LULC change detection and planning indicators

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Sources: eENVplus project 2015

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eEnvPlus main goals

Maximizing Openness

- Extensive support for **interoperability protocols.**

- Software infrastructure based on **open standards.**

- Modular/scalable/compliant **service oriented architecture.**

- Ensuring **interoperability with EU directives** (e.g. INSPIRE).

- Available as **Free and Open Source Software.**

- Providing **data in an open form**, in line with the objectives of the Digital Agenda for Europe (DAE).

Impact factors

- Make public geographic information **accessible, reusable, harmonized and validated** (against the relevant INSPIRE Data Specifications).

- Ensure use and re-use of **interoperable added value *eEnvironment* services**, in line with the DAE.

- Increase the **efficiency of the public sector** on environmental reporting obligations.

- Contribute to the **growth of the private sector (particularly SMEs)** with added value services for new businesses

Introduction

❑ **Evaluating LULC change over time** is a relevant issue in the recent list of development concerns in the international context, which was included in the recent financing programmes within the 2020 Agenda for the years to come.

❑ **Evaluating all these LULC changes over time is quite relevant to the planning process**

❑ **Build an example using the platform** - Urban growth and urban sprawl problems have different contours; in Portugal raised problems are, in some extent, related with increasing artificialized areas in the past decades, without a correspondent increase in population distribution. Metropolitan areas can give good examples the AML was the one selected and explored.

❑ Although the population of AML has increased in this period by almost one million inhabitants, the population of Lisbon decreased while the population increased in its periphery.

❑ Within this pilot a case study is presented based on building spatiotemporal indicators to monitor urban areas evolution over the last decades

Inhabitants in the metropolitan area of Lisbon
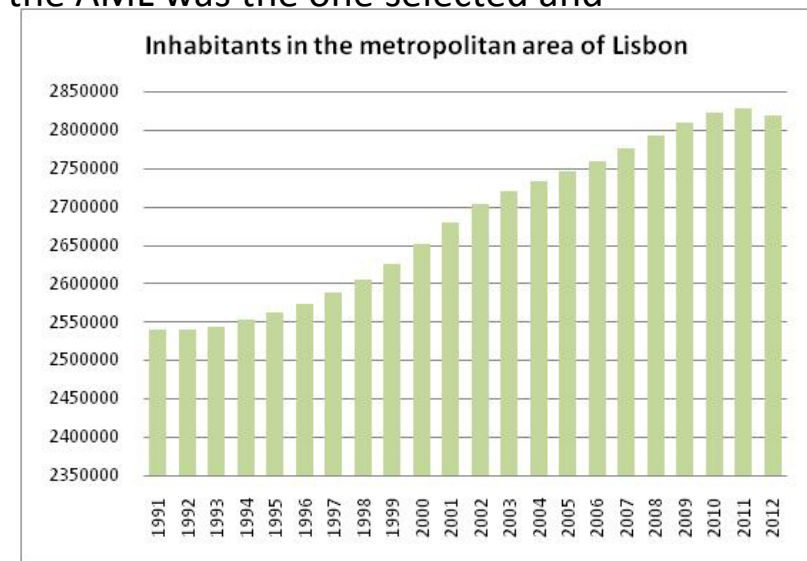
Source: INE, Estimativas Anuais da População Residente
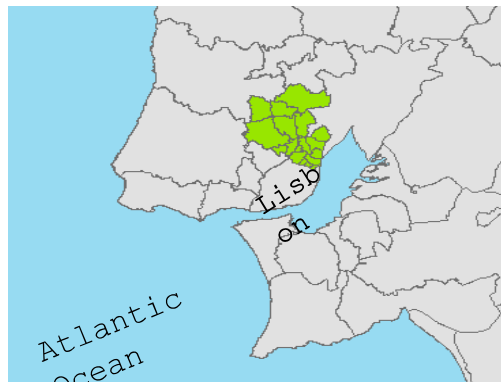
Pilot overview

The study area: Loures Municipality

Aims of the Portuguese pilot:

- Create an application to monitor land cover changes over time

- Develop a prototype integrating web services to build indicators and monitor LULCC dynamics

- Evaluate fitness for purpose of available datasets to deal with planning issues, including the environmental perspective
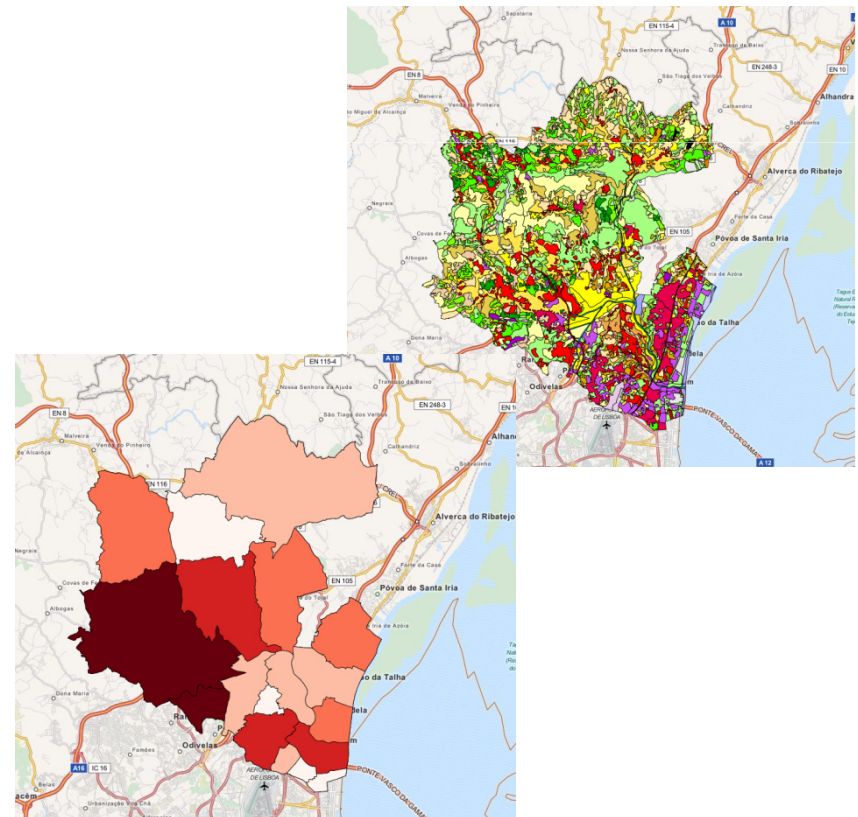
Pilot overview

- **Functionalities**

  - Select the datasets

  - Delineation of study areas: AML- Loures Municipality

  - Evaluate LCC over time (Ex: urban growth)

  - Integrate statistical data (time series)

  - Create dynamic territorial indicators to monitor and support land use planning activities.

  - Evaluate and document data accuracy

Pilot overview

☐ **Data used in the pilot**

- ◘ Land cover datasets: COS 1990, COS 2010, CLC 1990, CLC 2012

- ◘ Land use dataset (CRUS)

- ◘ Administrative units (CAOP)

- ◘ Statistical data (dynamic indicators)

- ◘ Base maps

Pilot overview

☐ **What was made within the project**

- Data harmonization (COS, CORINE, CRUS, Administrative units) and validation (ETS)

- Creation and validation of Metadata: COS, CORINE, CRUS and CAOP, INSPIRE compliant, included in the project

- Creation of indicators to monitor urban dynamics

- Geoportal (WFS, WMS and WPS), Open source

- Demonstration Example:

   - Metropolitan Lisbon Area-AML- Loures Municipality

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 (with INSPIRE extension)

Let's start with the platform and its components....

https://www.youtube.com/watch?v=fBMpqaKsiYU

Let's go into some usefull details

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METADATA COS2010 - Carta de Ocupação do Solo associada ao reporte de Kyoto

Modelo de dados	Vetorial
Unidade Mínima Cartográfica (UMC)	1 ha
Distância mínima entre linhas	20 m
Largura mínima de polígonos	20 m
Sistema de Georreferência	ETRS89/PT-TM06
Elipsoide de referência	GRS80
Projeção cartográfica	Transversa de Mercator
Latitude da origem das coordenadas retangulares	φ_0: 39° 40' 05'',73 N
Longitude da origem das coordenadas retangulares	λ_0: 8° 07' 59'',19 W
Falsa origem das coordenadas retangulares	$\Delta X = 0$ m; $\Delta Y = 0$ m
Fator de escala no meridiano central	K = 1
Nomenclatura	Nomenclatura hierárquica com cinco níveis de detalhe e 225 classes no 5° nível. A nomenclatura da carta 1995 possui uma legenda mais simplificada de apenas 85 classes
Dados de base	Imagens aéreas ortorrectificadas de 1995, 2007, 2010
Alguns dados auxiliares	Inventários Florestais Nacionais – IFN1, IFN4 e IFN5;Cartografia anual de áreas ardidas; Orto-imagens de 2005;Informação recolhida no campo (2009 e 2010)
Exatidão temática	Maior ou igual a 85%
Exatidão posicional	Melhor ou igual que 5,5 m
Referência de delimitação administrativa	Carta Administrativa Oficial de Portugal (CAOP), versão 2008.1

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METADATA CLC2012 : Descrição da Produção da Carta de Ocupação do Solo associada ao CORINE Land Cover

- CLC 2012 – Cartografia de uso de solo, com resolução de 25 ha, para Continente, Açores e Madeira com base em imagem de satélite.
- Alterações 2006/2012 – Resolução de 5 ha.
- Verificação e melhoria dos 5 níveis de elevada resolução: impermeabilidade, densidade de coberto florestal, tipo de floresta, pastagens, zonas húmidas e corpos de água.
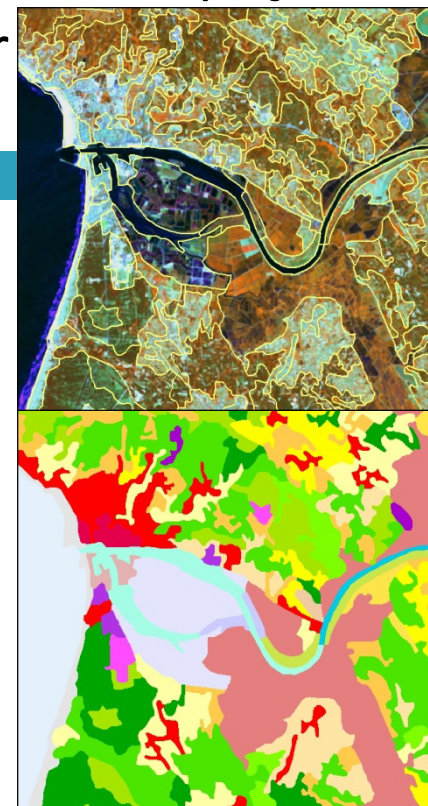
Precisão Geométrica – Melhor que 100 m
Precisão Temática – Maior ou igual a 85%
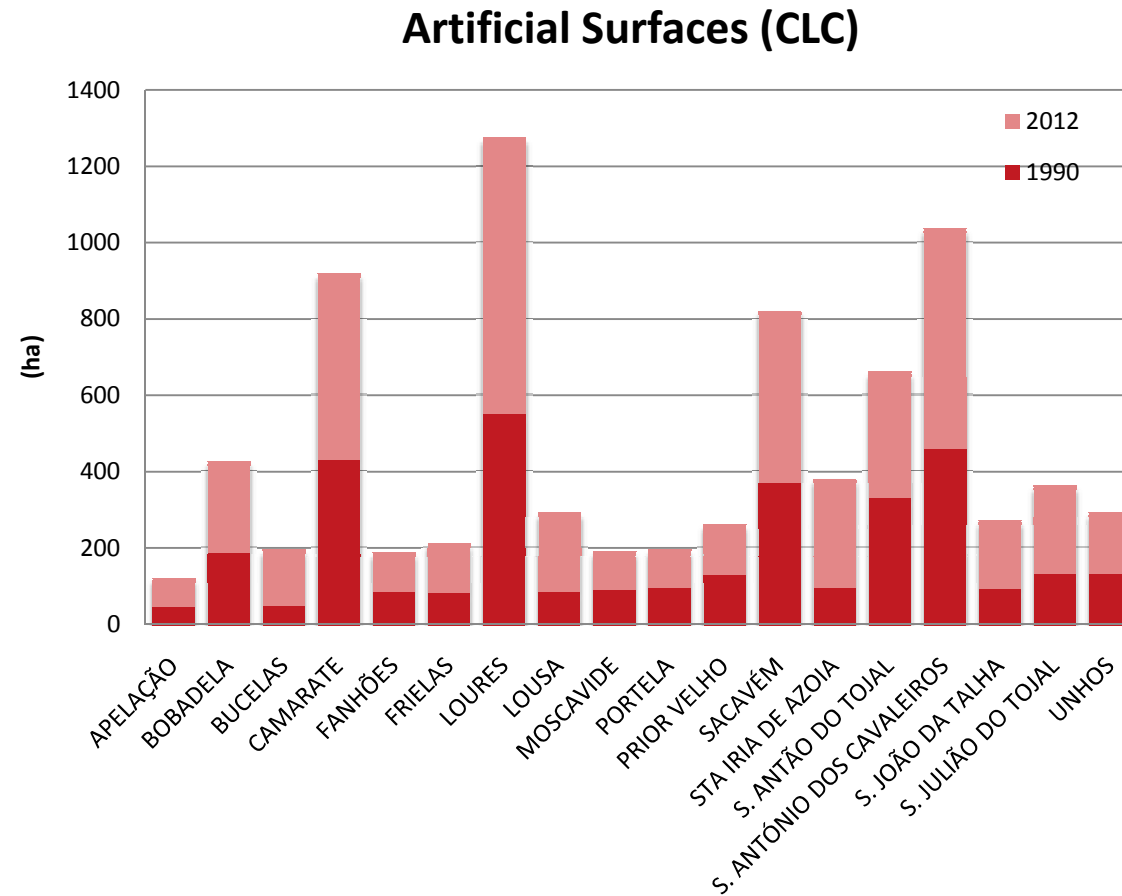Nomenclatura CORINE – 44 classes

Imagens de satélite a usar:

	2006		2012	
Satélite	SPOT 4	IRS P6	IRS P6	RapidEye
Sensor	HRVIR	LISS III	LISS III	RapidEye
Res.espac Multi-Espec./Pan	20 / 10	23	20	20
N.Bandas Multi-Espec./Pan	4 / 1	4	4	5

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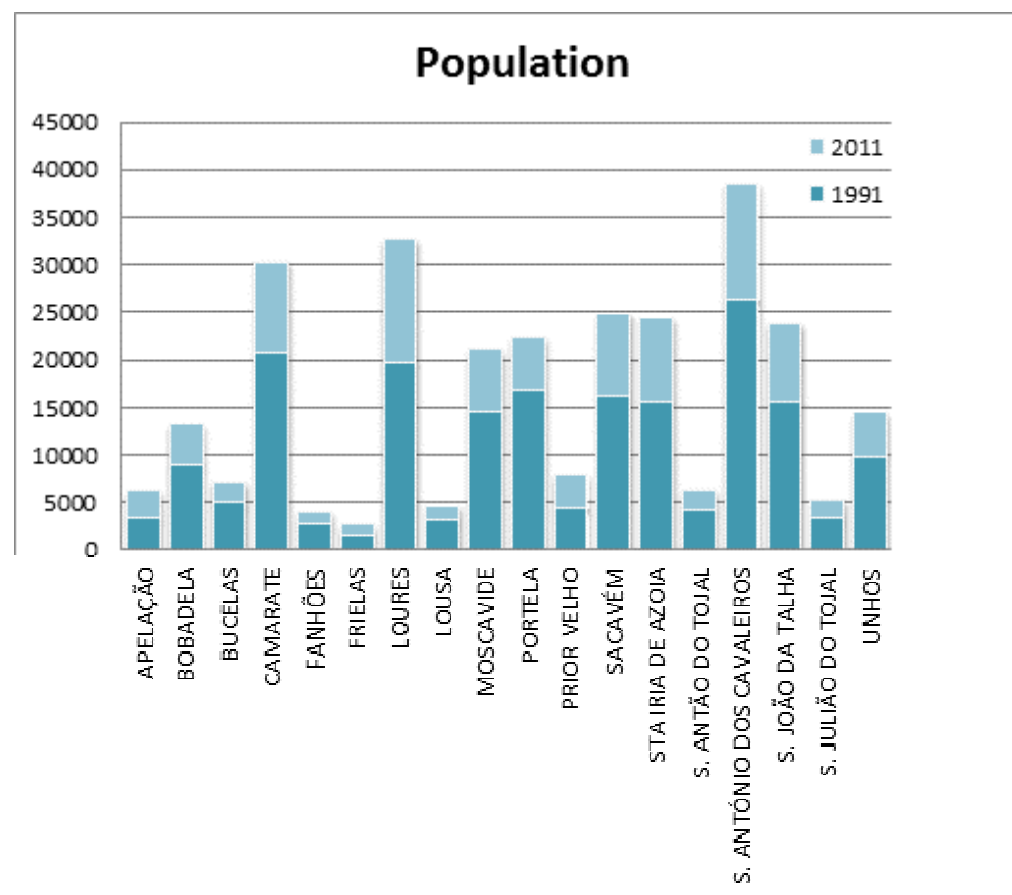
Artificial Surfaces (CLC)

Indicators visualization: Artificial Surface per Civil Parish
Data Source: LULC: CLC 90 (DGT/EEA) ; CLC 2011 (DGT/EEA)

Portuguese Pilot - LULC Change detection and planning indicators

Artificial Surfaces (COS)
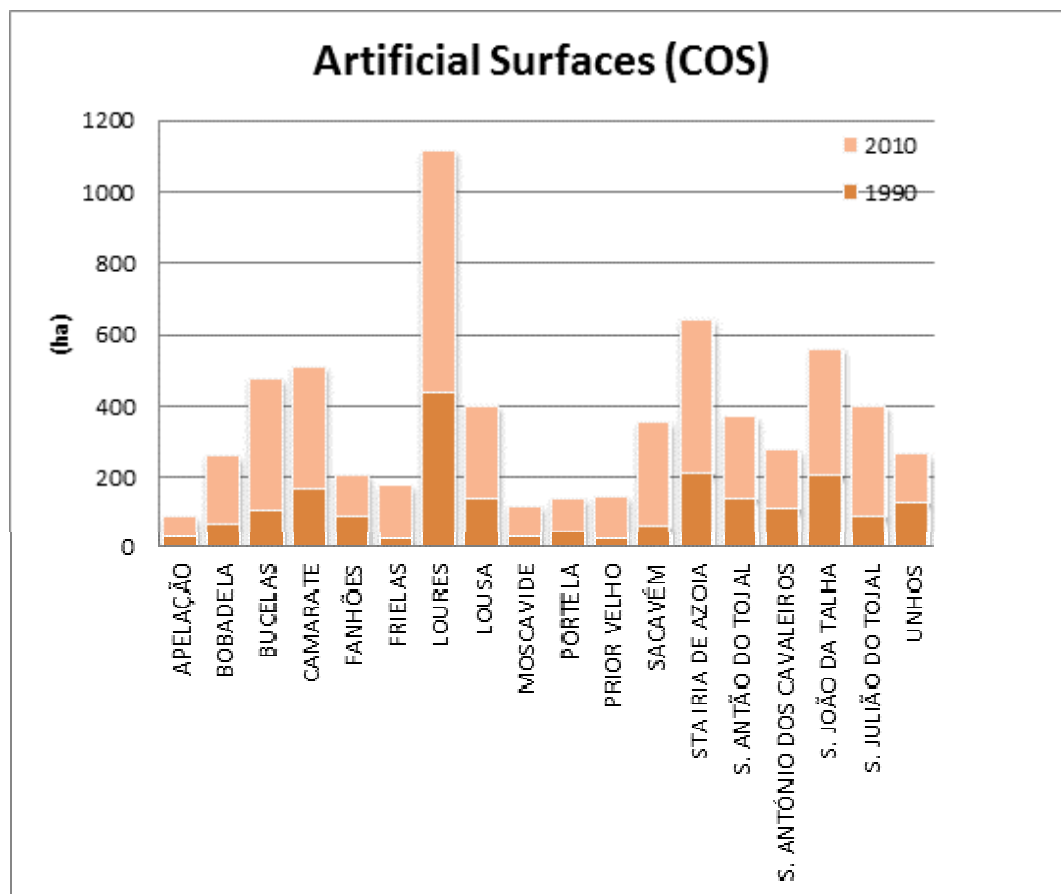
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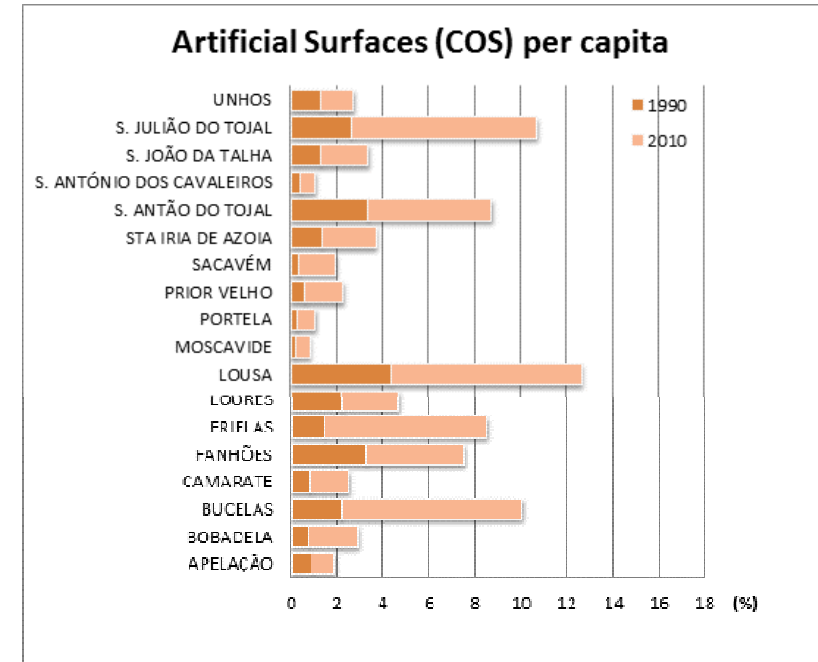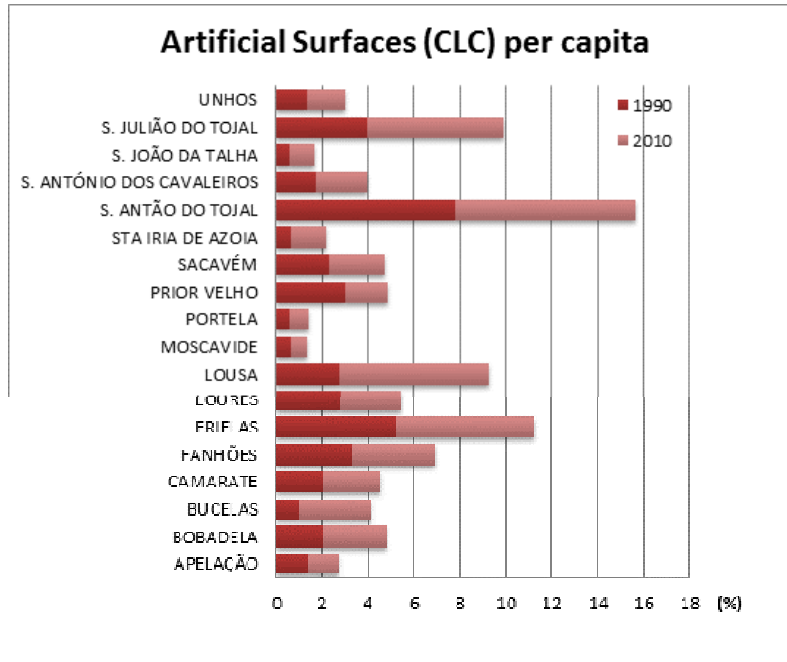Data Source: LULC: COS 90 (DGT) ; COS2010 (DGT)

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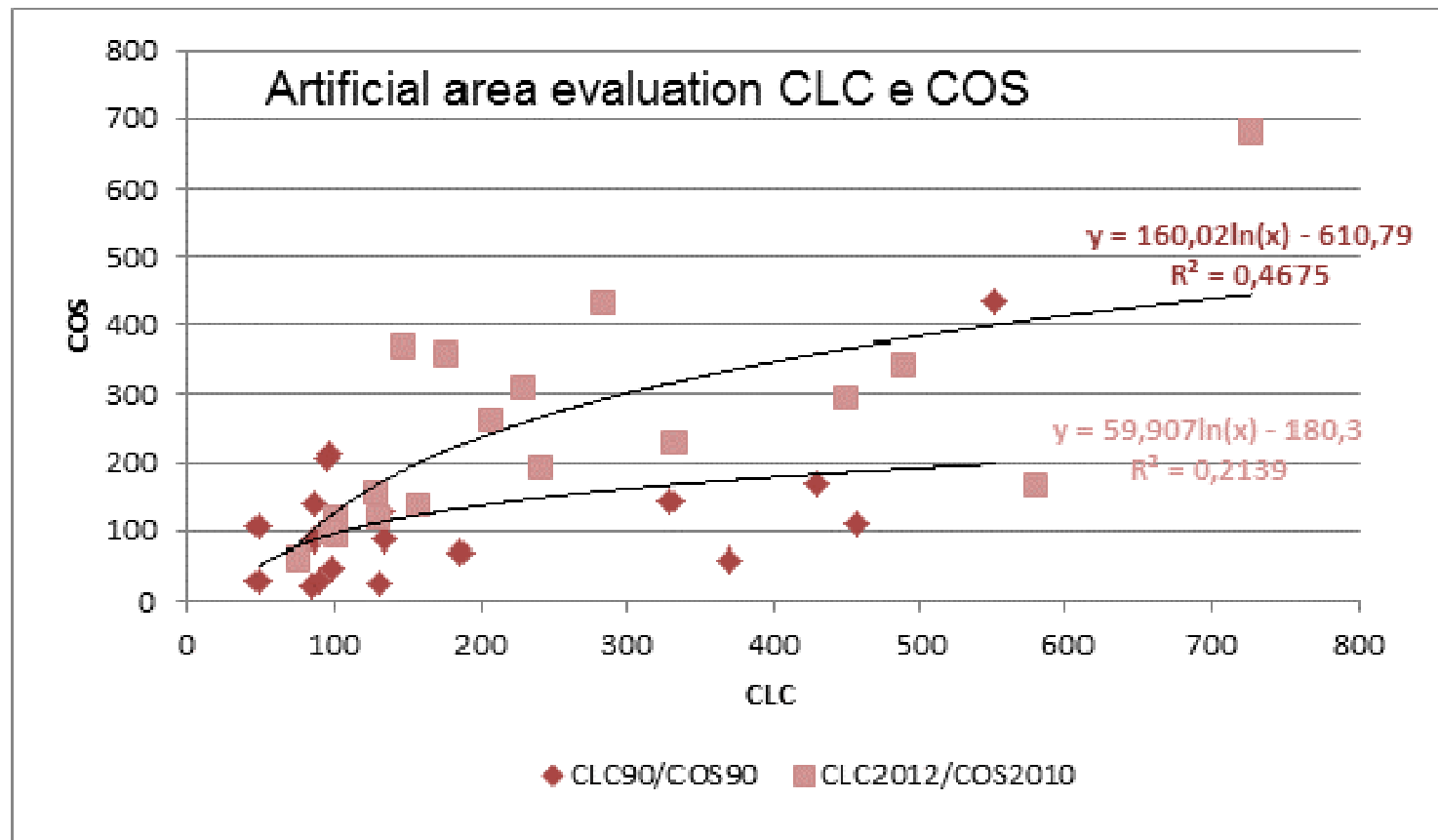

Indicators visualization: Population per Civil Parish
Data Source: CAOP 2014 (DGT); Population: Census 1991 and 2011 (INE)

Portuguese Pilot - LULC Change detection and planning indicators

Artificial Area evaluation: Comparing COS and CORINE datasets

Pilot main contributions

What was made within the project

- Data harmonization (COS, CORINE, CRUS, Administrative units) and validation, Inspire compliant (ETS)

- Creation and validation of Metadata: COS, CORINE, CRUS and CAOP, INSPIRE compliant, included in the project

- Enable creation of indicators to monitor Land Cover Changes over time. Ex: urban dynamics

- Geoportal development (WFS, WMS and WPS)-Open Source

- Demonstration Example:

    - Metropolitan Lisbon Area-AML- Loures Municipality

The Portuguese Pilot contribution to eEnvPlus main goals accomplishement

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eENVplus project, 2015