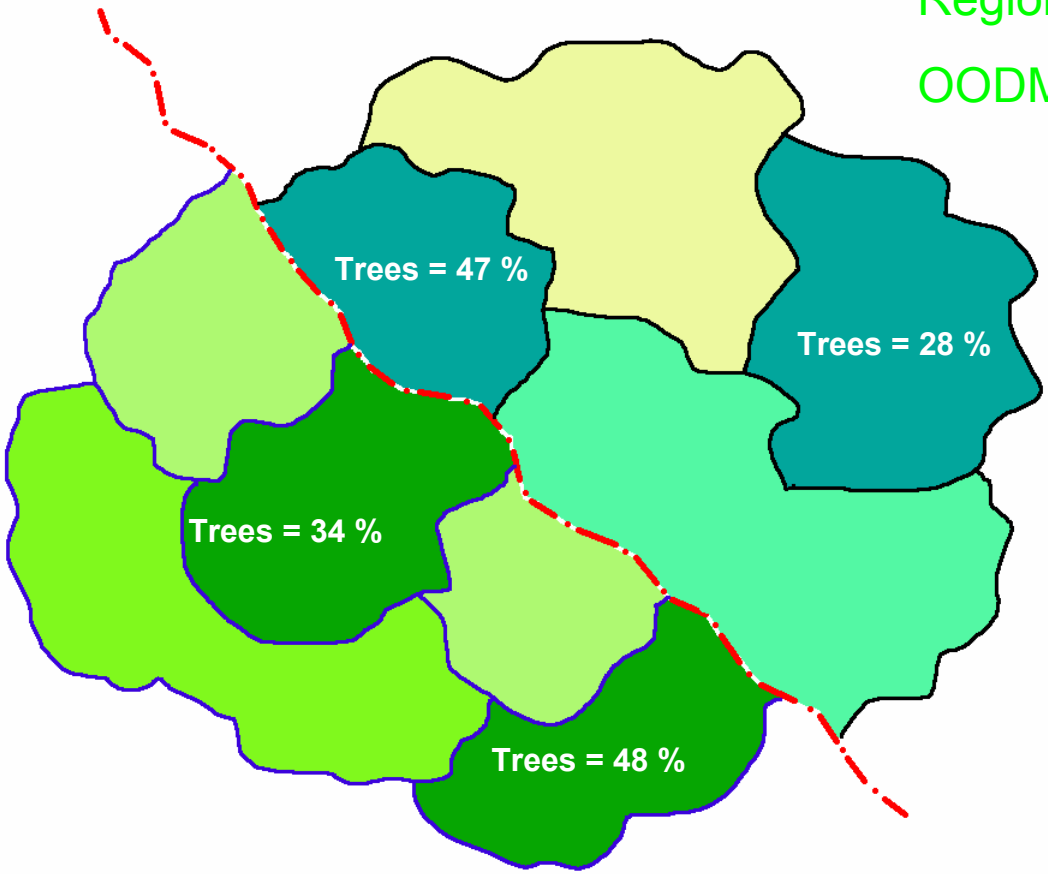
We have to **repeat the Photo interpretation**

Object-Oriented LU/LC Databases

Mosaicking possible:

Region 2:

OODM / “Profile 2”

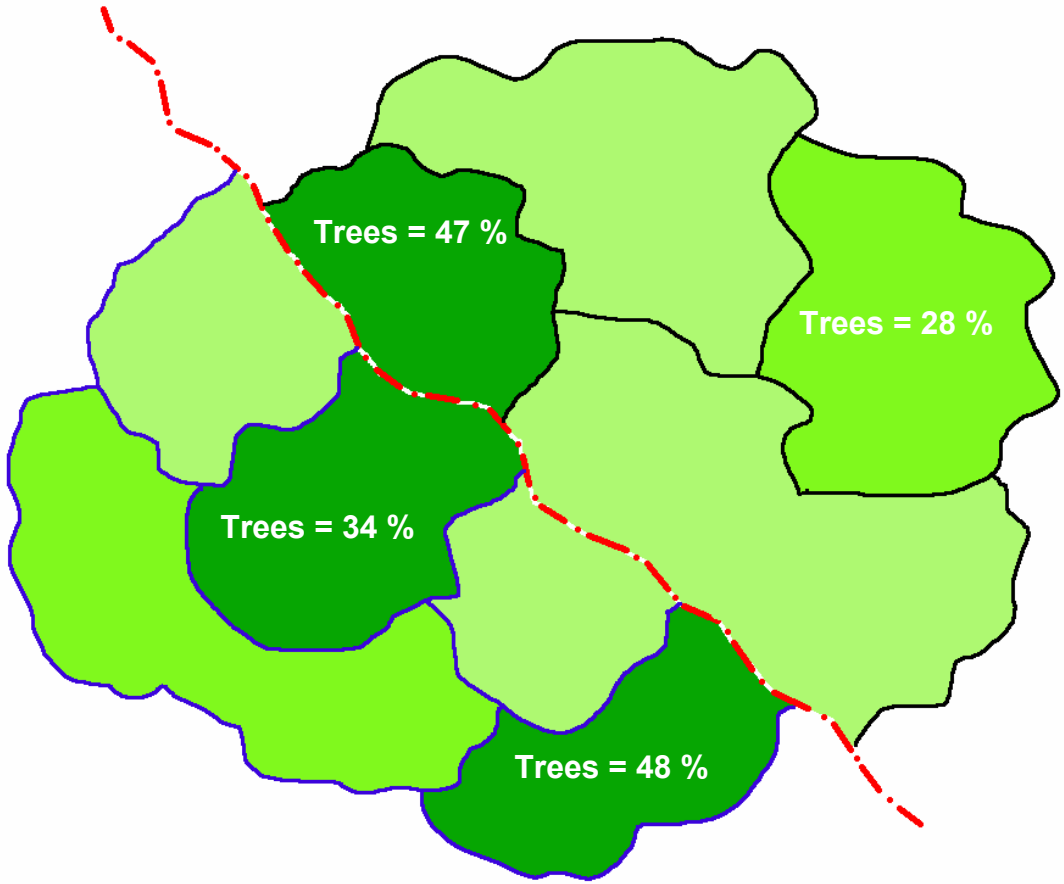


Region 1:

OODM / “Profile 1”

As we know the exact percentages of Land Cover Elements….

We can merge the common part of both "Profiles"



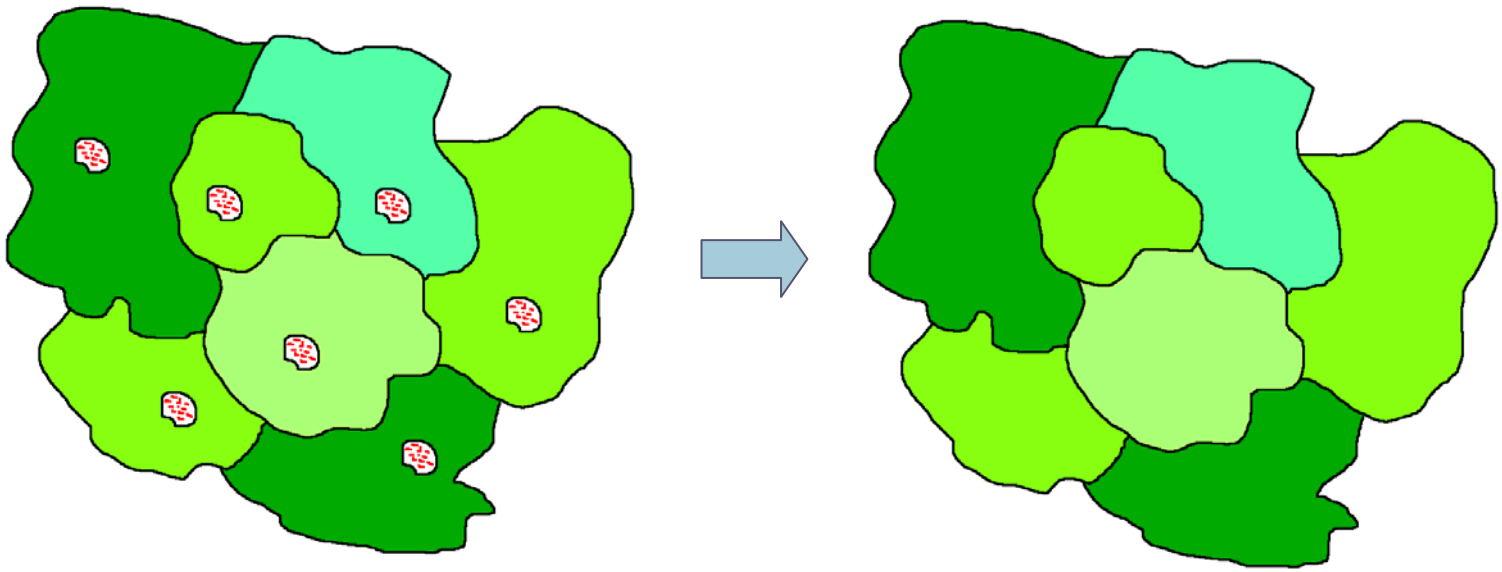
And assign the correct Land Covers

MINISTERIO DE FOMENTO
DIRECCIÓN GENERAL DEL INSTITUTO GEOGRÁFICO NACIONAL

LU/LC Classifications:

Statistical Inconsistencies between

high resolution and low resolution databases



High resolution (national) classification database:

10 % of region is 1.1.1. "Continuous urban fabric"

But all polygons (< 25 Ha: LR MMU)

Low resolution (European) classification database:

0 % of region is 1.1.1. "Continuous urban fabric)

Because Polygons have been assigned to dominant classes

❖ Outline

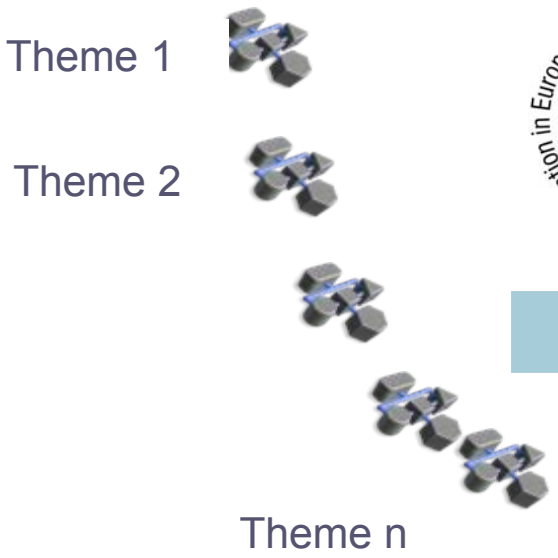
1. Preface: Database of “people”
2. Problems of Land Cover classifications
3. New solution: Parametric Object Oriented Land Cover databases
4. Can OO-LU/LC DB help the Bottom-Up approach?
5. **Adequacy to Inspire and GMES needs**

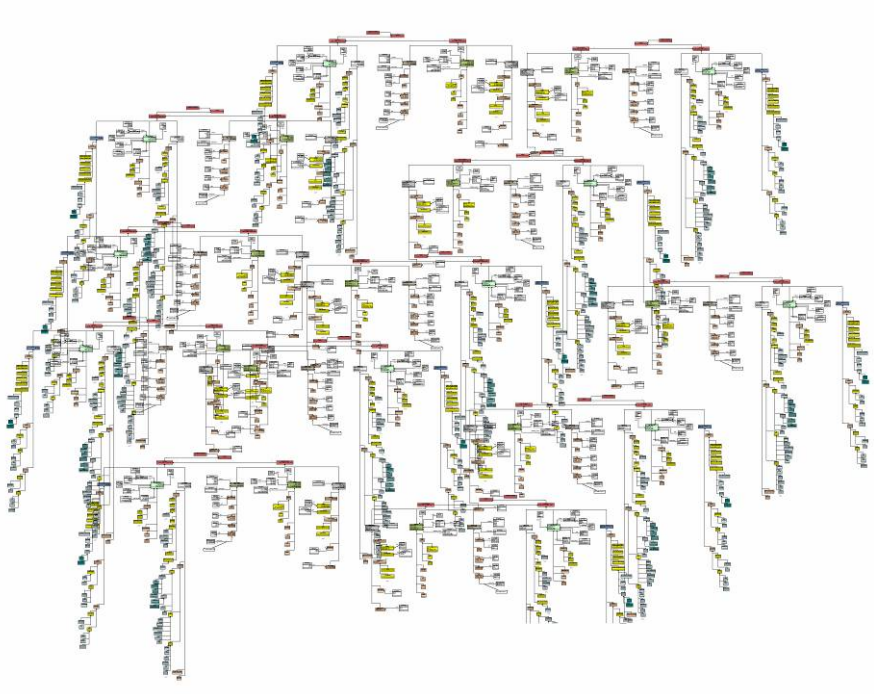
Needs	Land Cover/Use classifications	Object Oriented Data Models
1. Spatial generalization	NO *When we aggregate polygons into bigger ones, there is **no way to** automatically **derive the class** of the resultant polygon*	YES
2. Multirresolution coherence	NO *Classes in polygons **smaller than MMU disappear during generalization***	YES
3. Mosaicking of different existing Land Cover databases possible	NO *There is **no way to know de label** of a polygon in a DB with a different Nomenclature*	YES *One can merge existing OOLCDB to a common POODB*

Needs	Land Cover/Use classifications	Object Oriented Data Models
4. Integration with remote sensing automatically derived parameters (Top-Down approach)	NO *Each polygon has a single attribute: the class label*	YES *The mean of continuous value variables for each polygon´s area can then be input and stored in the OODM database as a parameter that qualifies each polygon*
5. Indefinite Extensibility	NO *- Proliferation of unusable classes, due to the multiple "crossings" of several classification criteria* *- It is impossible to add external information from a specialized field to a HC database*	YES *One can add new features and attributes as needed*
6. Allow for different update periods	NO *Each polygon has a single attribute: the class label. Is has to be updated at once*	YES *One can update certain "Land covers", Land Cover Elements or Attributes of an Object Oriented database more frequently. E.g:* *- urban fabric: 1 year* *- forest trees: 5 years*

Needs	Land Cover/Use classifications	Object Oriented Data Models
7. Perfect change detection	NO *Changes in polygons **not registered** unless they cross the "Class limit" values*	YES *Any variation in the composition or attributes of a polygon can be registered*
8. ISO 19109 compliance	NO *They are not **Feature Data Models (Application Schemas)*** *(**The same for FAO's LCCS**)*	YES *An OO-LCDM can easily be an ISO19109 FDM (Application Schema)*
9. INSPIRE "Generic Conceptual Model" (Document 2.5 v3.1) compliance	NO *They are not ISO 19109 compliant* *(**The same for FAO's LCCS**)*	YES *An OO-LCDM can easily be ISO19xxx compliant (Application Schema). You need to use UML 2.1*

- The use of FDM to model every geospatial theme is the only way to assure compatibility between them, and to make it possible to develop a "Consolidated Data Model" (CDM) of all Geospatial Information (GI) themes

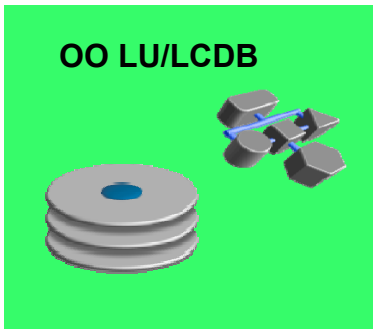




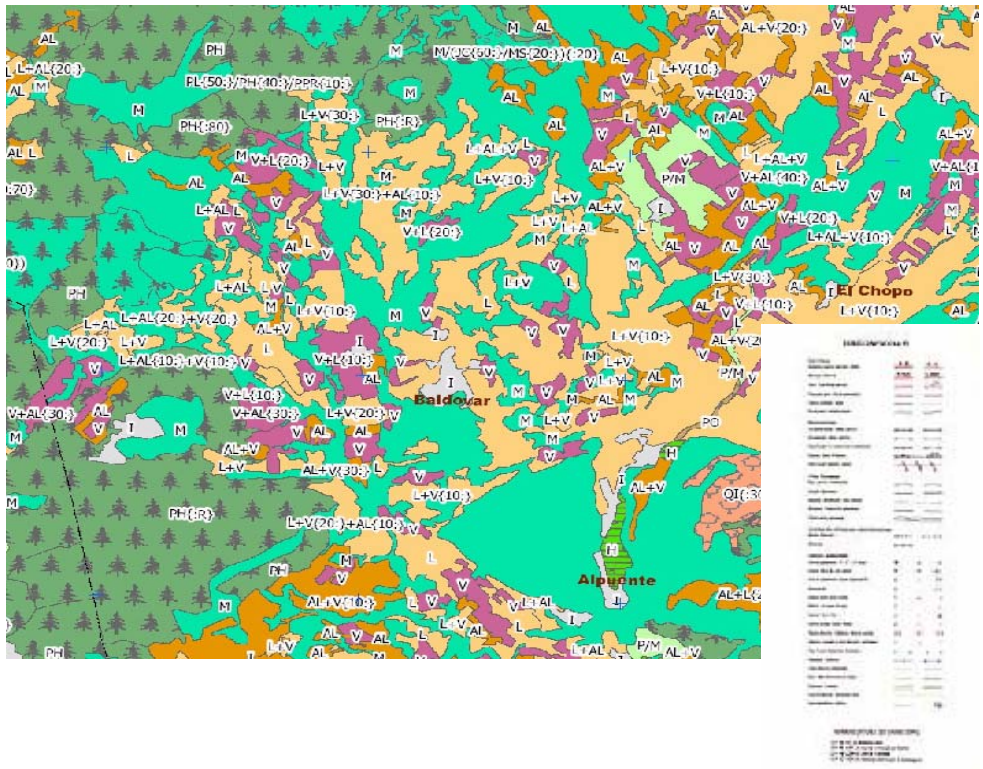
- INSPIRE is going to develop a CDM to integrate the different GI themes (in Annexes 1 to 3)

❖ “Backward” compatibility

- From an Object Oriented LU / LC Database, **standard classifications** can be **derived** by making appropriate **SQL queries** to the database

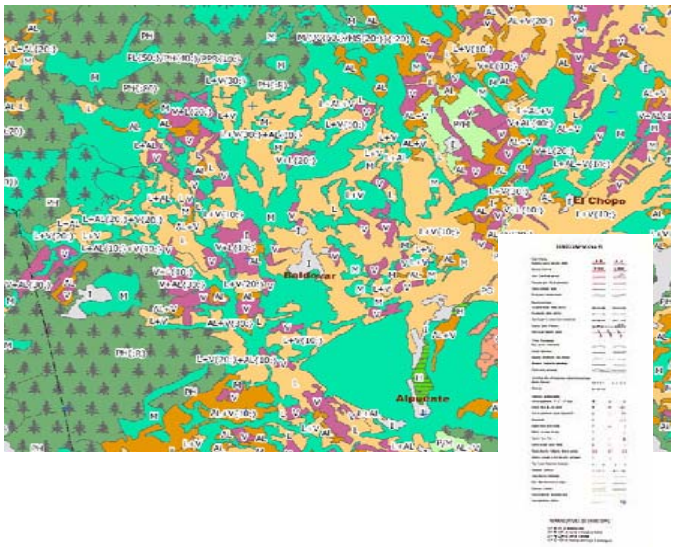


SQL Queries

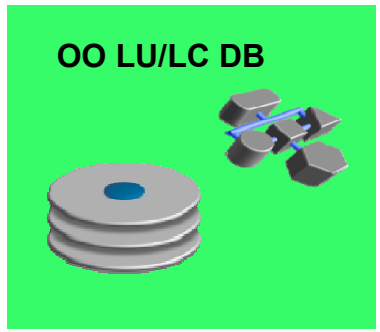


❖ "Forward" compatibility: Migration Path for **existing data**

- The information in existing LU/LC classifications datasets can be input in an adequately designed OO-LU/LC database:



Data processing



❖ Migration Path:

A) Automatic data processing:

- The polygon lines of an existing Classification Database are valid for the new Object Oriented database

- % of LCE and attribute values:

  Option 1: store min and max of class interval:
  attribute_max
  attribut_min

  Option 2:
  mean of interval = attribute value

Migration Path:

❖ B) Manually adding extra information (optional):

- Homogeneous polygons:
  - "Land Covers" are valid
  - You only need to add:
    - LC Elements %
    - attribute values for LC and LCE

- Non-Homogeneous polygons:
  - Dominant "Land Covers" are valid
  - You only need to add:
    - Additional Land Covers present in the polygon
    - LC Elements %
    - attribute values for LC and LCE

So then…

- Cost for producing an Object Oriented LU/LC database is estimated compared to traditional Classification Databases:

  only 15 – 20 % more

- Great increase in usefulness and reusability of information

- Migration path for existing classification databases possible

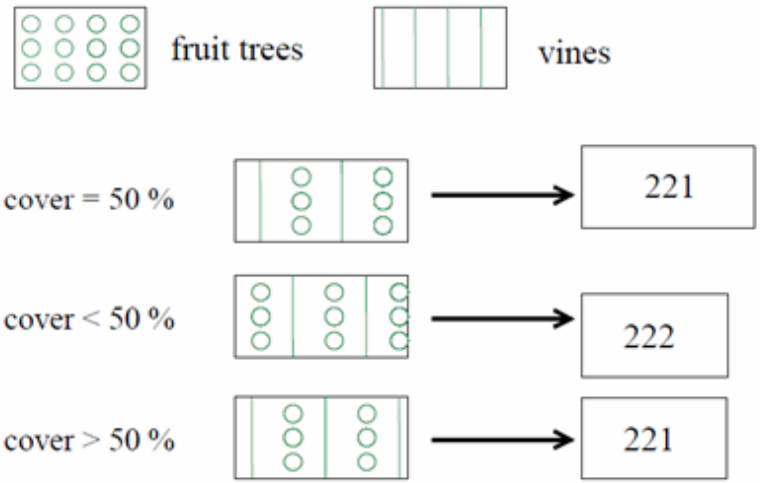
- Object Oriented approach make less critical to improve MMU, because statistics will be correct even with coarse MMU

Production and Verification / Validation of the database is easier:

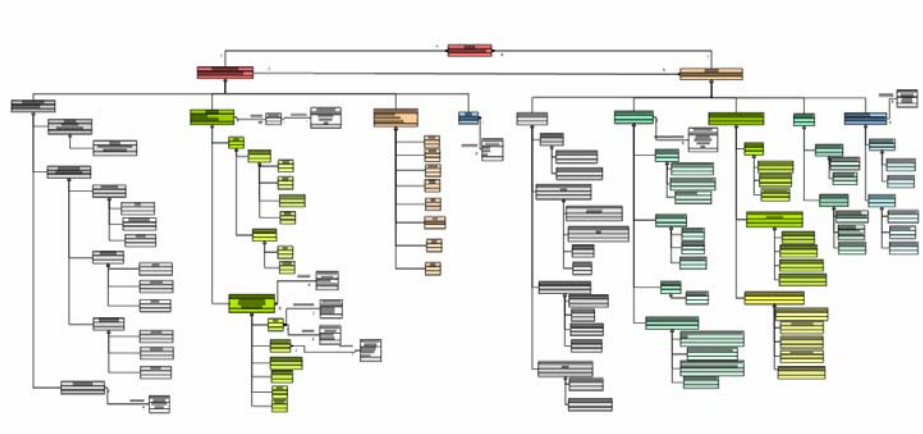
Photointerpreters do not need to keep in mind all the time complex definitions and "interpretation rules" of the Nomenclature.

Generalisation:
How to map vines associated with fruit trees within a single parcel?

- In this case, the dominance of each permanent crop should be considered. In general, priority will be given to vineyard if dominances are approximately the same. Otherwise the dominating permanent crop will be represented.



- In case of vines associated to olive trees within a single parcel, priority will be given to class 221.



- LU/LC, as any other G.I. theme can and should be modeled in UML using an ISO 19109 “Application Schema” (Feature Data Model)
- LCCS (FAO’s Land Cover Classification System) is **not** an acceptable solution
- The ideas and problems presented here are applicable to the development of many other Inspire Themes Data Models

- Spain is proposing international institutions with responsibility in LU/LC information (EEA, Inspire, GMES, ISO, FAO…) to adopt a similar philosophy for future LU/LC databases and offers its collaboration for building a standard LC Feature Data Model.

- In the last EIONET meeting in Copenhagen (23-24 April 2009) there was consensus between member States to create a Working Group for exploring the Object Oriented Land Cover Data Modeling approach for future Corine Land Cover.

SIOSE
Sistema de Información de Ocupación del Suelo de España
(Land Cover/Land Use Information System of Spain)

Nuria Valcarcel
Guillermo Villa
Instituto Geográfico Nacional
España

❖LAND COVER / LAND USE

- Multiples iniciativas en cobertura /uso de suelo a nivel:
  - Global (GlobCover/ESA, JRC, FAO..)
  - Europeo (Corine, GMES, LUCAS, European LC Data Centre..)
  - Nacional y regional
- La ocupación de suelo tiene aplicación en un amplio rango de dominios (G. forestal, agrícola, biodiversidad, planeamiento territorial, gestión hídrica, etc).

❖Comparación nomenclaturas

IPCC categories	IGBP	GlobCorine
Forest land	1 Evergreen Needleleaf Forests 2 Evergreen Broadleaf Forests 3 Deciduous Needleleaf Forests 4 Deciduous Broadleaf Forests 5 Mixed Forests 6 Woody Savannas 14 Cropland / Natural Vegetation Mosaic (3) 9 Savannas (2)	2.3 Permanent crops and associations (3) 3.2 Mosaic farmland (3) 4.1 Standing forest 4.2 Transitional woodland and shrub (2) 7.1 Forested wetlands
Cropland	12 Cropland 14 Cropland / Natural Vegetation Mosaic (3)	2.1 Non-irrigated arable land 2.2 Irrigated or post-flooded agriculture 2.3 Permanent crops and associations (3) 3.2 Mosaic farmland (3)
Settlements	13 Urban and Built-up	1 Artificial areas

- ‘Bosque’:
- IGBP: FCC >60 %; altura > 2m
- GlobCORINE: FCC> 30 % ; altura > 3m

❖Qué queríamos conseguir (2005)?

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 March 2007

establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

Información capturada una vez, compartida por muchos

(4) The infrastructures for spatial information in the Member States should be designed to ensure that spatial data are stored, made available and maintained at the most appropriate level; that it is possible to combine spatial data from different sources across the Community in a consistent way and share them between several users and applications; that it is possible for spatial data collected at one level of public authority to be shared between other public authorities; that spatial data are made available under conditions which do not unduly restrict their extensive use; that it is easy to discover available spatial data, to evaluate their suitability for the purpose and to know the conditions applicable to their use.

❖Qué queríamos conseguir (2005)?

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 March 2007

establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

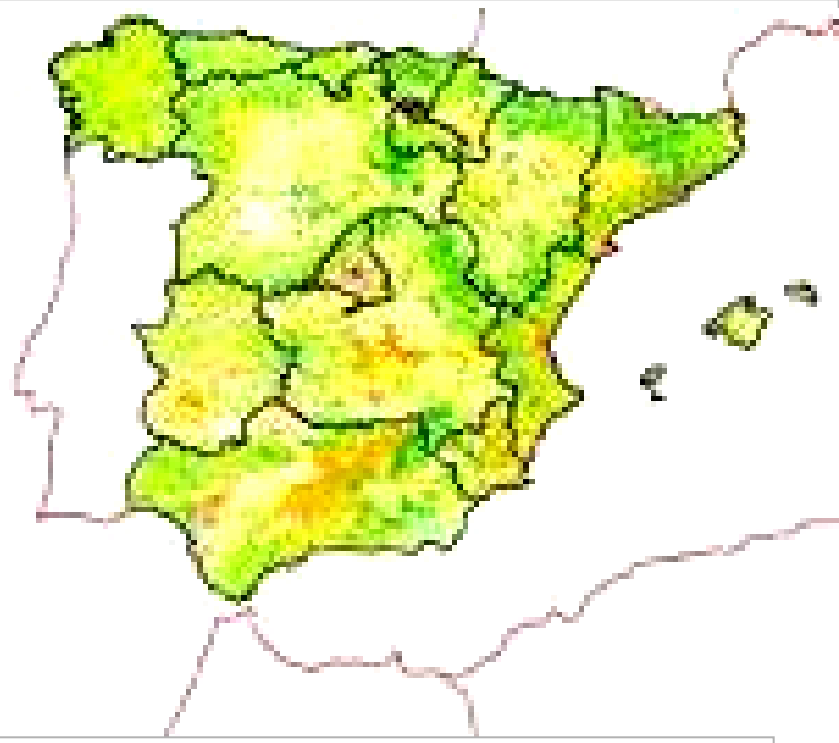
INTEROPERABILITY OF SPATIAL DATA SETS AND SERVICES

Article 7

1. Implementing rules laying down technical arrangements for the interoperability and, where practicable, harmonisation of spatial data sets and services, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 22(3). Relevant user requirements, existing initiatives and international standards for the harmonisation of spatial data sets, as well as feasibility and cost-benefit considerations shall be taken into account in the development of the implementing rules. Where organisations established under international law have adopted relevant standards to ensure interoperability or harmonisation of spatial data sets and services, these standards shall be integrated, and the existing technical means shall be referred to, if appropriate, in the implementing rules mentioned in this paragraph.

Armonización e interoperabilidad de las LC/LU DBs existentes en España

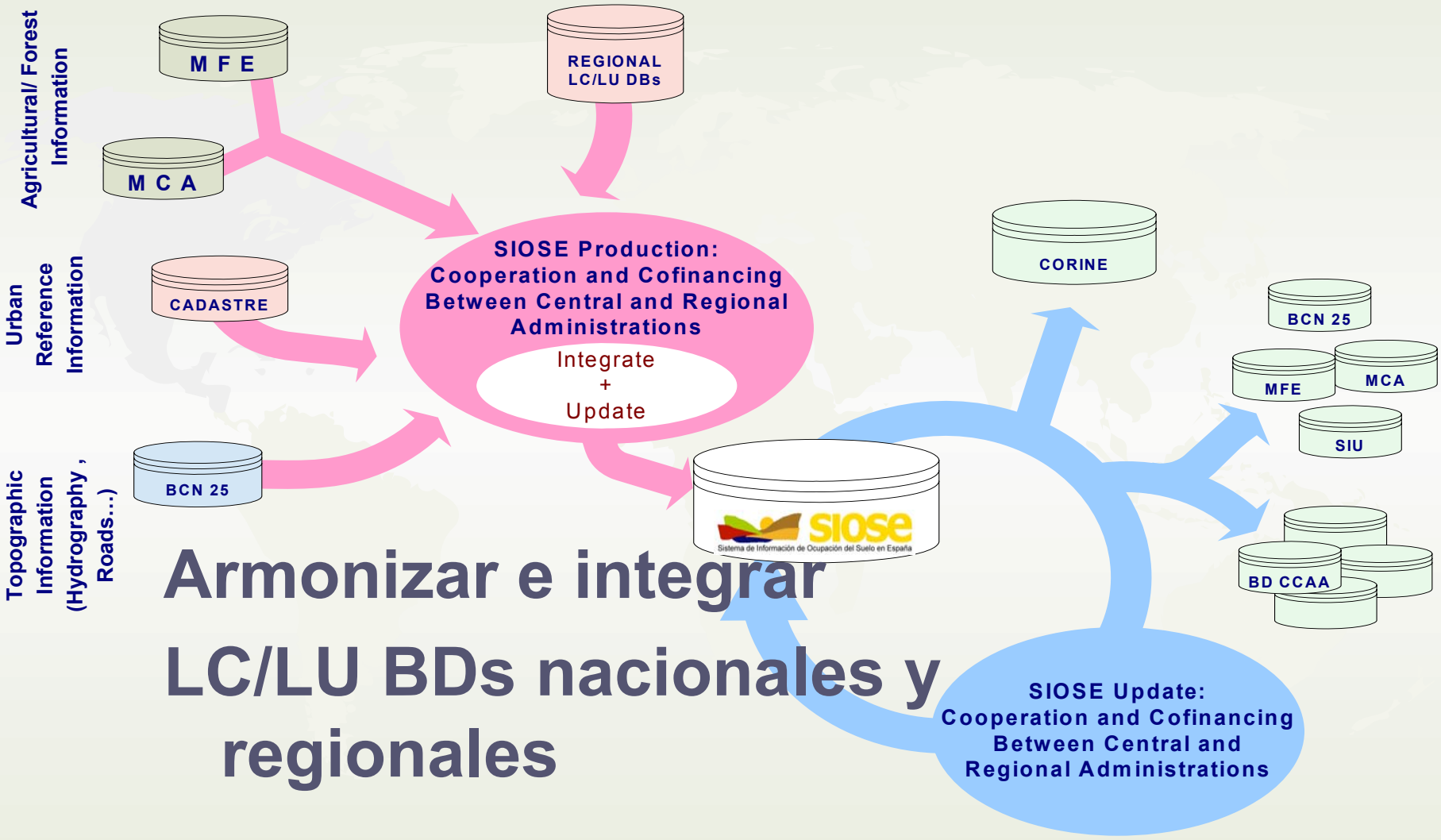
❖Qué queríamos conseguir (2005)?



Mejorar CLC2000: necesidad de información más detallada de LC/LU

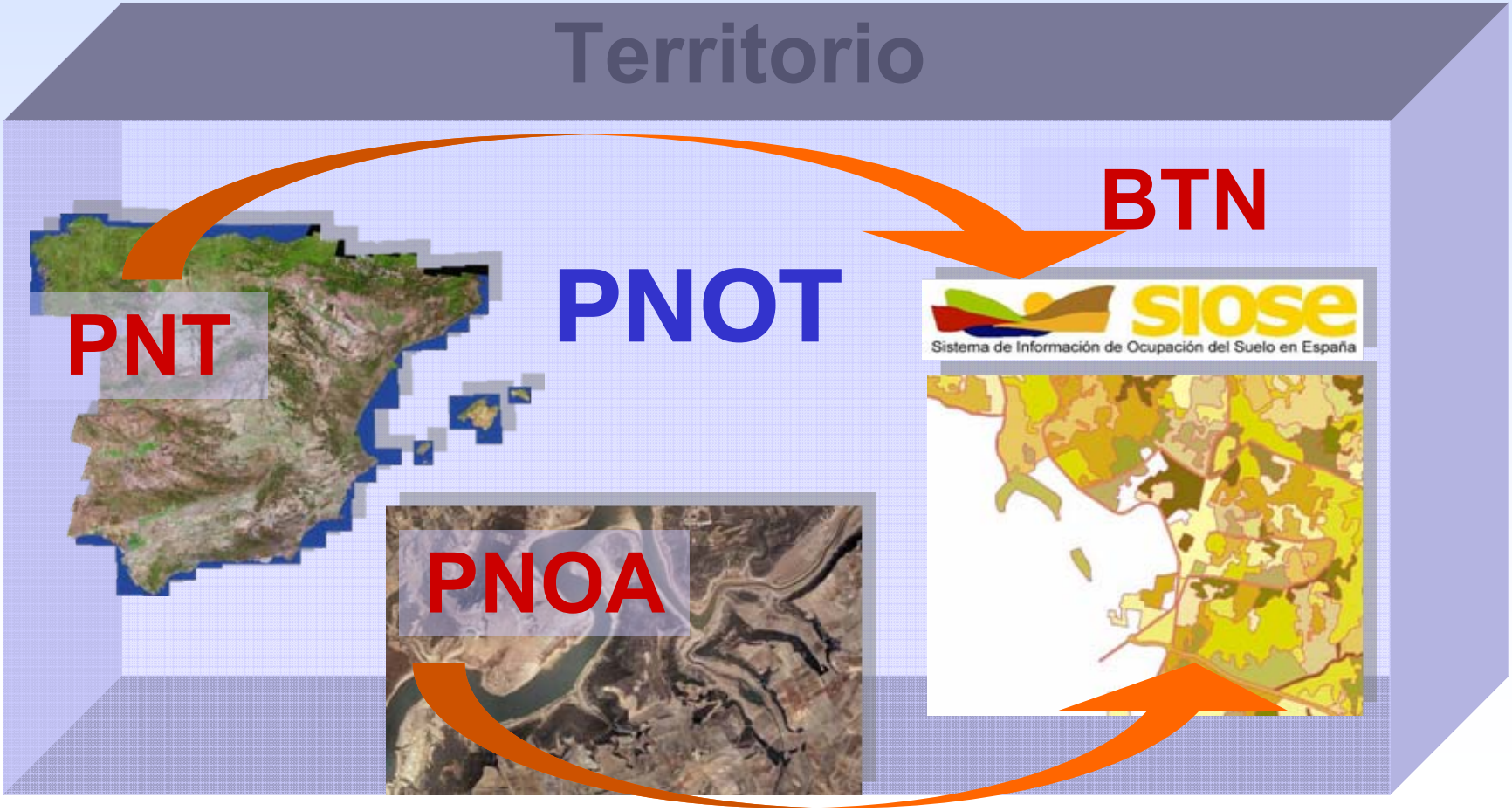
- Algunas instituciones nacionales y regionales producían land use/cover GIS de más detalle que CLC2000 :
  - geométrica → mayor escala
  - Semantica → parámetros temáticos (propósito)

❖Qué queríamos conseguir (2005)?



Armonizar e integrar LC/LU BDs nacionales y regionales

Producción coordinada en el Plan Nacional de Observación del Territorio

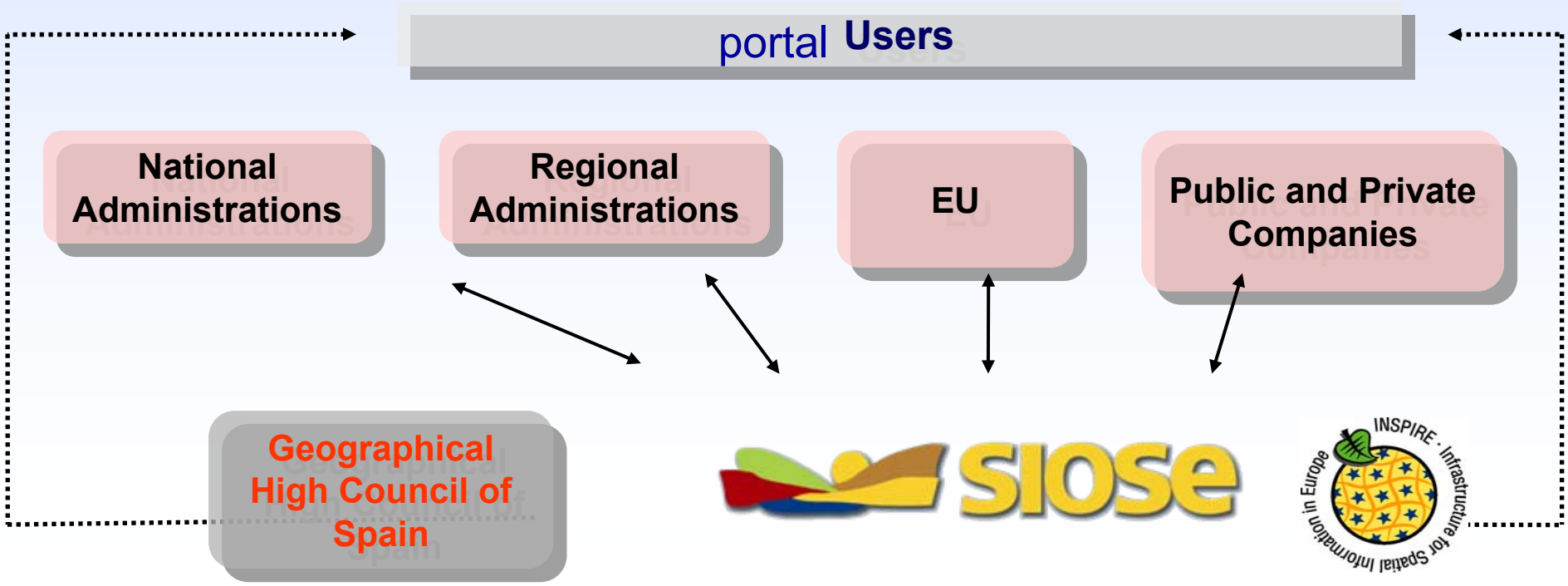


❖Qué tenemos (2009)?

❖**Producción descentralizada (inc. presupuesto)** (19 Adm. Regionales + Adm. Central)

❖**Modelo de producción eficiente**: Actualización **2 años**.

❖**Modelo de datos alcanzado por consenso**

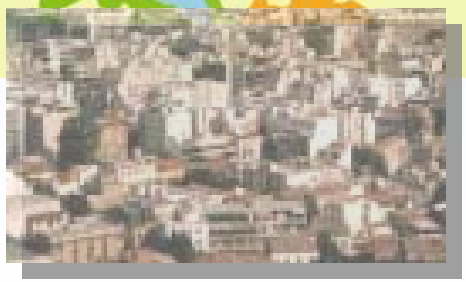


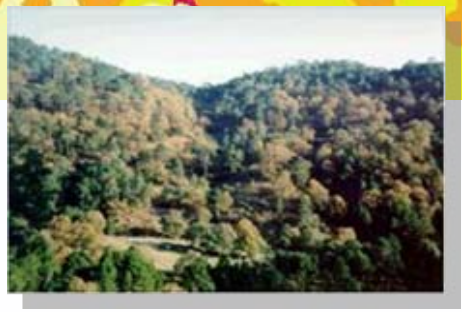
❖Qué tenemos (2009)?

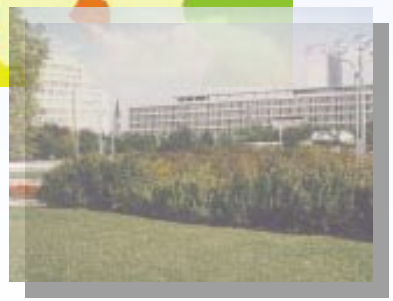
Sistema de Información de Ocupación del Suelo en España

Base de datos de Ocupación de Suelo de España 1:25.000.

❖BD LC/LU Nacional: **homogénea, multi-parametro, multi-propósito, multi-escala**, basada en **requerimientos comunes de nuestros usuarios**







Modelo de datos conceptual, normalizado e interoperable de la ocupación del suelo

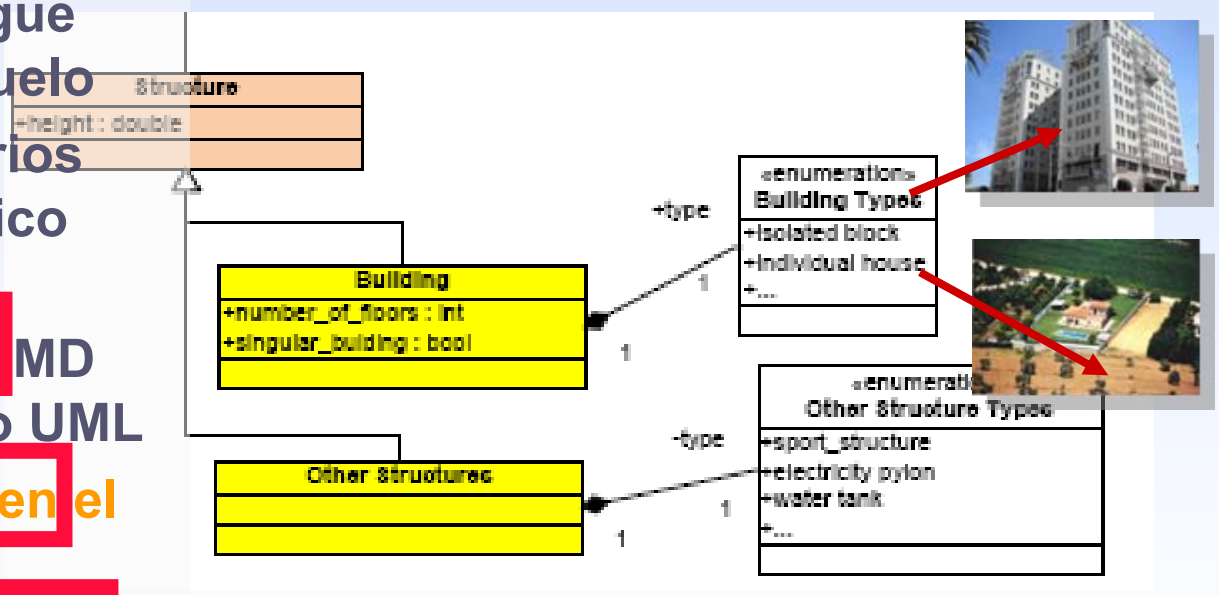
Multi-criterio: distingue cobertura y uso del suelo

Multi-parametro: varios atributos para un único polígono

Orientado a objetos: MD entidad relación usando UML

Facilmente extensible en el futuro

Elaborado en consenso



ISO TC211 + OGC

Coordinado con los Planes Nacionales de Teledetección y Ortofotografía Aérea

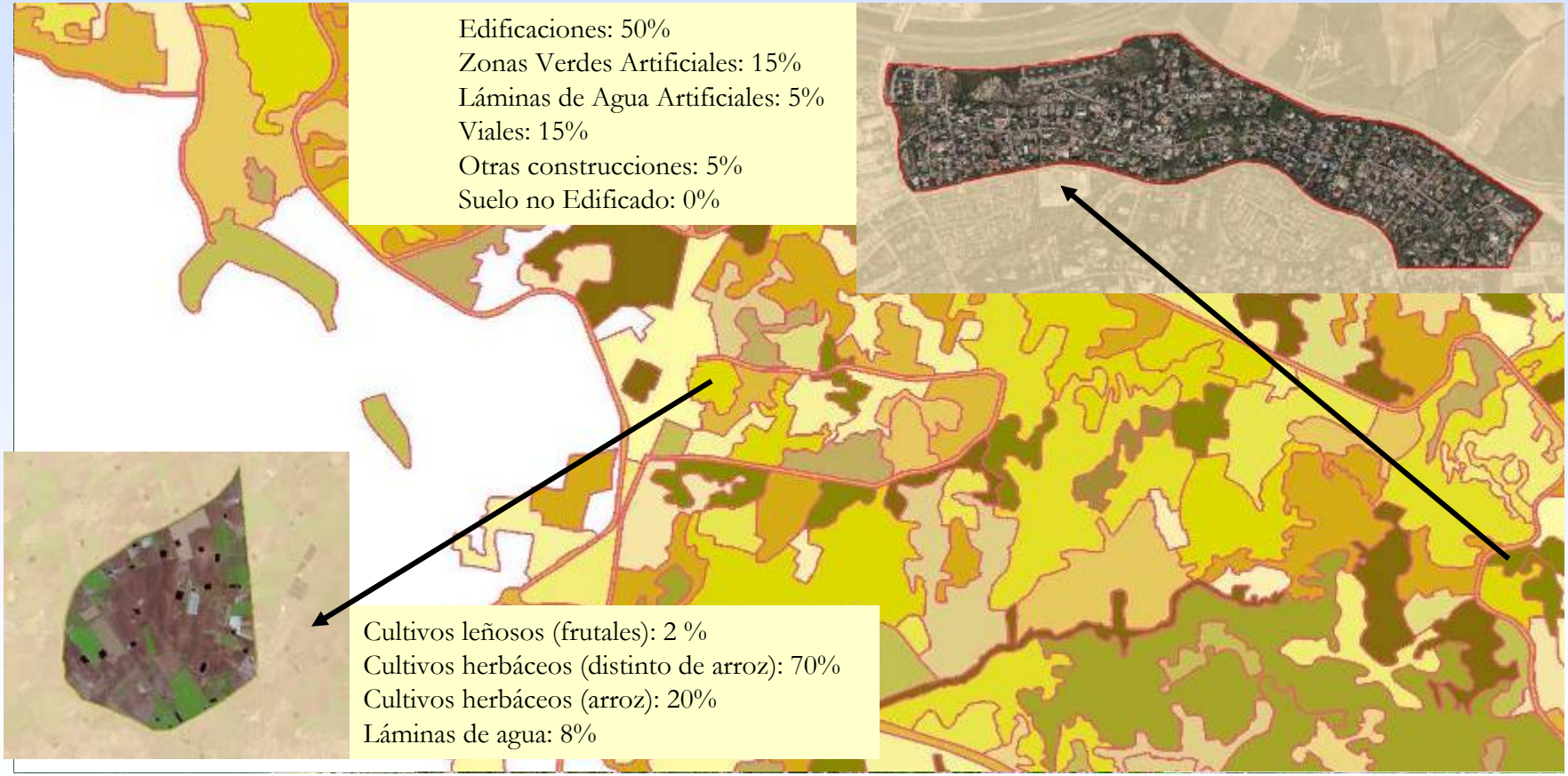
❖Qué tenemos (2009)?

GOBIERNO DE ESPAÑA | MINISTERIO DE FOMENTO | INSTITUTO GEOGRÁFICO NACIONAL

SIOSE
Sistema de Información de Ocupación del Suelo en España

- Unidad mínima cartografiable variable, *según las clases.*
  - ✓ - *Tejido urbano y Agua: 1 ha.*
  - ✓ - *Zonas agrícolas: 2 ha.*
  - ✓ - *Zonas forestales y naturales: 2 ha.*
  - ✓ -*Humedales, playas, invernaderos, Vegetación de ribera: 0,5 ha.*

Proceso de Obtención

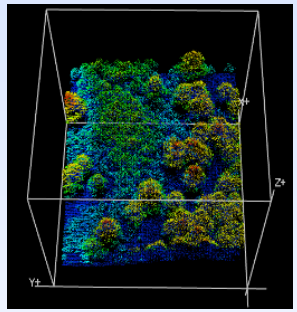


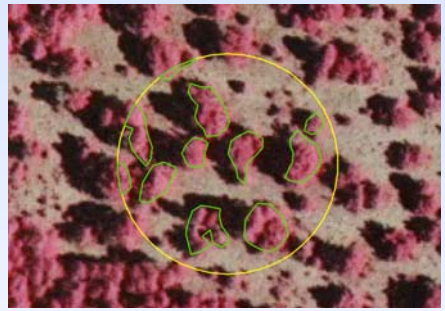
❖Qué tenemos (2009)?

SIOSE
Sistema de Información de Ocupación del Suelo en España

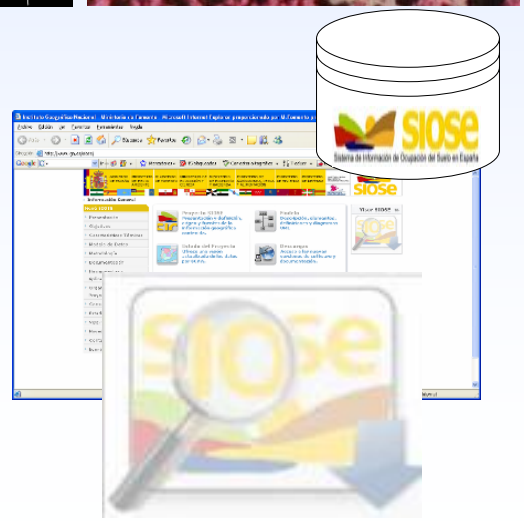
Productos adicionales:

- ❖Proyectos de investigación y desarrollo asociados
- ❖WMS services & portal Web
- ❖Herramientas SW
- ❖Base de datos de campo





Web portal: www.siose.es.
Digital photograph album of LC/LU + SIOSErama



❖Qué tenemos (2009)?

SIOSE
Sistema de Información de Ocupación del Suelo en España

Inspire SDIC LC/LU: Productores, expertos y usuarios

Call for SDICs and LMOs - Microsoft Internet Explorer proporcionado por M.Fomento proxy_pac

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Your Details

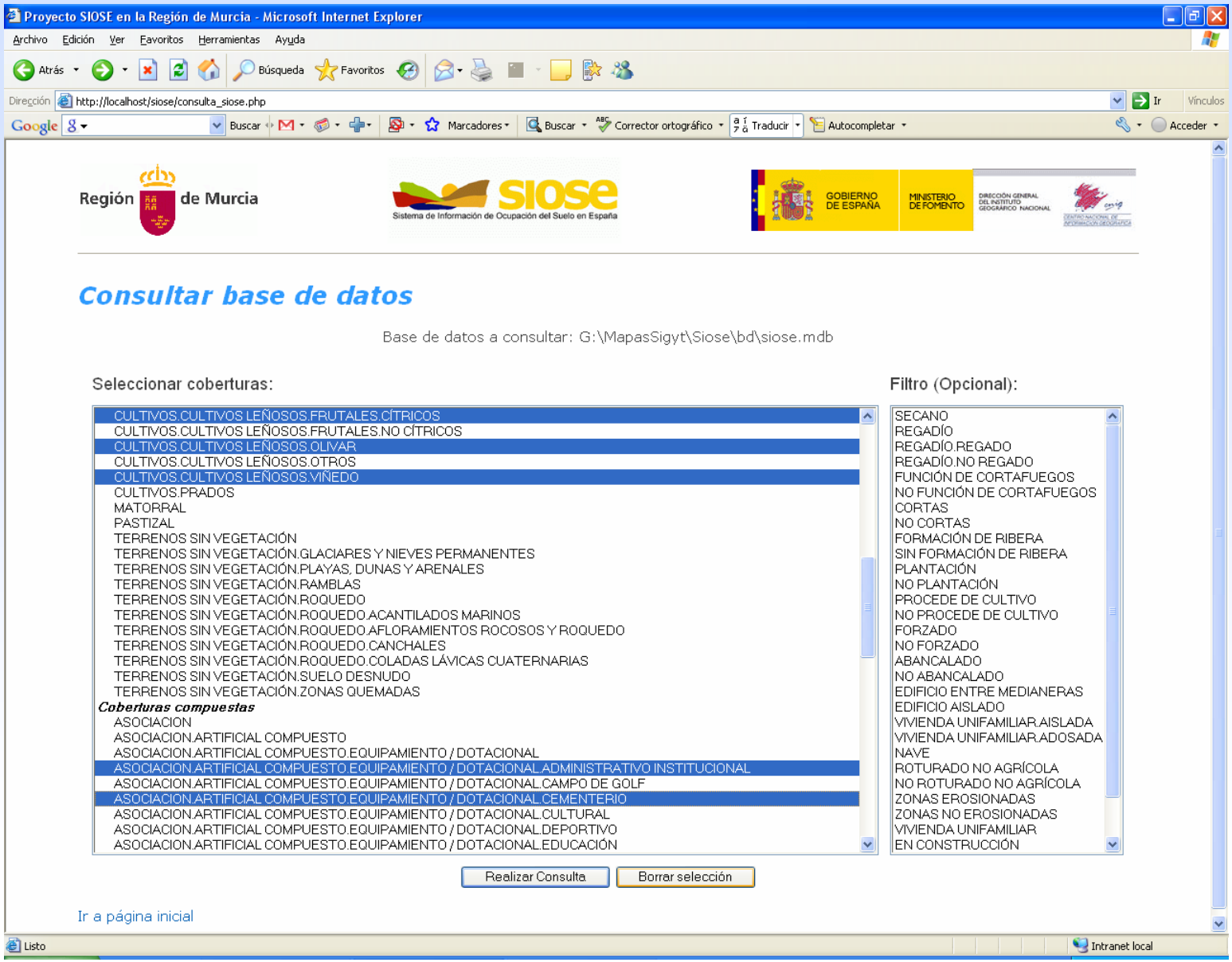
All Registered SDIC/LMOs

@Contact Webmaster
Important Legal Notice

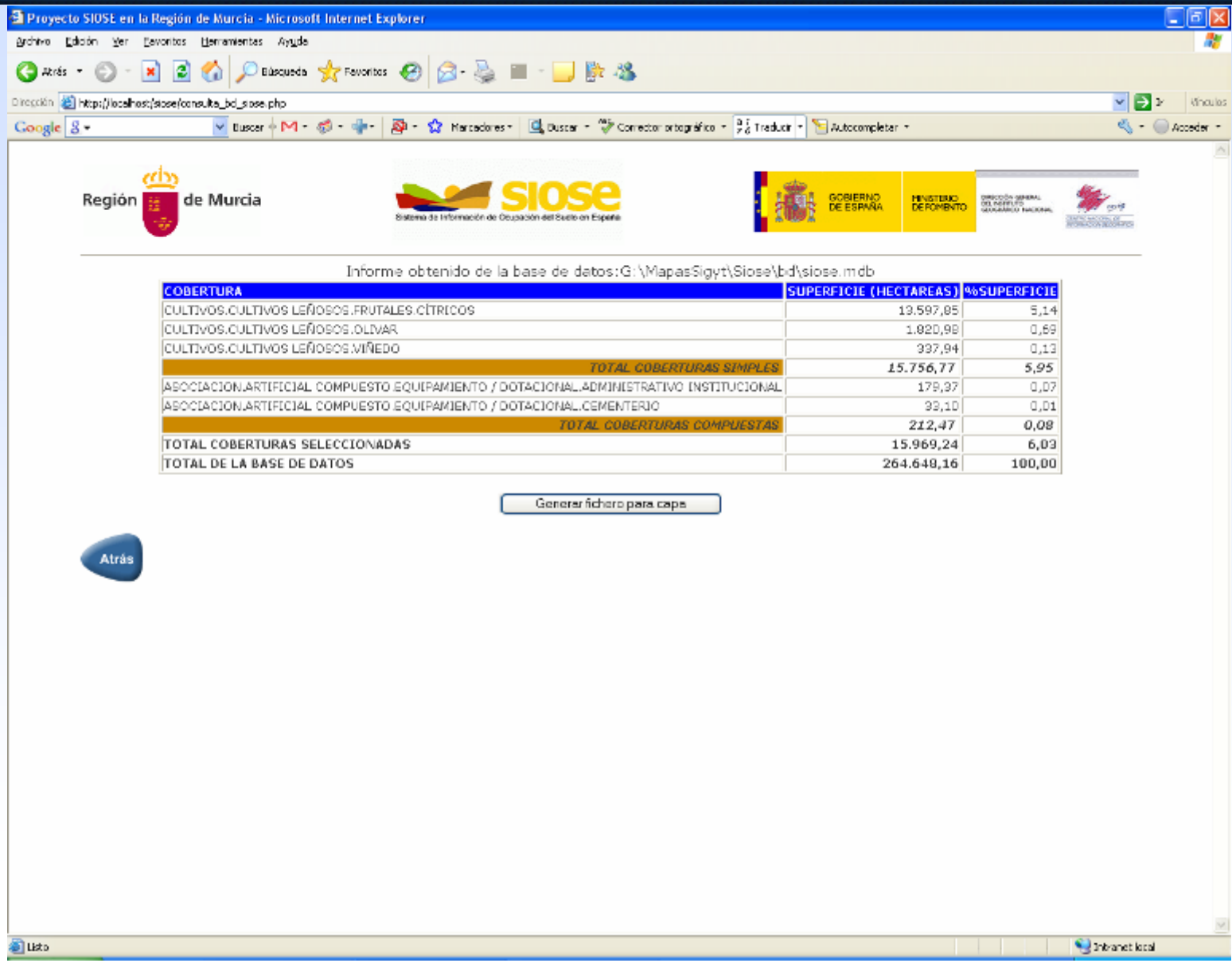
Spatial Data Interest Community Description

Description	
SDIC Title [1]	National Assembly of the Land Cover and Use Information System of Spain (SIOSE)
Acronym [2]	SIOSE National Assembly
Mission and Objectives [3]	IGN Spain (EIONET´s National Reference Center for Soil) is coordinating SIOSE Project (S... at 1:25.000 nomin... This project is bei... than 25 institution... Groups. Decisions... organization aspe... representatives of... community of proc... membership as a... initiative.
Mandate [4]	Discuss issues to... System of Spain -... modeling, referenc...

Explotación de datos de Siose

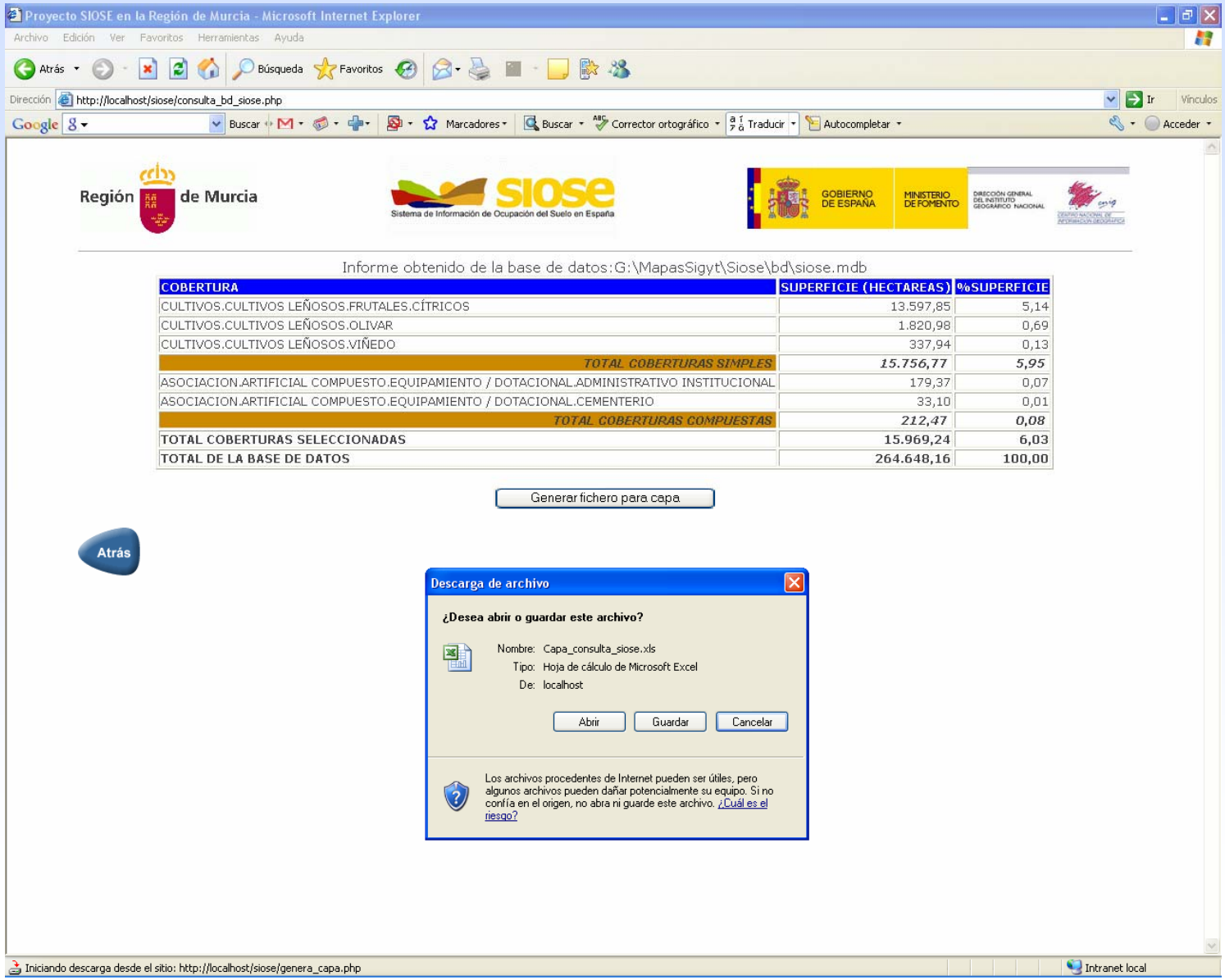


Explotación de datos de Siose



COBERTURA	SUPERFICIE (HECTAREAS)	%SUPERFICIE
CULTIVOS.CULTIVOS LEÑOSOS.FRUTALES CÍTRICOS	13.597,85	5,14
CULTIVOS.CULTIVOS LEÑOSOS.OLIVAR	1.820,98	0,69
CULTIVOS.CULTIVOS LEÑOSOS.VIÑEDO	337,94	0,13
TOTAL COBERTURAS SIMPLES	*15.756,77*	*5,95*
ASOCIACION.ARTIFICIAL COMPUESTO EQUIPAMIENTO / DOTACIONAL.ADMINISTRATIVO INSTITUCIONAL	179,37	0,07
ASOCIACION.ARTIFICIAL COMPUESTO EQUIPAMIENTO / DOTACIONAL.CEMENTERIO	33,10	0,01
TOTAL COBERTURAS COMPUESTAS	*212,47*	*0,08*
TOTAL COBERTURAS SELECCIONADAS	15.969,24	6,03
TOTAL DE LA BASE DE DATOS	264.648,16	100,00

Explotación de datos de Siose



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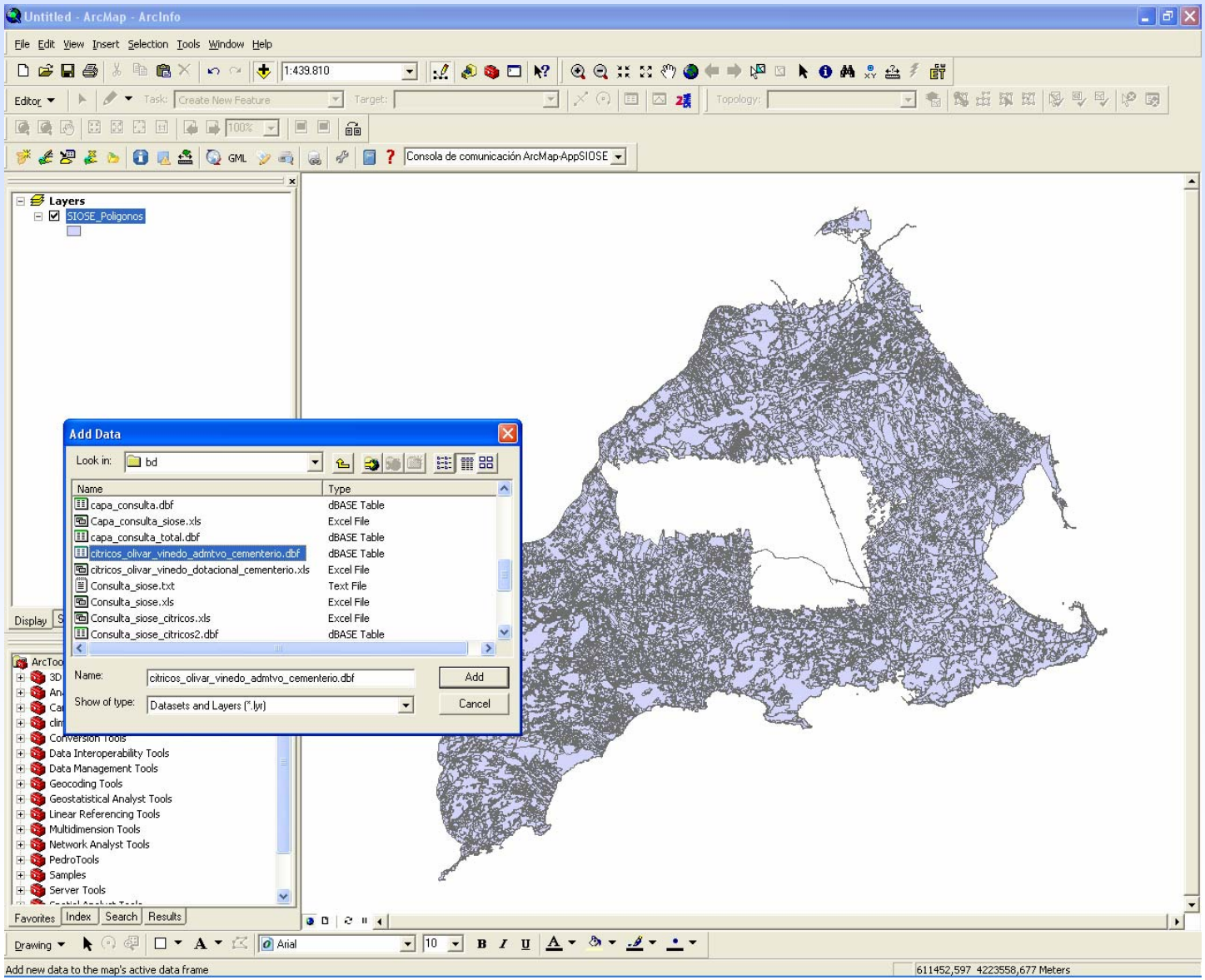
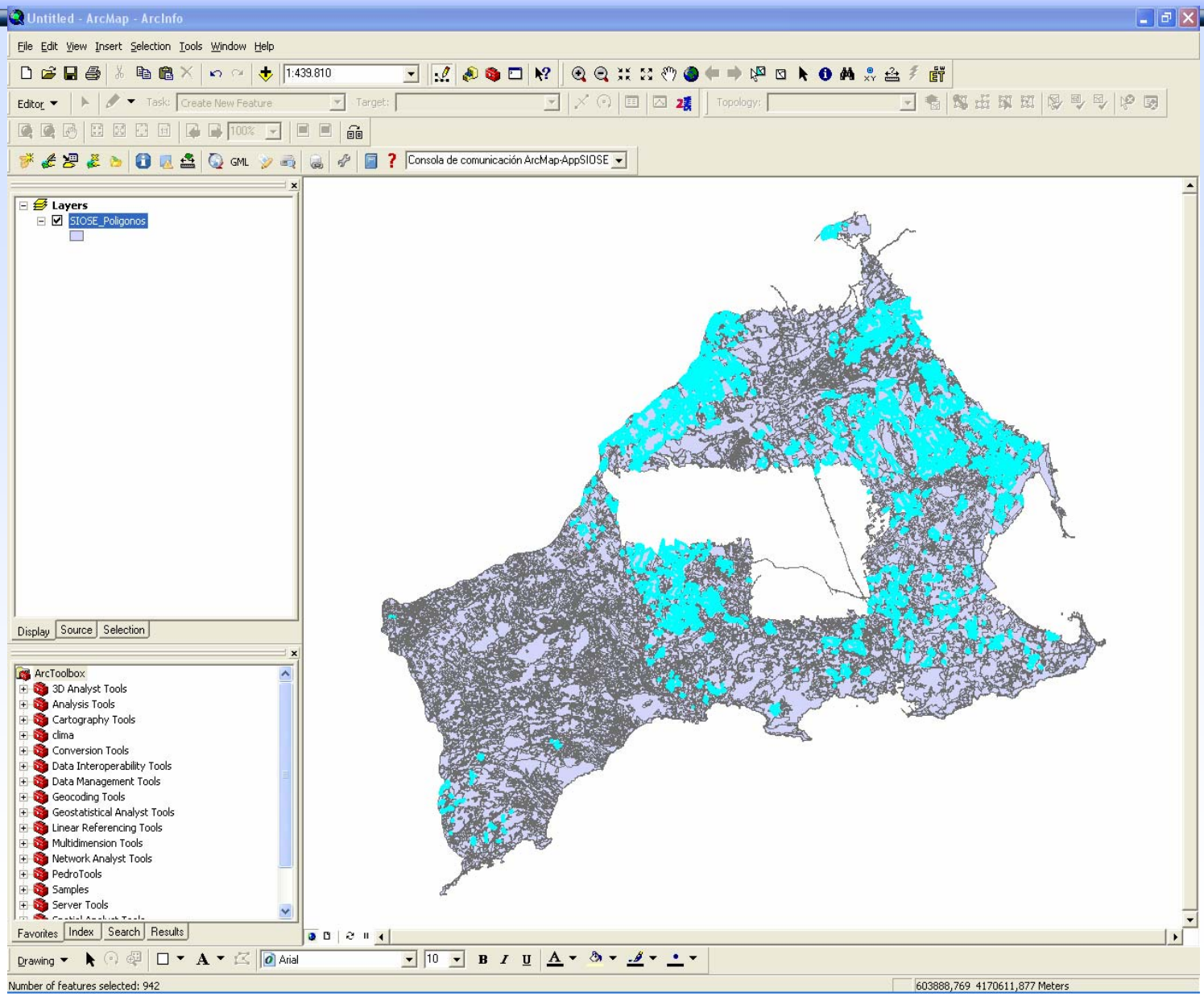
Explotación de datos de Siose



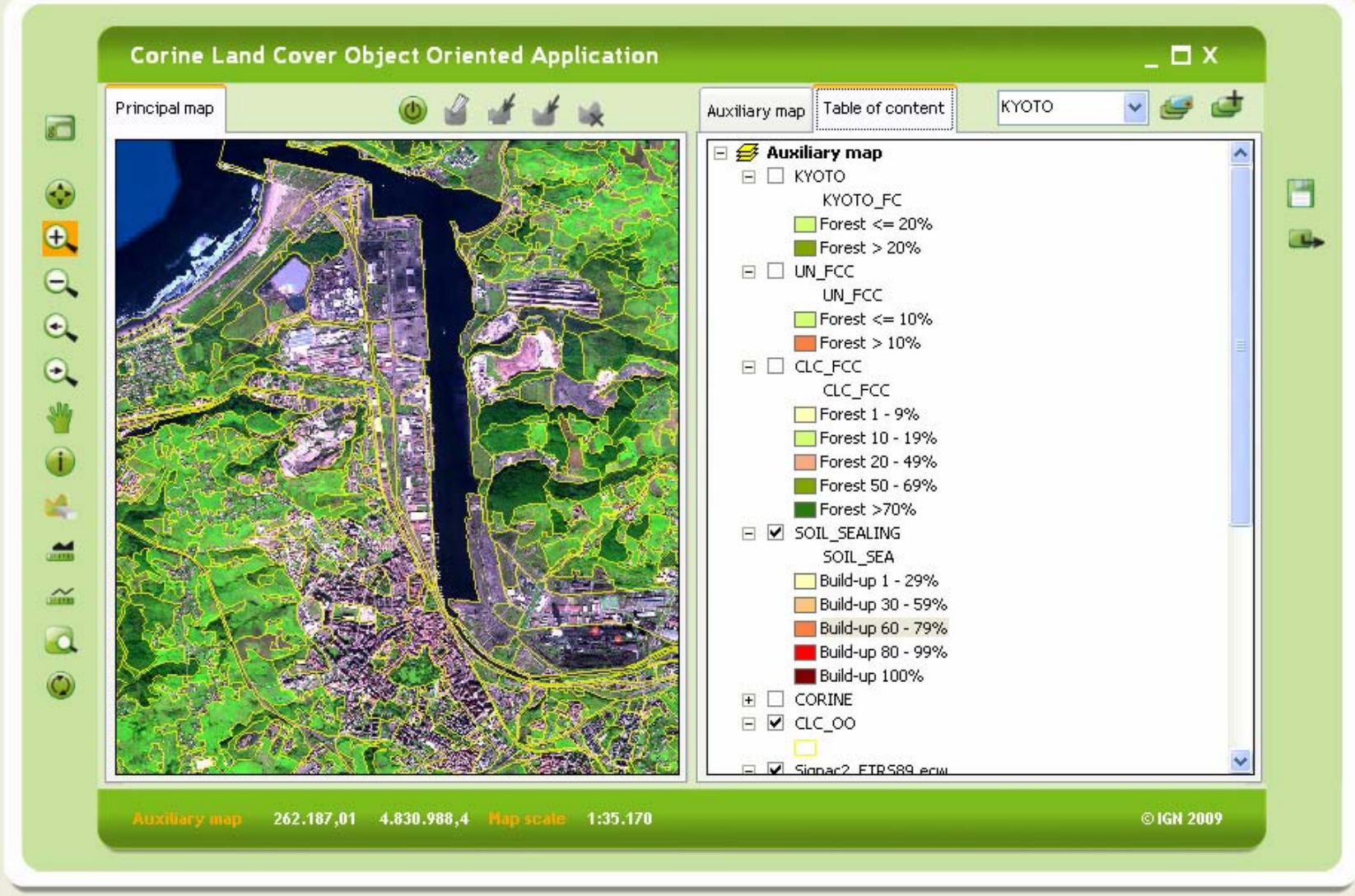
Explotación de datos de Siose



❖SIOSE multipurpose use: Corine Land Cover Thematic Map

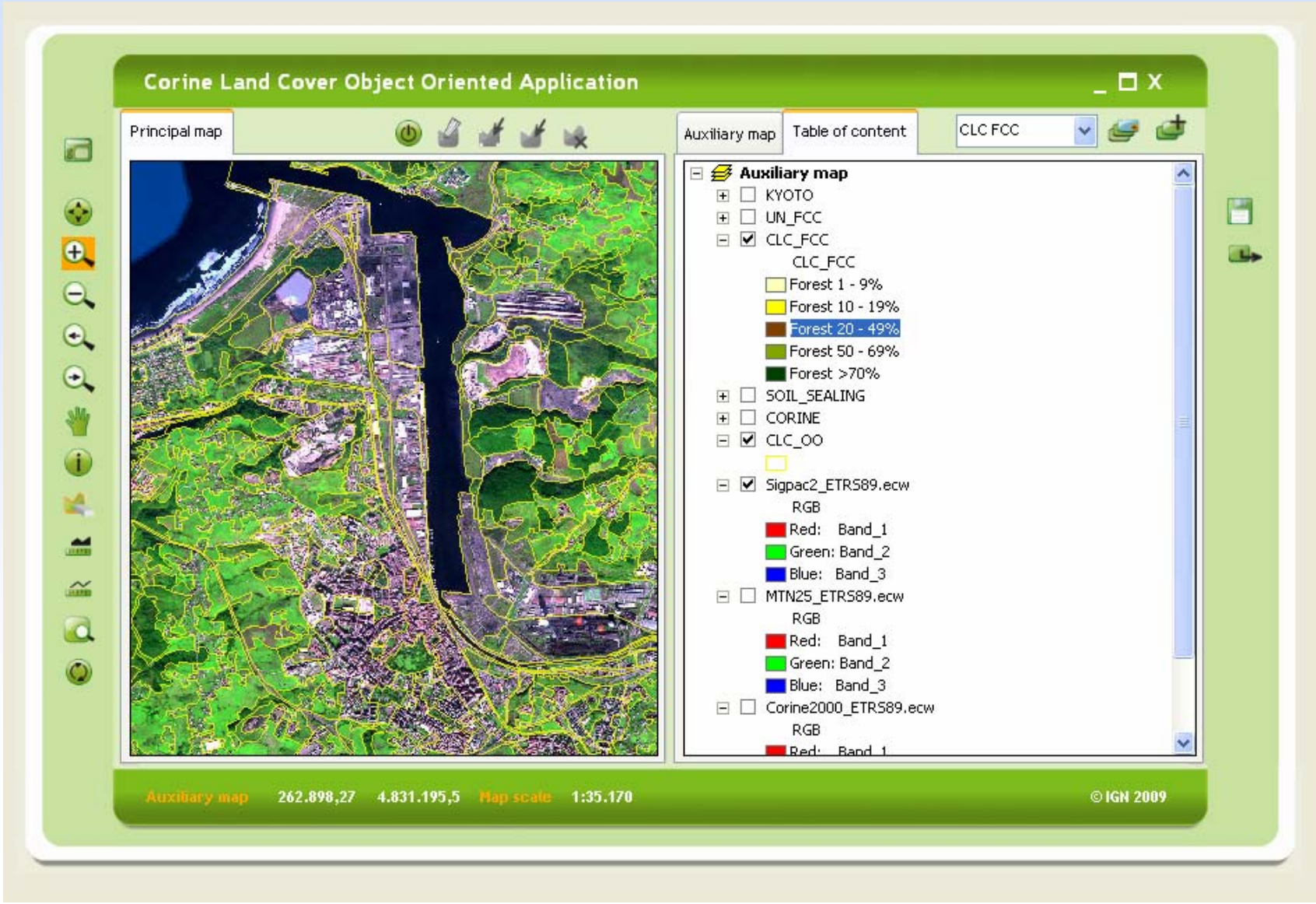
❖SIOSE multipurpose use: Corine Land Cover Thematic Map

❖SIOSE multipurpose use: Soil Sealing Thematic View



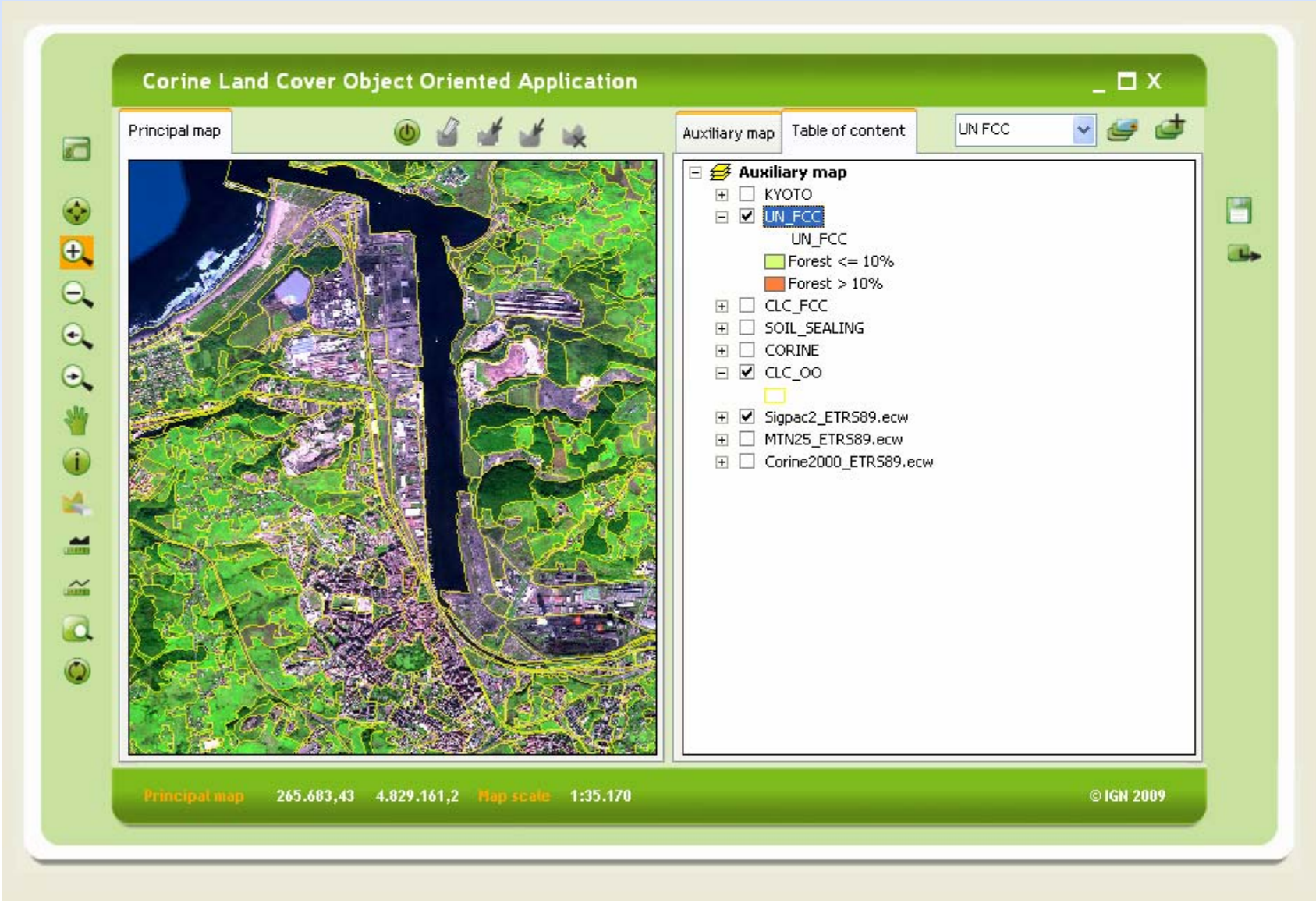
❖SIOSE multipurpose use: Soil Sealing Thematic View

❖SIOSE multipurpose use: % Tree Coverage View



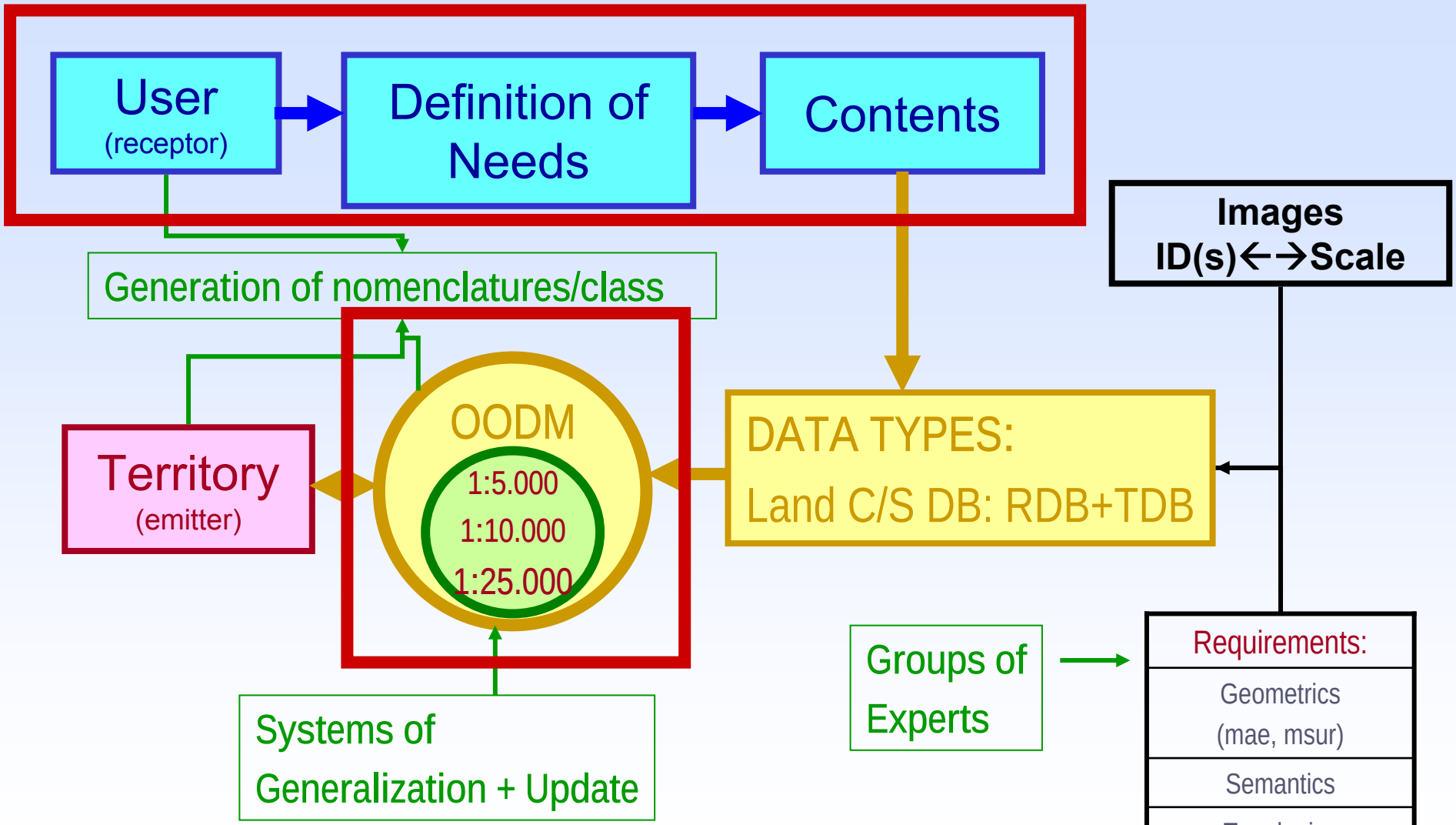
❖SIOSE multipurpose use: % Tree Coverage View

❖SIOSE multipurpose use: UNFCCC Tree Coverage View



❖SIOSE multipurpose use: UNFCCC Tree Coverage View

❖How? →
Object Oriented Conceptual DM



Thank you for your kind attention