LC change detection and planning indicators

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eENVplus

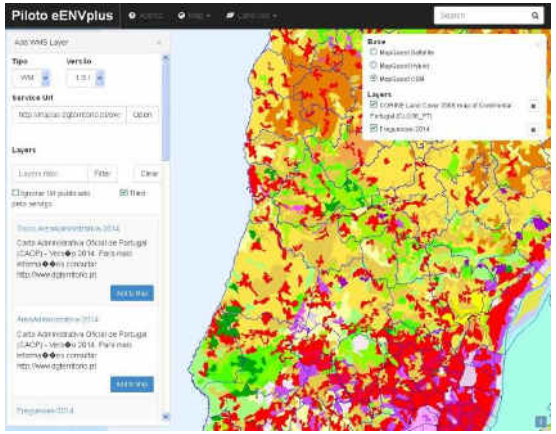
d·gTerritório
Directorate-General For Territorial Development

Geospatial World Forum 2016, 23-26 May 2016, Rotterdam

Summary

1. Introduction
2. Pilot overview
3. Data description
4. Inspire data harmonization
   - Mapping and transformation
   - Validation
5. Metadata
6. Tools used and functionalities
7. Exploitation of the pilot
8. Main contributions

Introduction



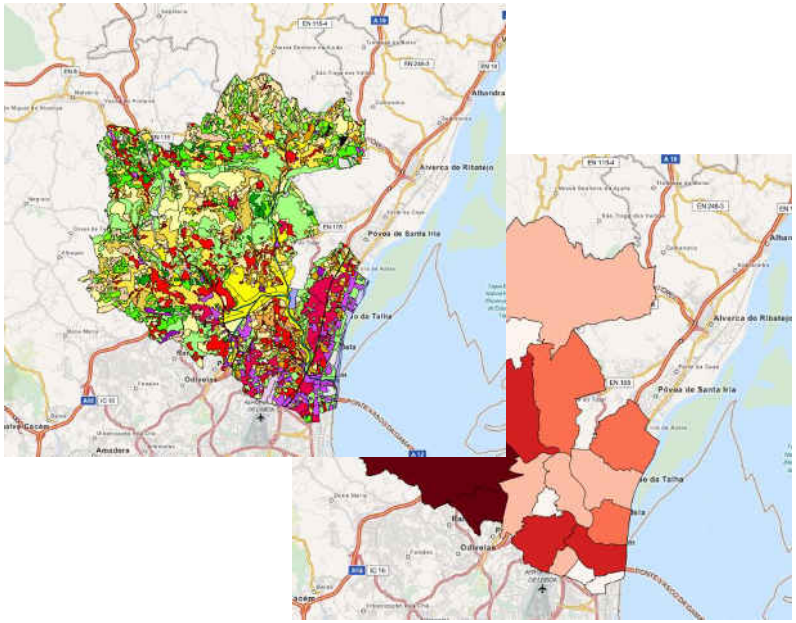
- eENVplus Project:
  - The objective is to create an open and interoperable infrastructure capable to integrate existing infrastructures according to the requirements of Inspire and international standards.
- Portuguese pilot:
  - Objective is to develop an application to monitor land cover changes between different dates for an area defined by the user and
  - Enabling the characterization of the territory using indicators, built from census information, with the objective to monitor urban dynamics.
- Rationale:
  - Monitoring territorial evolution can help understand development strategies and induce more effective planning

Pilot overview

- **What was made**
  - Demonstration Example:
    - Lisbon Metropolitan Area(AML)
  - Inspire data harmonization (LC: COS, CLC; LU: CRUS; AU: CAOP) and validation
  - Creation and validation of Metadata: COS, CLC, CRUS and CAOP.
  - Creation of indicators to monitor urban dynamics
  - Geoportal (WFS, WMS and WPS), Open source

Pilot overview

- **Data used in the pilot**
  - Land cover datasets: COS 1990, COS 2010, CLC 1990, CLC 2012
    - COS 1990 has a nomenclature with 76 base classes that can be combined to form new (composite classes). Total nº of classes: around 700.
    - COS 2010 nomenclature hierarchical, with 225 classes in 5 levels with level 3 compatible with CLC nomenclature.
  - Land use dataset (CRUS)
  - Administrative units (CAOP)
  - Statistical data (indicators)
  - Base maps



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Data Harmonization

Data models → Mapping → Transformation → Validation

Source dataset &
Inspire data specifications

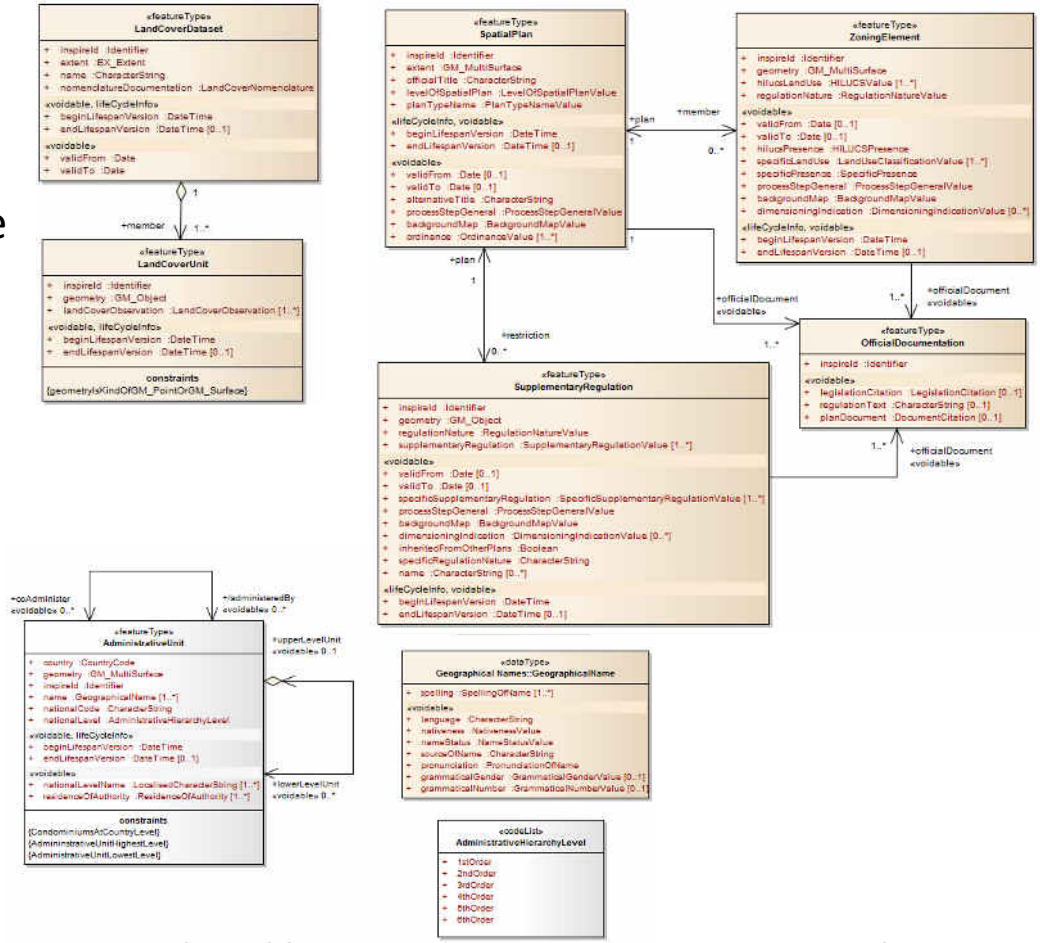
Rules

Remodeled dataset
Inspire compliant

Validated dataset

Data Model

- **The following <u>Inspire application schemas</u> were used:**
  - LC theme:
    - LandCoverVector
    - LandCoverNomenclature
  - LU theme:
    - PlannedLandUse
    - LandUseNomenclature
  - AU theme:
    - AdministrativeUnits



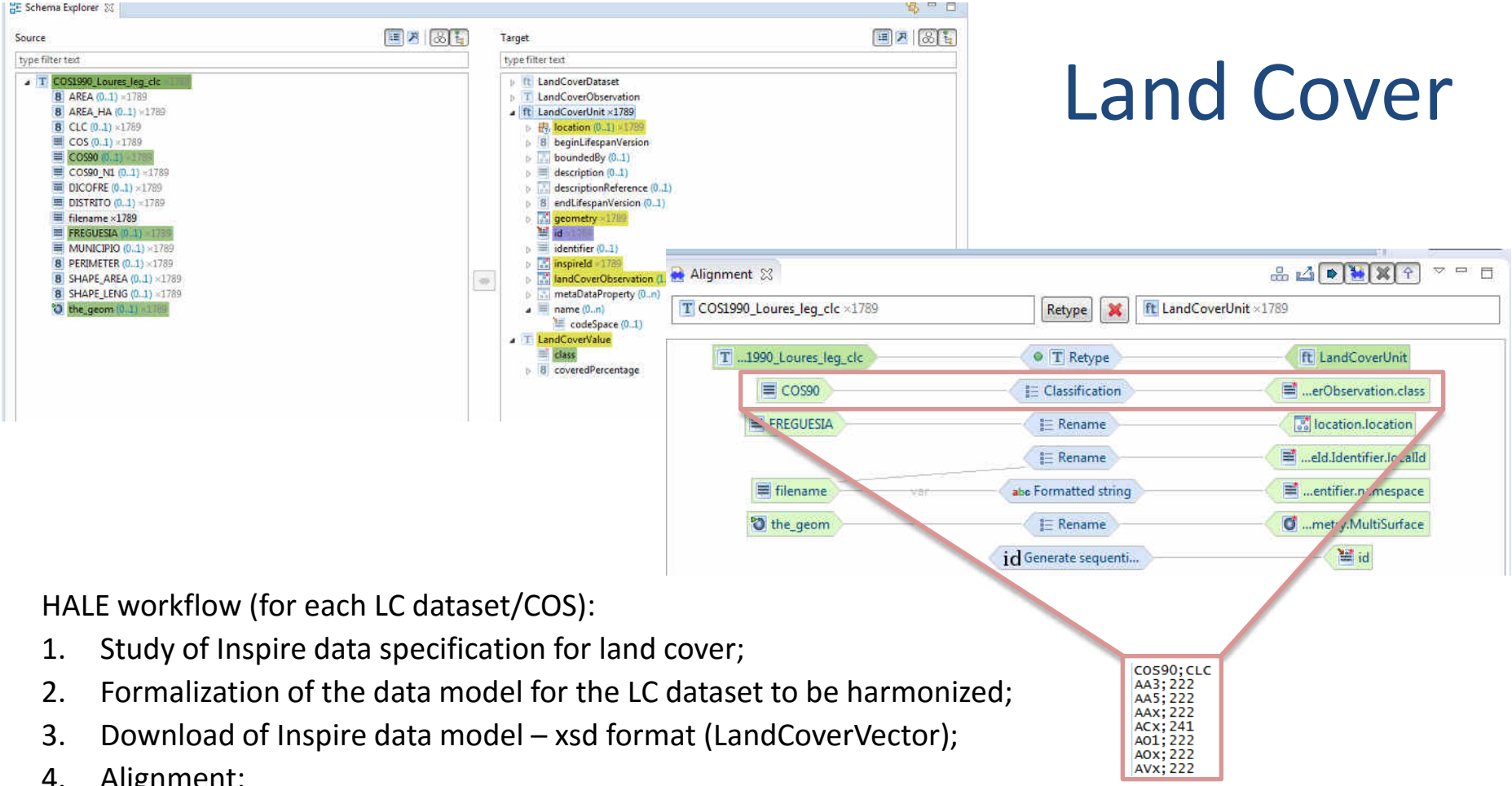
Methodology

- **Mapping and Transformation: rules creation and implementation**
  - Use of software (HALE – Humboldt Alignment Editor)

- **Validation**
  - Altova XMLspy
    - XML schema validation
  - OGC & Inspire validation tests
    - GML Test engine; Inspire conformance

- **Metadata**
  - EUOSME and thesaurus

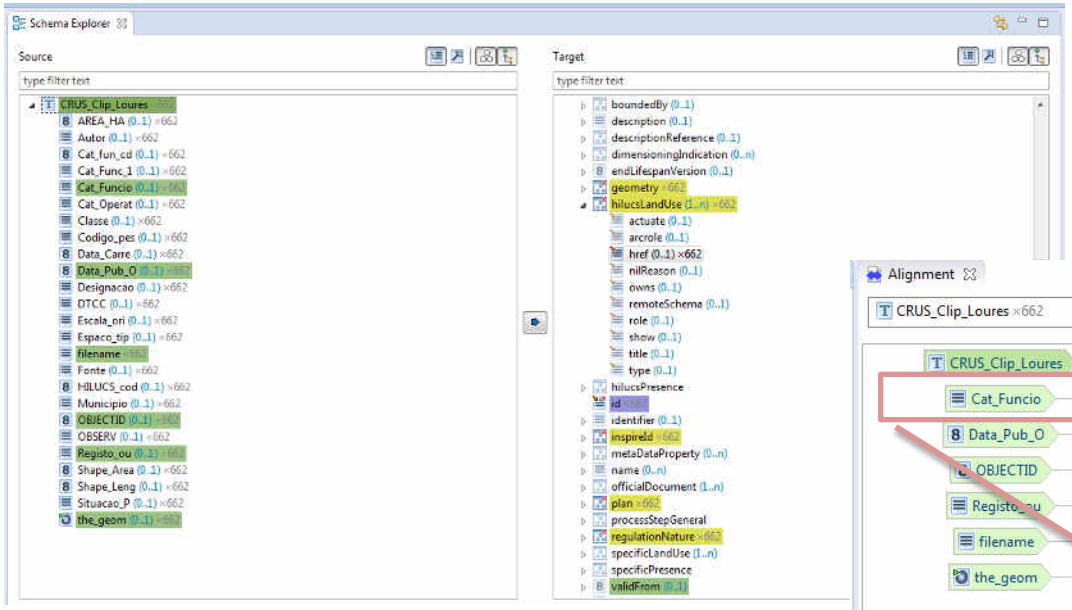
Land Cover

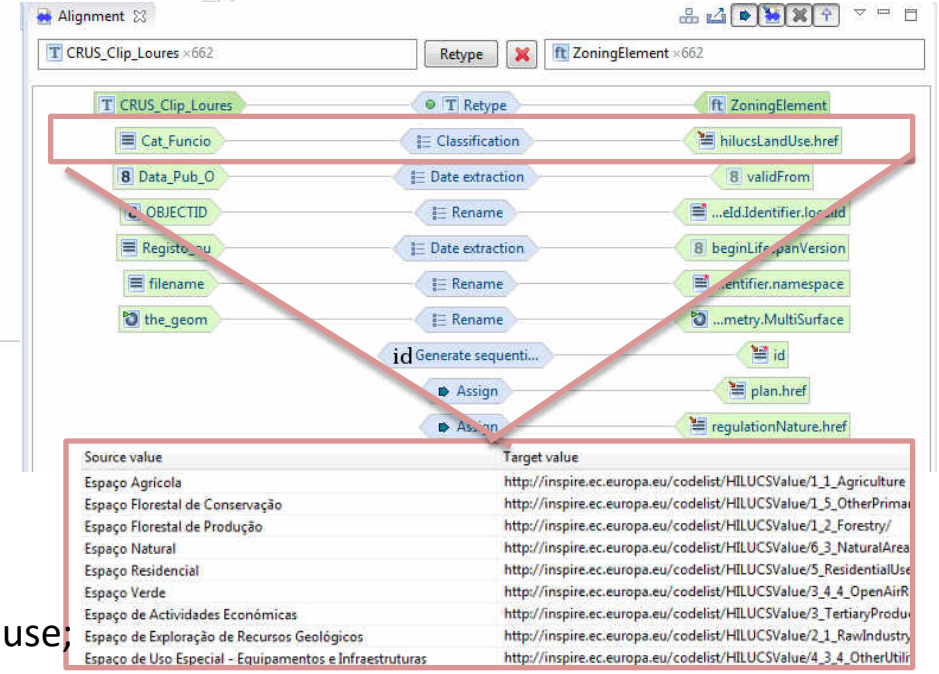


HALE workflow (for each LC dataset/COS):

1. Study of Inspire data specification for land cover;
2. Formalization of the data model for the LC dataset to be harmonized;
3. Download of Inspire data model – xsd format (LandCoverVector);
4. Alignment:
    1. Mapping of COS entities and attributes with Inspire app. schema,
    2. Matching between COS and CLC nomenclatures.
5. Output: GML file created after the harmonization proccess.

Land Use

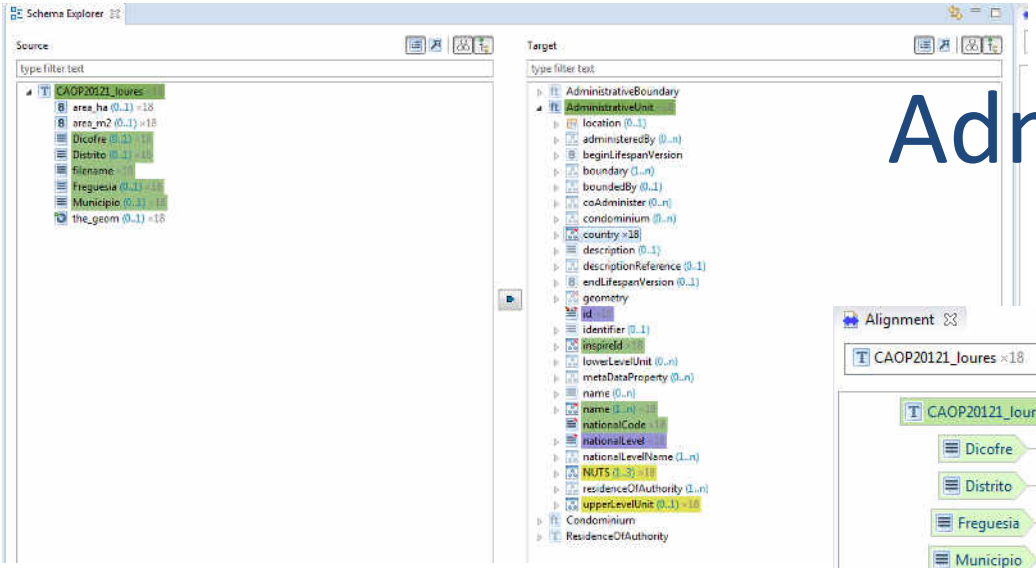


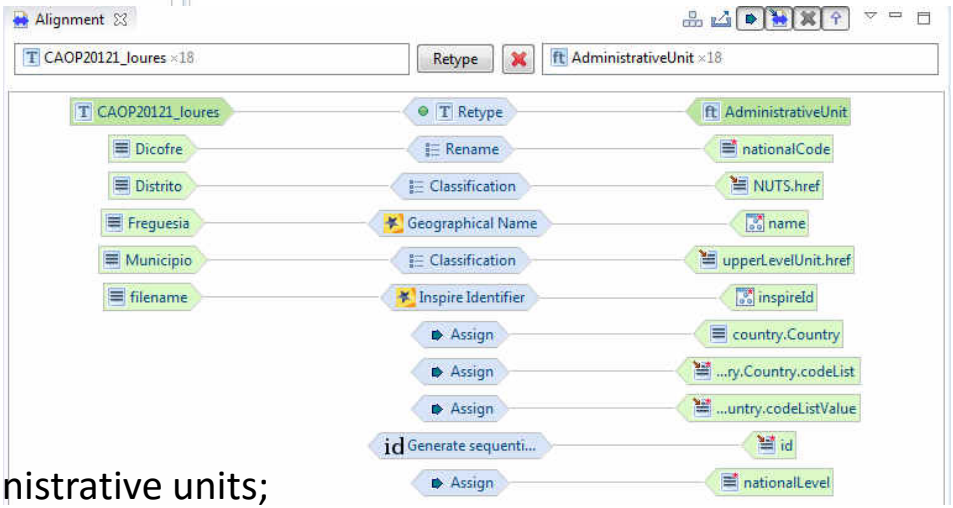


HALE workflow:

1. Study of Inspire data specification for land use;
2. Formalization of the data model for the LU dataset to be harmonized;
3. Download of Inspire data model – xsd format (PlannedLandUse)
4. Alignment:
   1. Mapping of CRUS entities and attributes with Inspire app. schema,
   2. Matching of national (CRUS) nomenclature with HILUCS (Hierarchical INSPIRE Land Use Classification System) in order to connect to a register managed within INSPIRE.
5. Output: GML file created after the harmonization proccess.

Administrative units





HALE workflow:

1. Study of Inspire data specification for administrative units;
2. Formalization of the data model for the AU dataset to be harmonized;
3. Download of Inspire data model – xsd format (AdministrativeUnits);
4. Alignment:
    1. Mapping of CAOP entities and attributes with Inspire app. Schema,
    2. CAOP has 3 levels of AUs (Distrito, Município, Freguesia),
    3. Matching between these levels and AdministrativeHierarchyLevel (Levels of administration in the national administrative hierarchy).
5. Output: GML file created after the harmonization proccess.

Methodology

- **Mapping and Transformation: rules creation and implementation**
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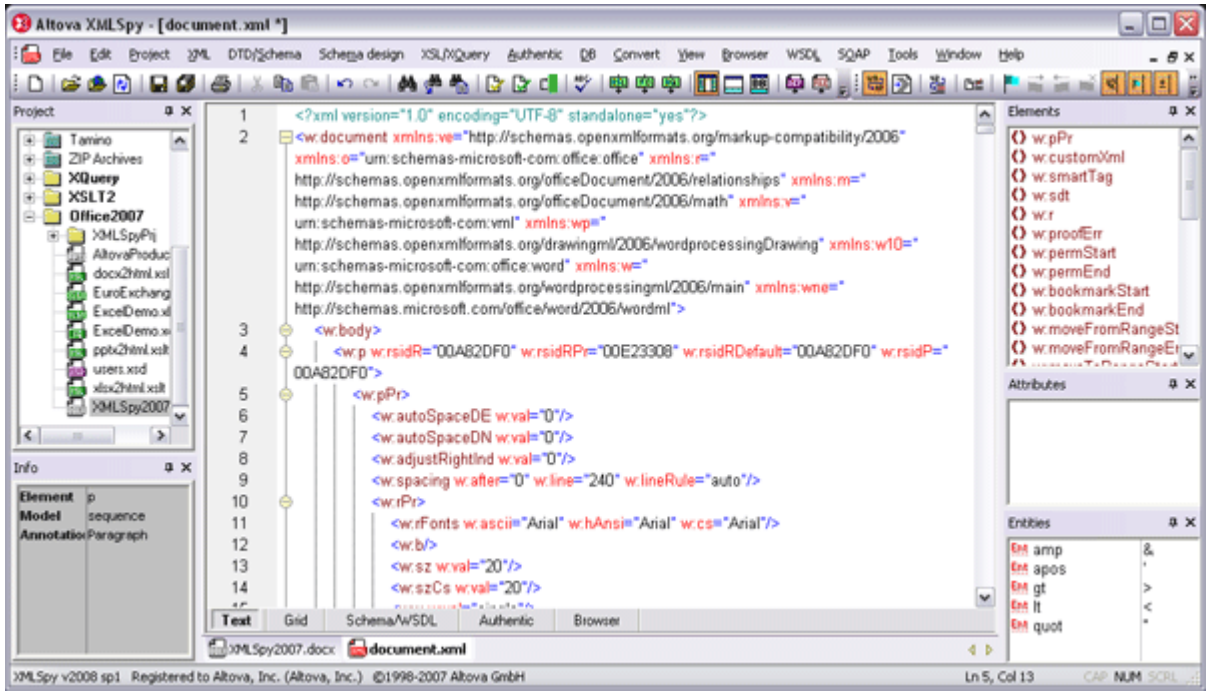
    - GML Test engine; Inspire conformance

- **Metadata**
  - **EUOSME and thesaurus**

Validation

Altova XML spy

Upload the harmonized datasets (xml file) and run the process. Success message if the harmonization OK. If not, there's a message explaining where it fails.



Validation

```
Testing suite tns:ets-gml32-3.2.1-r17 in Test Mode with defaultResult of Pass ...
Testing tns:Main type Mandatory in Test Mode with defaultResult Pass (s0005)...
      Assertion: The GML application schema or data set satisfies all
      relevant constraints.
      Test suite: gml32-3.2.1-r18
      ======== Test groups ========
      All GML application schemas
          Passed: 7 | Failed: 0 | Skipped: 0
      GML application schemas defining features and feature collections
          Passed: 2 | Failed: 0 | Skipped: 0
      GML application schemas defining spatial geometries
          Passed: 2 | Failed: 0 | Skipped: 0
      GML application schemas defining time
          Passed: 0 | Failed: 0 | Skipped: 2
      GML application schemas defining spatial topologies
          Passed: 0 | Failed: 0 | Skipped: 2
      GML Documents
          Passed: 5 | Failed: 0 | Skipped: 11


      See detailed test report in the TE
   Test tns:Main Passed
Suite tns:ets-gml32-3.2.1-r17 Passed
```

- OGC Validation tests (GML)
- Inspire conformance (ETS)

OGC® Making location count.

TEAM Engine v4

eENVplus Validation Service

Results for session s0005

Test Suite: GML 3.2 (ISO 19136:2007) Conformance Test Suite

Test tns:Main (View Details): Passed

Summary of results

Best Practice	Passed	Continue	Not Tested	Warning	Skipped	Failed	Failed (Inherited)
0	1	0	0	0	0	0	0

See the detailed test report.

Execute this session again | Delete this session | Download log Files | Create execution log report file

Sessions list

If you have any questions or suggestions, feel free to contact the eENVplus team.

TEAM Engine 4.0.5

- eENVplus Validator: http://showcase.eenvplus.eu/client/validation.htm

Methodology

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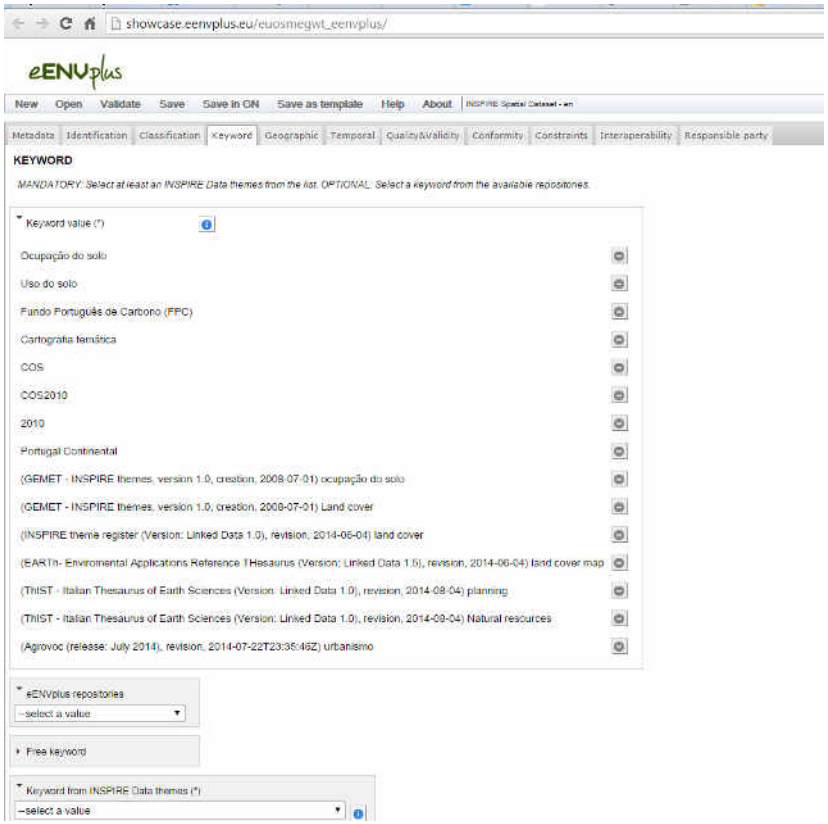
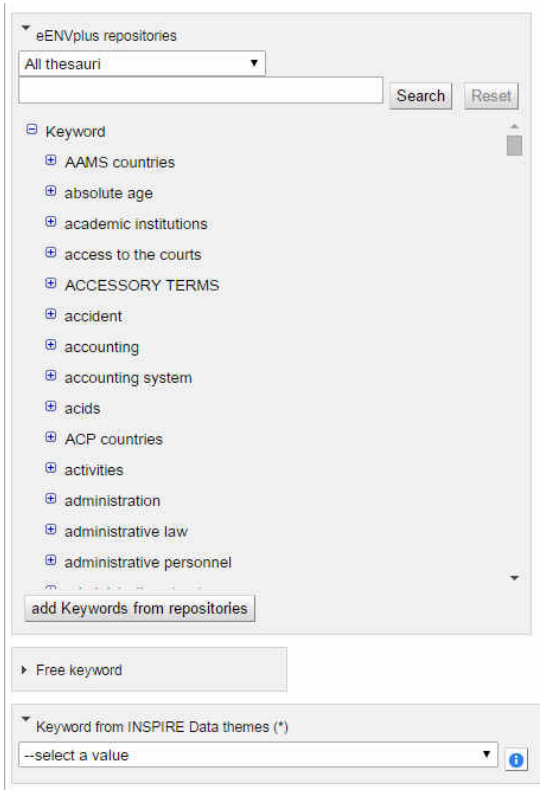
- **Metadata**
  - **EUOSME and thesaurus**

- EUOSME (European Open Source Metadata Editor) has been extended to access the eENVplus Catalogue Service and to navigate through Thesaurus Framework services.
- LusTRE (Linked Thesaurus fRamework for Environment) is a multilingual Thesaurus Framework for the environment whose objective is to improve metadata compilation and metadata discovery.





- EUOSME: http://showcase.eenvplus.eu/euosmegwt_eenvplus/
- LusTRE: http://showcase.eenvplus.eu/client/thesaurus.htm

Pilot overview

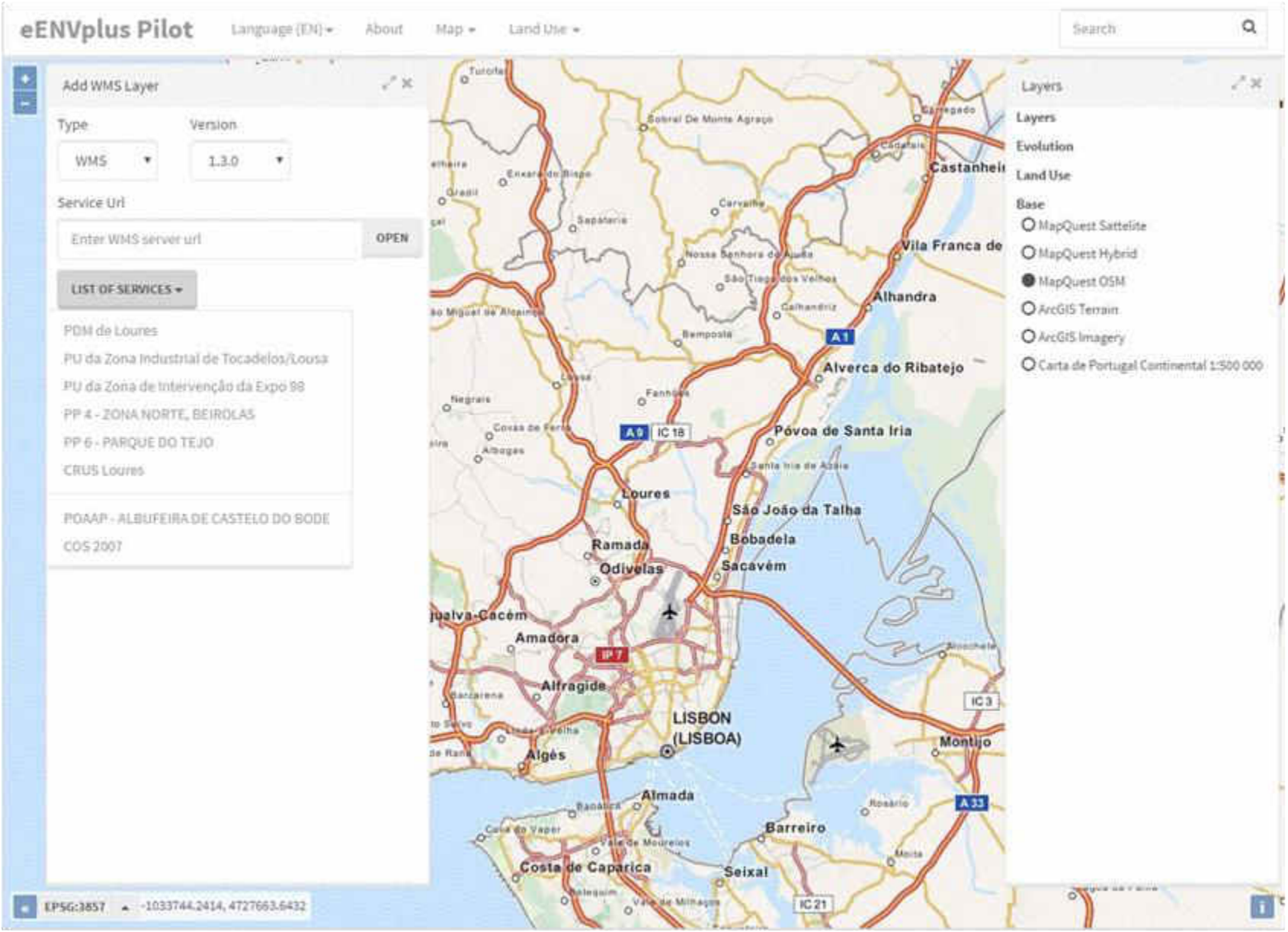
- **Tools used**
  - Data harmonization – HALE
  - Arcgis
  - Geoportal Client:
    - OpenLayers 3 (OL3)
    - Jquery
    - Bootstrap
  - Server:
    - Python
    - Flask
  - Map services:
    - Databases: Postgres/Postgis
    - Map servers: Geoserver

Let’s start with the pilot and its components....

http://mapas.dgterritorio.pt:85/eenvplus

Pilot functionalities

- Visualize LC, LU and AU data
- Visualize base cartography or other datasets of interest
- Select area and data for processing
- Determine change between datasets (WPS)
- Visualize & download results
- Analyse results:
  - Characterize the area using indicators
  - Relate LC changes with socio-economic data



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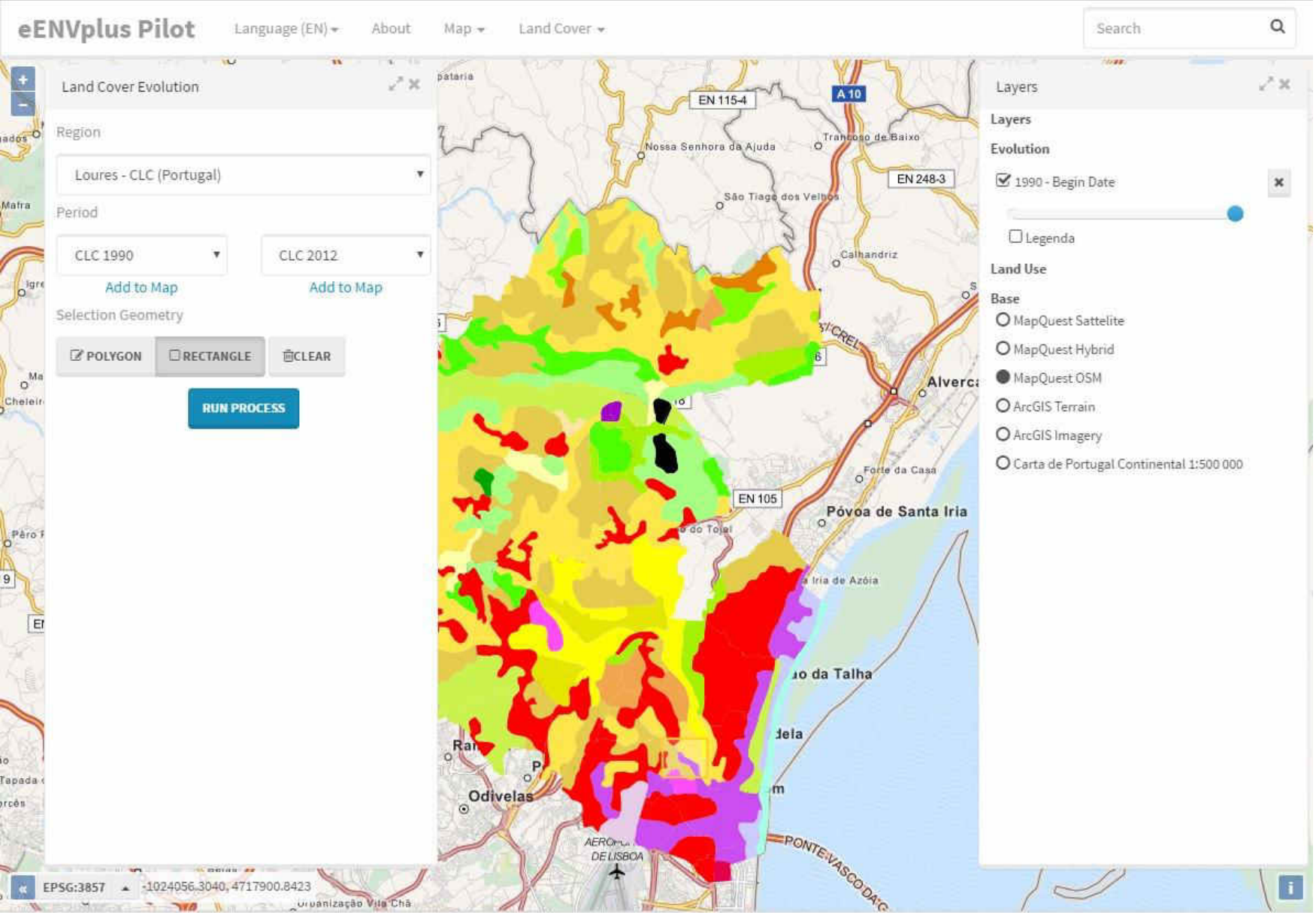

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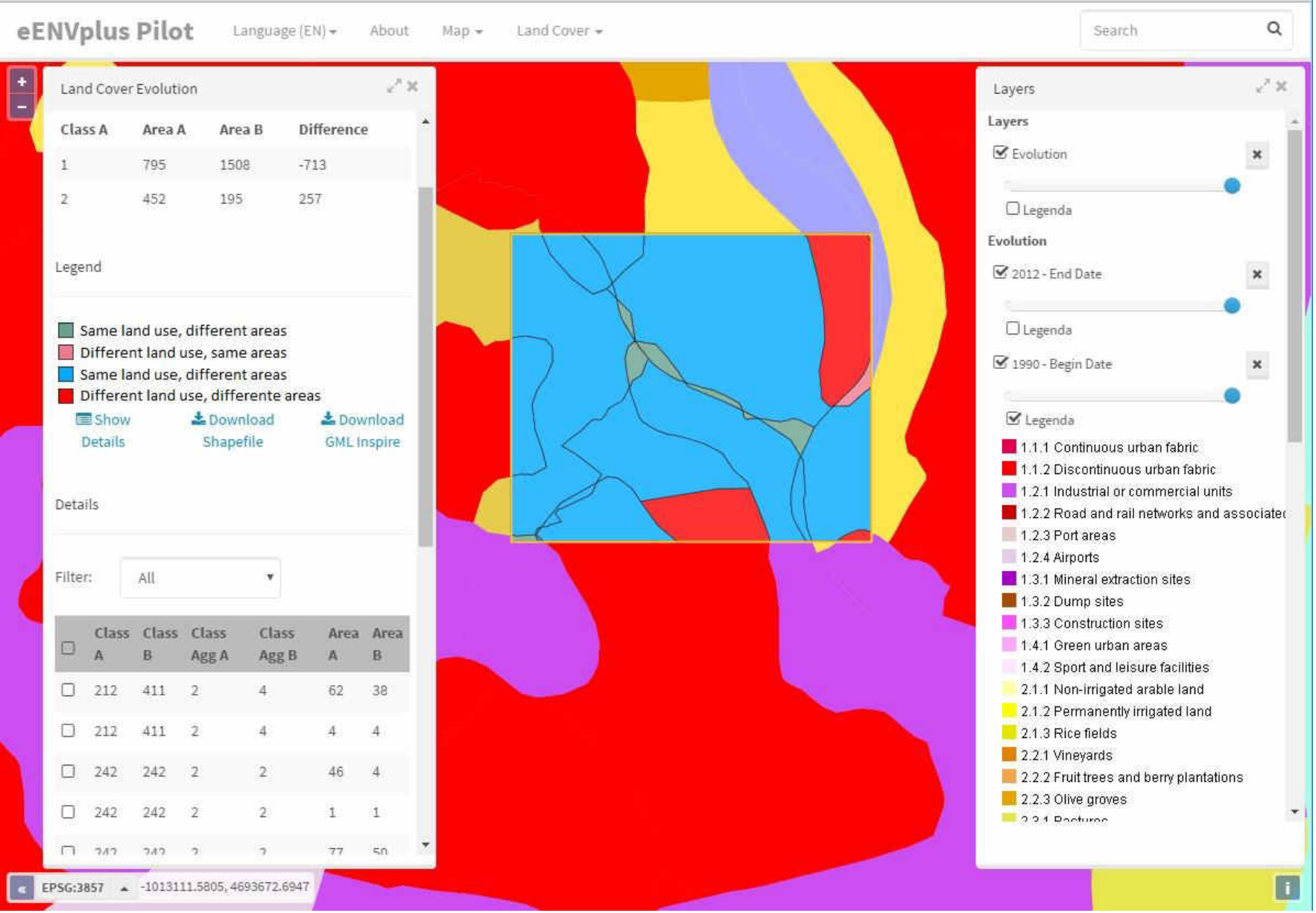
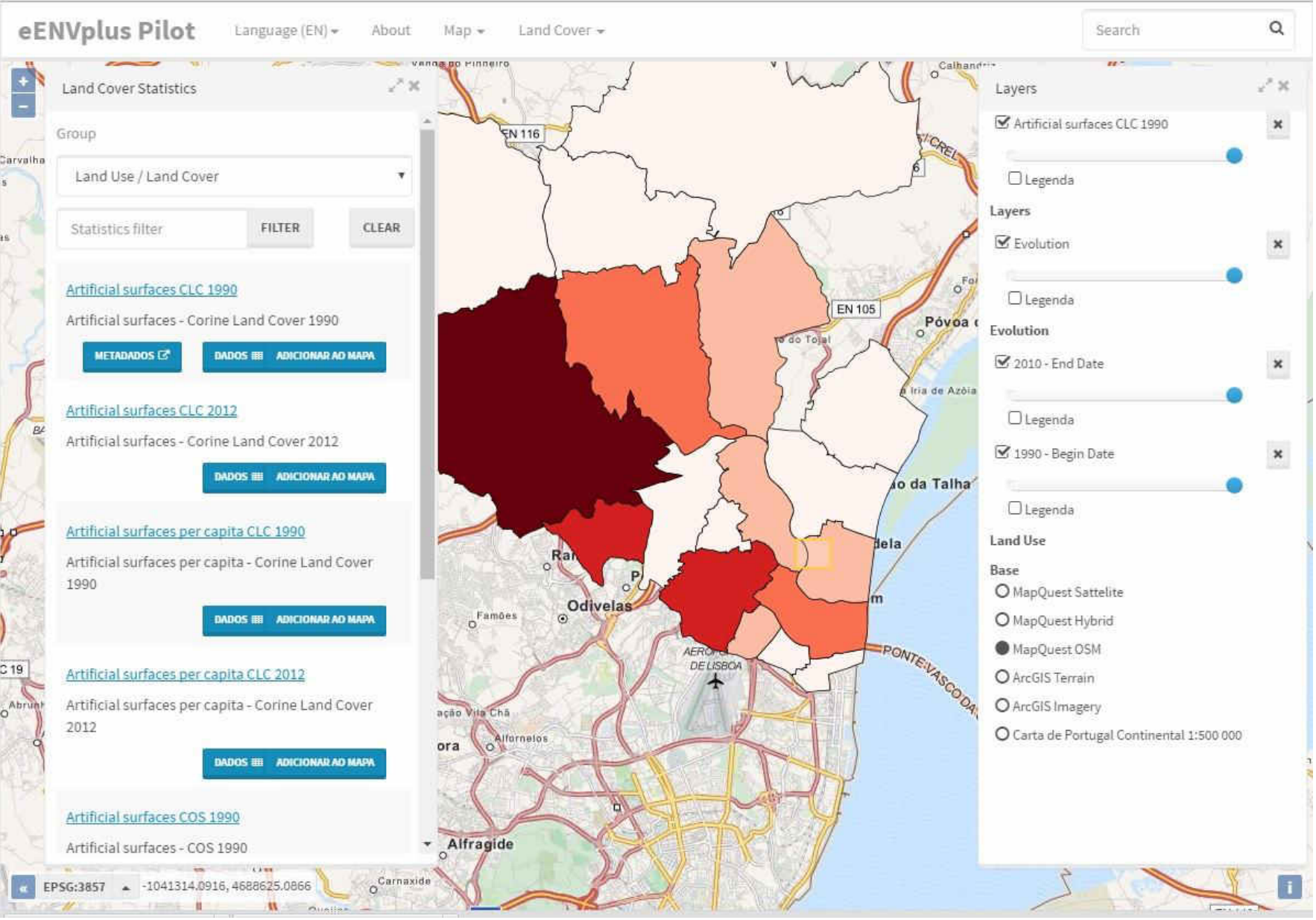

eENVplus Pilot
Language (EN)
About
Map
Land Cover
Search
Land Cover Evolution
Class A Area A Area B Difference
1 795 1508 -713
2 452 195 257
Legend
Same land use, different areas
Different land use, same areas
Same land use, different areas
Different land use, differente areas
Show Details
Download Shapefile
Download GML Inspire
Details
Filter: All
Class A Class B Class Agg A Class Agg B Area A Area B
212 411 2 4 62 38
212 411 2 4 4 4
242 242 2 2 46 4
242 242 2 2 1 1
Layers
Layers
Evolution
Legenda
Evolution
2012 - End Date
Legenda
1990 - Begin Date
Legenda
1.1.1 Continuous urban fabric
1.1.2 Discontinuous urban fabric
1.2.1 Industrial or commercial units
1.2.2 Road and rail networks and associate
1.2.3 Port areas
1.2.4 Airports
1.3.1 Mineral extraction sites
1.3.2 Dump sites
1.3.3 Construction sites
1.4.1 Green urban areas
1.4.2 Sport and leisure facilities
2.1.1 Non-irrigated arable land
2.1.2 Permanently irrigated land
2.1.3 Rice fields
2.2.1 Vineyards
2.2.2 Fruit trees and berry plantations
2.2.3 Olive groves
EPSG:3857
-1013111.5805, 4693672.6947



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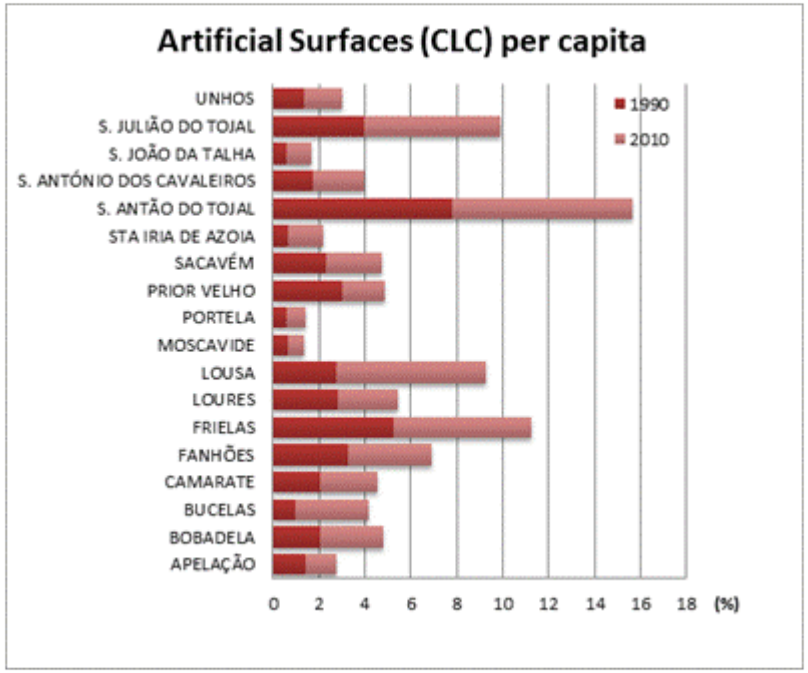
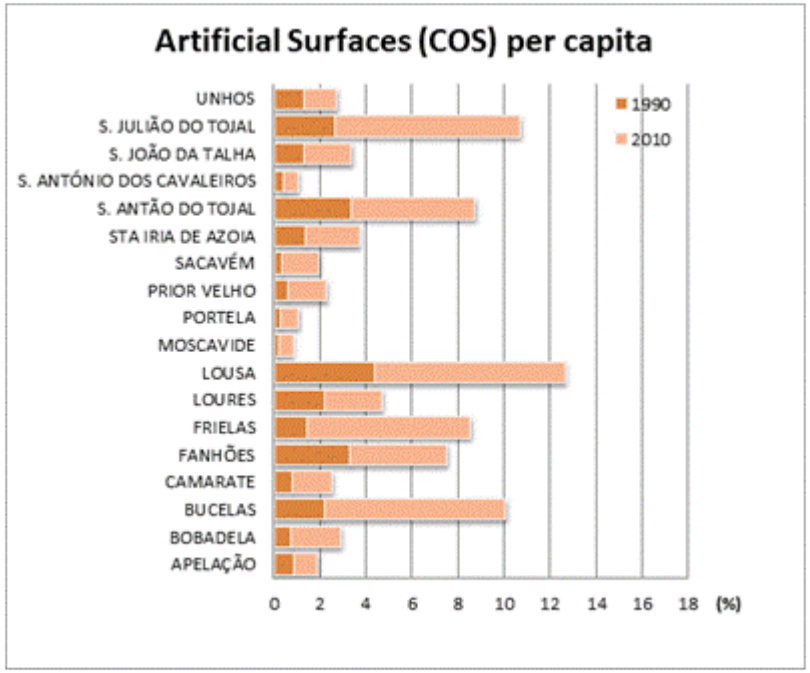
Portuguese Pilot - LC Change detection and planning indicators

Indicators visualization: Artificial Surfaces per Capita per Civil Parish





- Enables the assessment of the adequacy of available datasets to evaluate the sustainability of urban growth combined with the socio-economic evolution and environmental pressures.

Pilot main contributions

- Demonstration Example:
  - Lisbon Metropolitan Area (AML)
- Inspire data harmonization (LC: COS, CLC; LU: CRUS, AU: CAOP) and validation
- Creation and validation of Metadata (INSPIRE compliant).
- Characterization of the territory using indicators to monitor Land Cover Changes over time. Ex: urban dynamics
- Geoportal development (WFS, WMS and WPS) - Open Source

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- **Authors:**
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