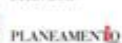




## **Periurban Agriculture and Mediterranean Ecosystems: the Azeitão Cheese production system as an example of sustainable multifunctional agriculture in Lisbon Metropolitan Area**

Isabel Carvalho Rodrigues  
Universidade Nova de Lisboa - Faculdade de Ciências e Tecnologia  
Departamento de Ciências de Engenharia do Ambiente

Organização:



Apoio:

Media Partner:



# Periurban Agriculture and Mediterranean Ecosystems

**the Azeitão Cheese production system as an example of sustainable multifunctional agriculture in Lisbon Metropolitan Area**

- Importance of conserving the Mediterranean ecosystems
- The impact of urban sprawl in nature conservation and biodiversity
- Periurban agriculture and the conservation of Mediterranean landscapes in areas of urban expansion
- The production of Azeitão Cheese: a peri-urban multifunctional system of Lisbon Metropolitan Area (AML)

# Mediterranean Ecosystems

- **Importance of conserving the Mediterranean ecosystems**



# Mediterranean Region



# Mediterranean Region

## *A Hotspot of biodiversity*

### European Ecological Regions



Source: <http://www.eea.europa.eu/legal/copyright>

● Biodiversity Hotspots

### EU Biodiversity Policy

- Birds Directive
- Habitats Directive
  - Natura 2000 Network
- EU Biodiversity Strategy

# Mediterranean Region

## *Biodiversity*

- High level of species and endemism. Examples:
  - more than 25 000 species of flowering plants (10% of all known in earth; 50% endemic)
  - about 360 species of birds among the 500 species present in all Europe
- Adaptation of species to peculiar environmental conditions, namely, resistance to drought
- Determinant intervention of humans in:
  - composition and distribution of ecosystems
  - introduction of exotic species
  - specific and intraspecific diversity

# Mediterranean Region

## *Cultural Landscapes*



*"Apart from some remote areas, **there is probably no square metre of the Mediterranean that has not been directly and repeatedly manipulated and, one might say, 'redesigned' by humans**".*

*(J. Blondel and J. Aronson, 1999)*

# Mediterranean Region

## *Cultural Landscapes*



**With sustainable agriculture, men has largely contributed to shape Mediterranean landscapes**



# Mediterranean Region

## *Threats*



Abandonment



Dense matorrals and  
loss of mosaic landscapes



Fire



Intensification of agriculture



Urbanization, specially in coastal zones



# Mediterranean Region

## *Landscapes and Biodiversity Conservation*

The Mediterranean biodiversity develops itself in fragmented landscapes (mosaic landscapes).

Cultural and biological diversity are interconnected.

**Conservation of biodiversity in the Mediterranean region is necessary and requires the continuity of sustainable agro-forestry systems.**

# Periurban Agriculture and Mediterranean Ecosystems

- The impact of urban sprawl in nature conservation and biodiversity



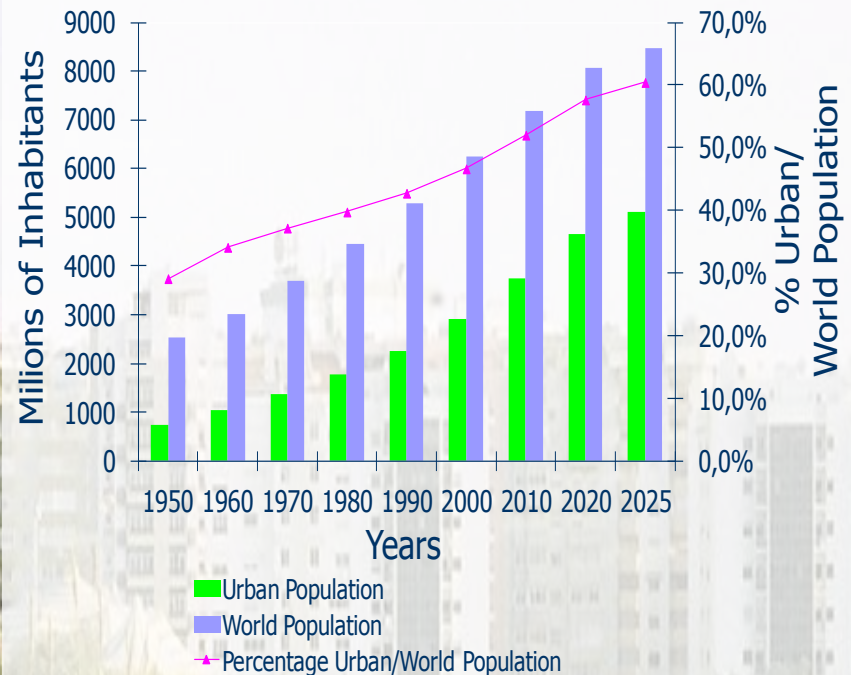
# Urban Growth

*“By the turn of the century, almost half the world will live in urban areas.*

*This is the century of the ‘urban revolution.’”*

(WCED,1987)

## Urban and World Population, 1950-2025



Source: UN Centre for Human Settlements (*in* Gilpin, 2000)

# Urban Growth

## *Impacts*

- **Development of metropolitan areas** with large suburban chaotic neighborhoods
- Increasing socio-economic dysfunctions:
  - poverty
  - loss of cultural identity
  - declining quality of life
- Uncharacterized environment:
  - pressure on natural resources
  - biodiversity depletion**
  - increasing pollution
  - erosion and adverse micro-climatic effects
- **Human desertification of rural areas**



# Urban Growth

## *Greenways and Agriculture*

**Greenways combine different land uses;** they safeguard the existence of a *Continuum Naturale*

In metropolitan areas, the rural landscape represents the core of the system of green spaces.

**Agriculture structures rural landscape and has, in this context, new functions such as:**

- environmental protection
- landscape conservation
- recreational and cultural value

# Periurban Agriculture and Mediterranean Ecosystems

- Periurban agriculture and the conservation of Mediterranean landscapes in areas of urban expansion



# Urban and Periurban Agriculture

## Urban Agriculture

Is an activity located within the limits of urban settlements.

- Different constraints from predominantly rural areas
- It is "more or less urban" according to greater or lesser interaction with the urban ecosystem
- New functions

## Periurban Agriculture

Develops itself on the fringes of urban spaces, under its influence.



# Periurban Agriculture and Mediterranean Ecosystems

**The role of agriculture in preserving biodiversity is undeniable in Mediterranean region.**

The agriculture “capability” of structuring the territory, with a sustainable management of space, is an attribute of the activity.

**The possibility of developing sustainable farming systems in periurban environment requires the study of "new functions" that it can play.**

# Periurban Agriculture and Mediterranean Ecosystems

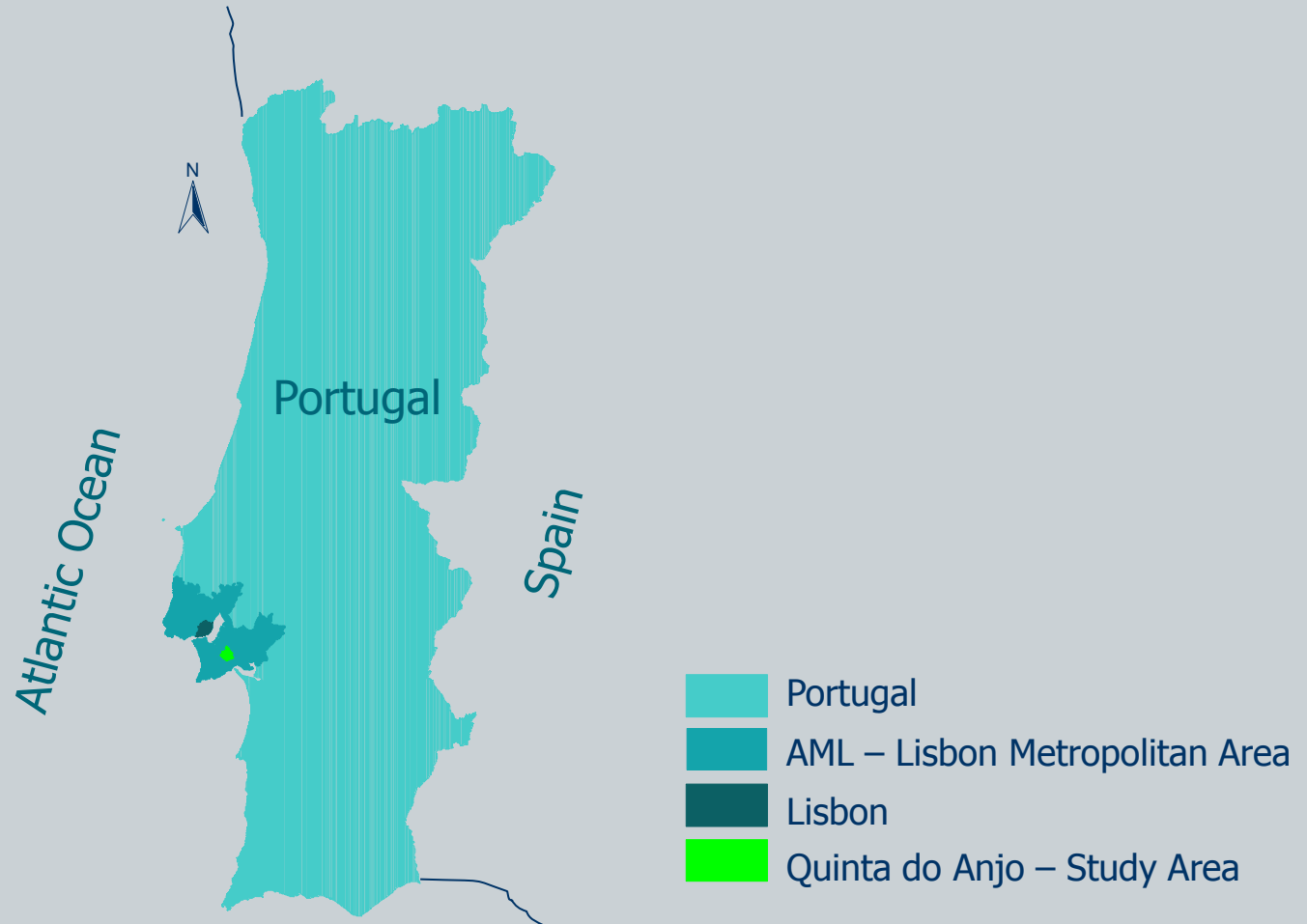
*- Study case:*

**the Azeitão Cheese production system as an example of sustainable multifunctional agriculture in Lisbon Metropolitan Area (AML)**



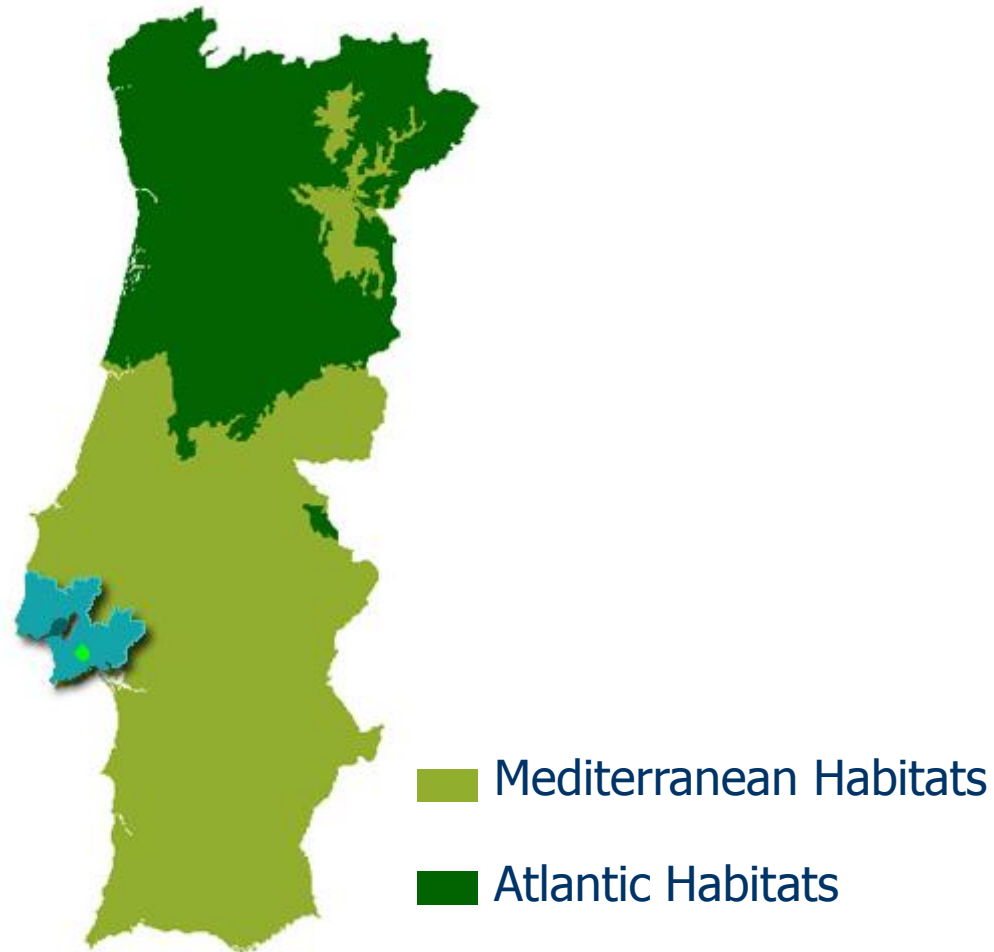
# Study Area

*Lisbon Metropolitan Area – Quinta do Anjo (Palmela Municipality)*



# Study Area

## *Ecological Region*



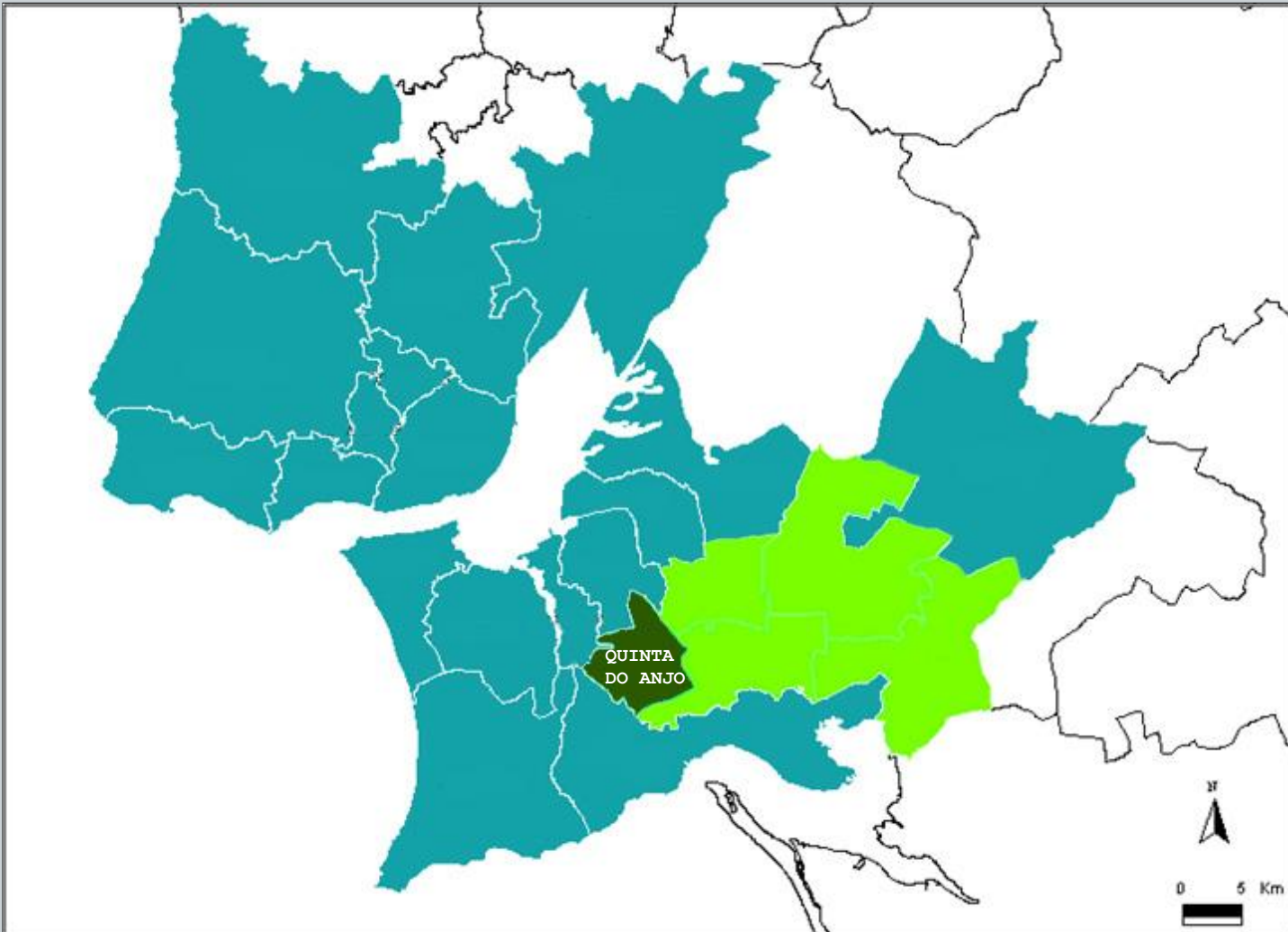
Source: J. Malato-Beliz, 1976 e Carta de Paisagem - Atlas Digital do Ambiente, Instituto do Ambiente, 2003

### **Periurban Agriculture and Mediterranean Ecosystems**

Isabel Carvalho Rodrigues ♦ Universidade Nova de Lisboa ♦ September 2011

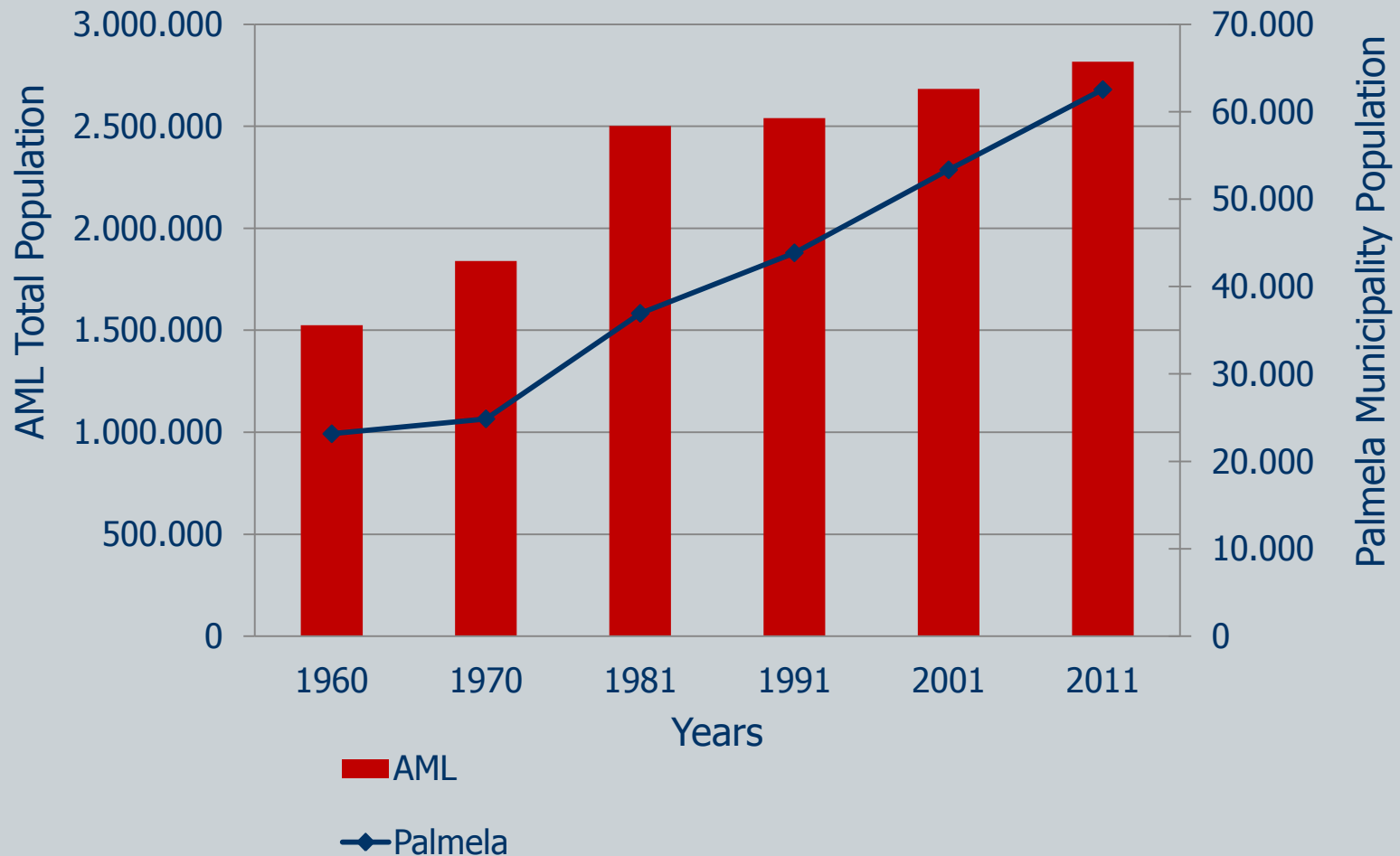
# Study Area

*Lisbon Metropolitan Area – Palmela Municipality - Quinta do Anjo*



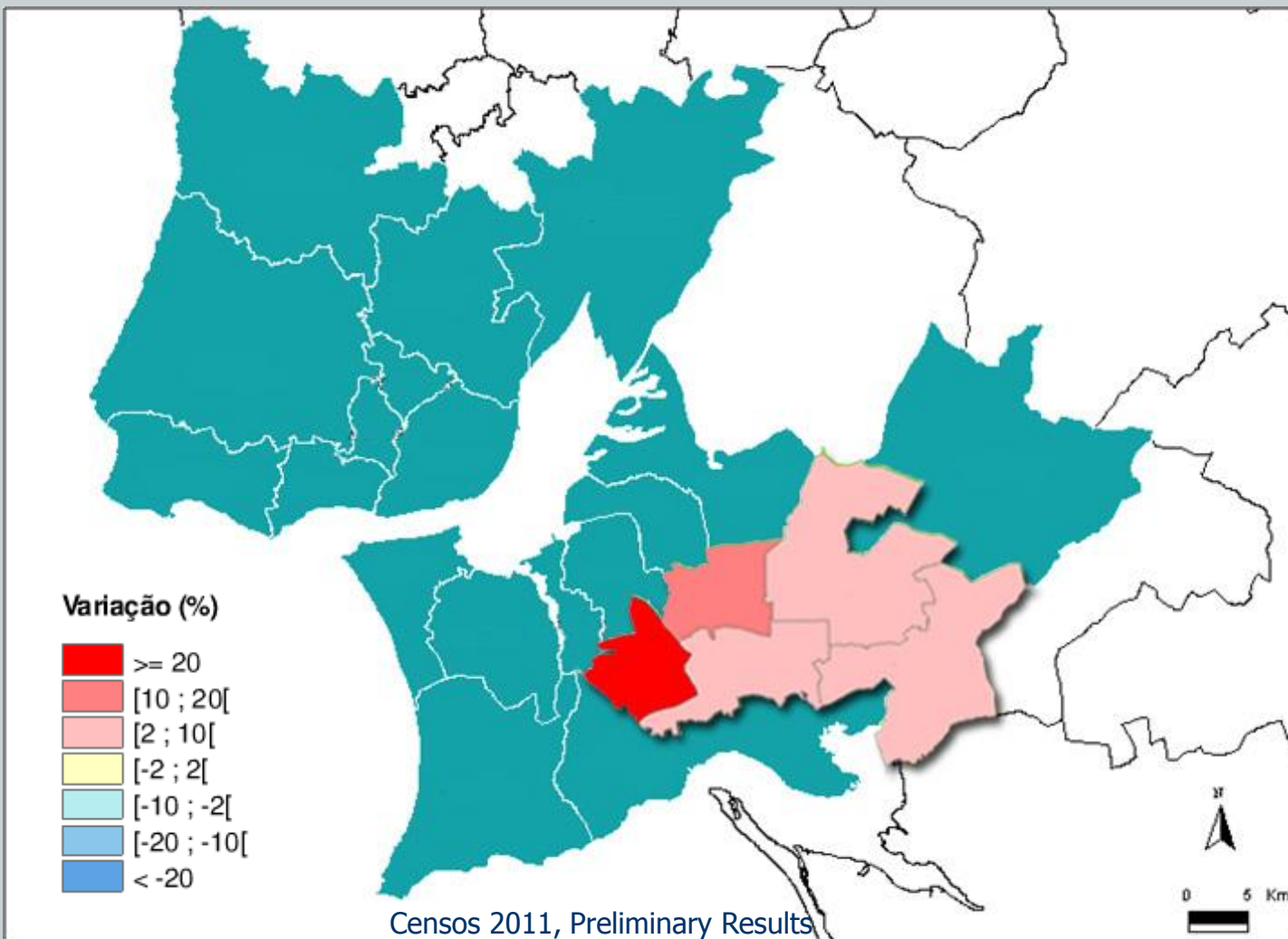
# Study Area

## *AML and Palmela: Resident Population, 1960 - 2011*



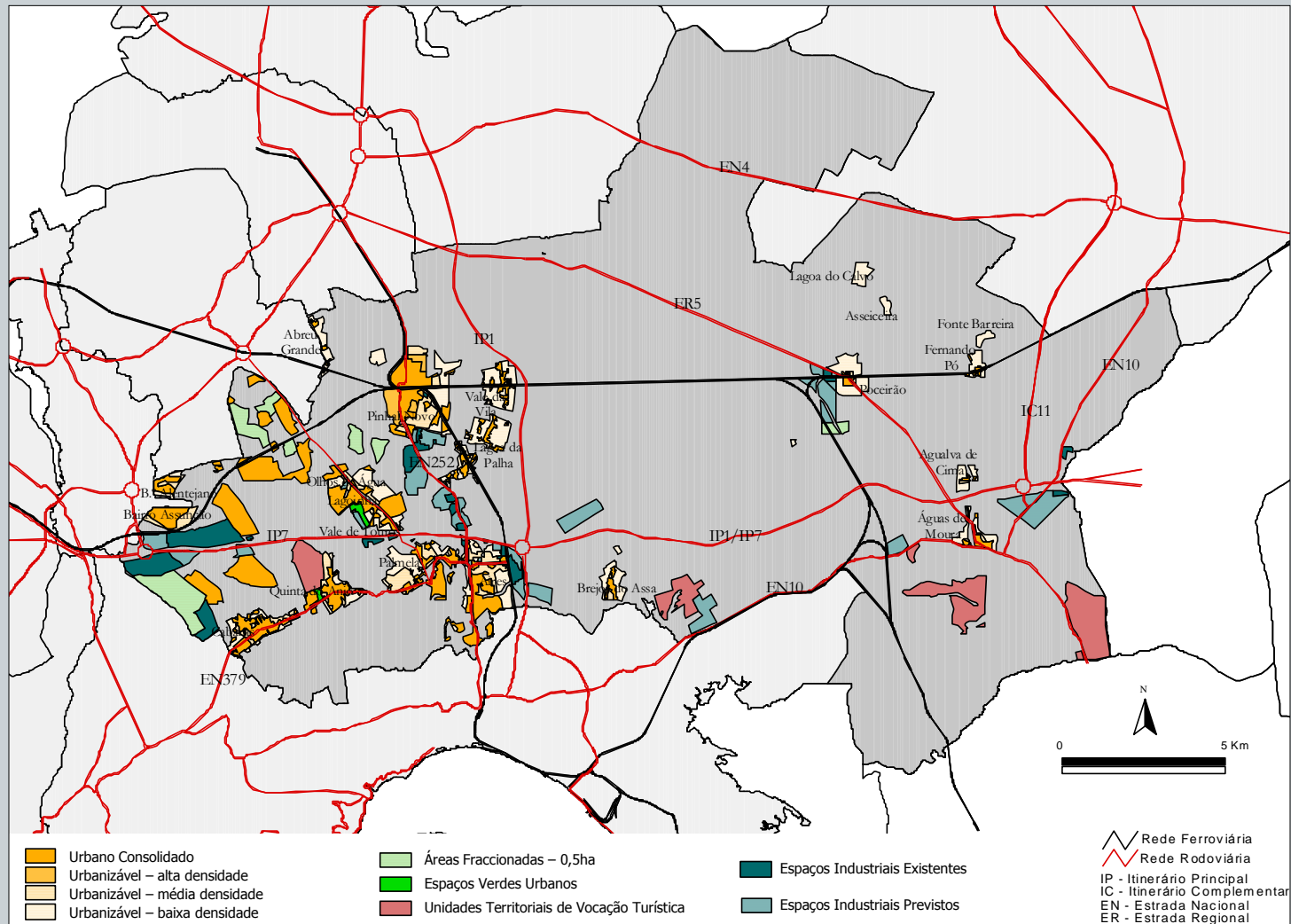
# Study Area

## *Palmela: Evolution of Resident Population by District, 2001-2011*



# Study Area

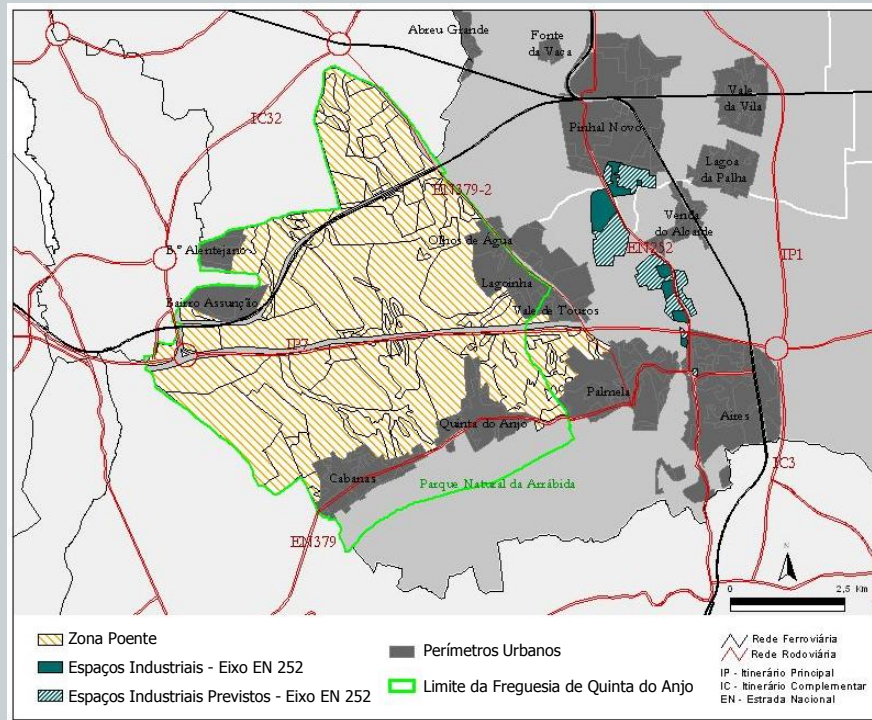
## *Palmela: Urban Areas*





# Study Area

## Palmela and Quinta do Anjo

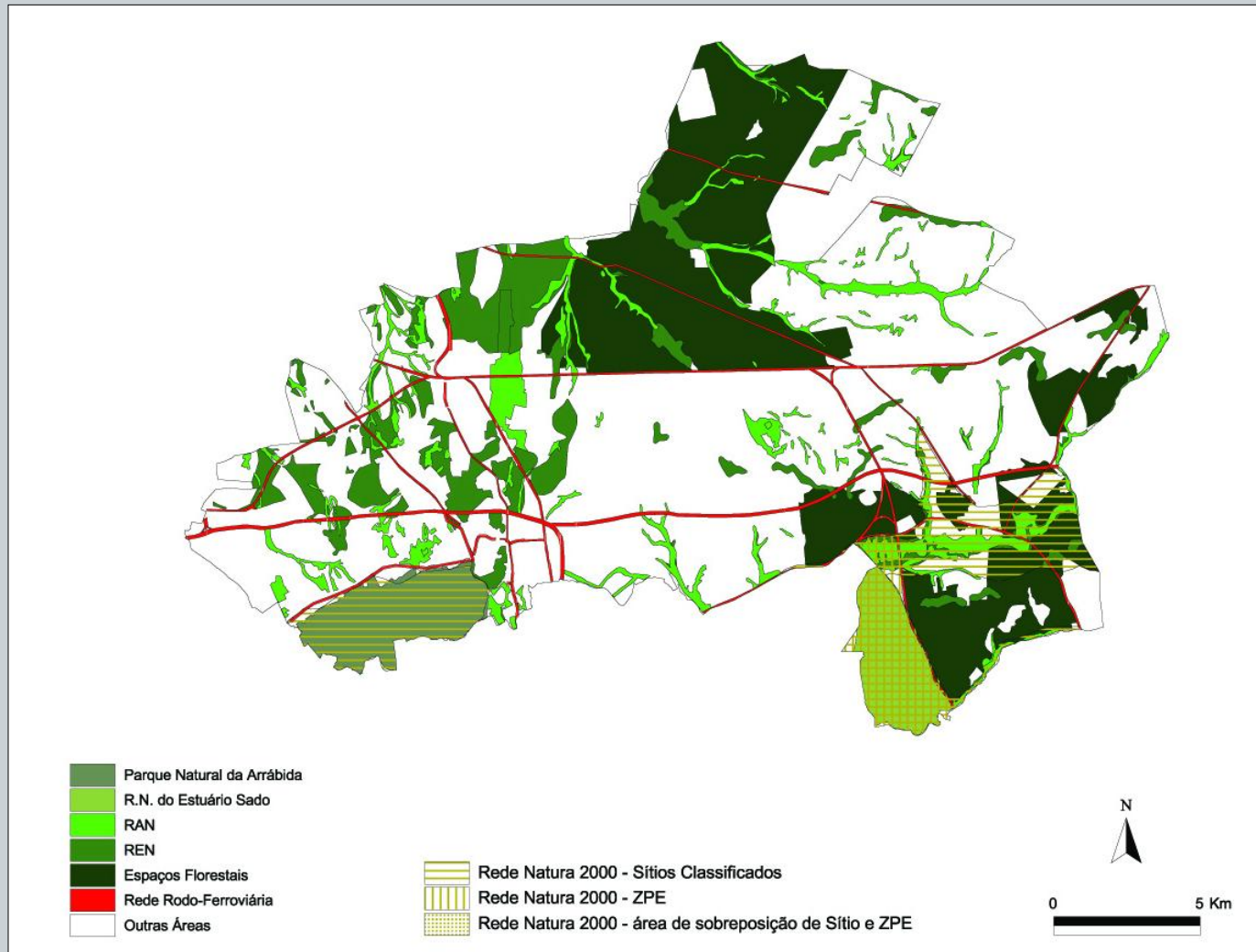


**Speculative division of property and unregulated building coexist with great promiscuity.** (PROTAML, 2002)



# Study Area

## *Palmela: Green Structure*



# Study Area

## *Quinta do Anjo*

### **Green Structure**

#### – **Protected areas:**

Parque Natural da Arrábida - Natura 2000 Site  
National Agriculture Reserve Sites  
National Ecological Reserve Sites

### **Economic Activities**

– **Building:** with increasing urbanization, building is an important sector in the study area

– **Industry:** expanding sector; presence of big national industrial infrastructures

– **Agriculture:** important sector, with increasing results in some productions and with declining indicators in some other products, threatened by the urban spread

# The Azeitão Cheese Production System



- An artisanal cheese produced at the foot of the Arrabida Mountains:
  - Made with raw ewe's milk, mainly from Saloia sheep (autochthon breed), through the action of a cardoon (*Cynara cardunculus*, L.) steep
  - The Arrabida's spontaneous pastures give the milk a special and rich flavor, which is important for cheese quality

# The Azeitão Cheese Production System

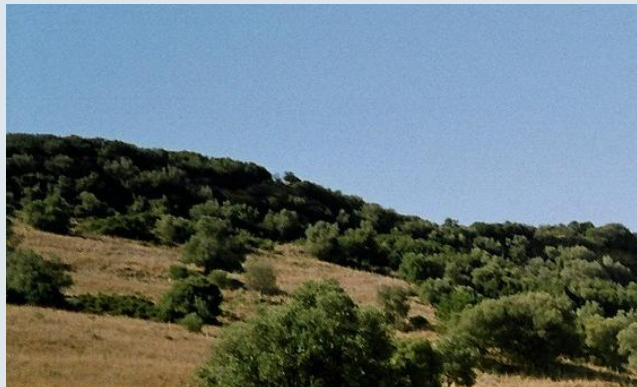


- The system reached a great development specially at Quinta do Anjo; this evolution is benefiting:
  - Maintenance of the spontaneous grasslands; these grasslands are orchid habitats
  - Development of Saloia breed
  - Testing sowed pastures, safeguarding cheese quality
  - Valorization of soils with potential to agriculture

# The Azeitão Cheese Production System

–Producers organization and Common Agricultural Policy (CAP) incentives led to a resurgence of the system in the decade of 1980; ARCOLSA (Regional Association of Sheep Breeders from Arrábida Mountain) had an important role in this issue.

–Institutional protection offers advantages in different stages of the agri-food production process:



Grasslands – orchid habitat  
“Habitats” Directive



Saloia Breed  
CAP - Genetic Resources  
Conservation Schemes



Cheese  
Protected  
Designation of Origin

# The Azeitão Cheese Production System

## *Constraints*

- Difficulties in conciliating goals of different stakeholders, namely, breeders and cheesemakers, environmentalists, urban promoters.
- Competition with manufactory activities, urbanization pressure and lack of an integrated spatial strategy.
- Lack of technical support in order to improve milk performance of Saloia breed that leads to the introduction of more productive exotic breeds.
- Dysfunctions in market functioning with increasing prices of ewe milk and depression on prices in retail sector.

# The Azeitão Cheese Production System

## Potentialities Evaluation

SUSTAINABLE ATTRIBUTES	LANDSCAPE RESOURCES					DEVELOPMENT OPPORTUNITIES					GLOBAL VALUE
	Visual quality	Historic and cultural value	Landscape structure	Ecological stability	SUB-TOTAL	Agricultural production	Tourism	Education	Socio-economic value	SUB-TOTAL	
<b>POTENTIALITIES OF THE SYSTEM</b>											
<b>Preservation of traditional practices</b>	0	2	2	0	4	1	1	2	2	6	10
<b>Conservation of rural landscapes</b>	2	2	2	2	8	1	1	1	0	3	11
<b>Biodiversity protection</b>	1	2	2	2	7	1	1	1	2	5	12
Valorization of soils with agricultural potential	0	0	1	2	3	2	0	0	1	3	6
Landscape equilibrium	2	0	1	2	5	1	1	1	0	3	8
Establishment of a <i>continuum naturale</i>	1	1	1	1	4	0	1	0	2	3	7
<b>TOTAL</b>	<b>6</b>	<b>7</b>	<b>9</b>	<b>9</b>	<b>31</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>7</b>	<b>23</b>	<b>54</b>

2	–Essencial
1	–Useful
0	–Indifferent



# The Azeitão Cheese Production System

## *Potentialities Evaluation*



### - **Preservation of Traditional Practices**

- Traditional production systems are important to the cultural identity.
- Through traditional practices it is possible to understand local history and culture.
- Only a system with vitality enables the maintenance of the cultural landscape associated with it.

# The Azeitão Cheese Production System

## *Potentialities Evaluation*



- **Conservation of Rural Landscapes/Landscape Equilibrium :**
  - The Mediterranean biodiversity develops itself in fragmented landscapes (mosaic landscapes), where grasslands are fundamental elements.
  - The system is part of the cultural patrimony and contributes to the structure of a landscape that supports the extant biodiversity.

# The Azeitão Cheese Production System

## *Potentialities Evaluation*

### - Biodiversity Protection



Some orchids that occur in the grasslands of the study area

**Habitat:** *Semi natural dry grasslands and scrubland facies on calcareous substracts (Festuco-Brometalia) – important orchid sites (“Habitats” Directive, Annex I)*

# The Azeitão Cheese Production System

## *Potentialities Evaluation*

### - **Biodiversity Protection**

-Saloia breed is threatened; its population has greatly declined in recent years.



www.ovinoscaprinos.com

- *"A striking factor in the decline of the Saloia has been the loss of grazing land to residential and industrial sites which have spread beyond Lisbon well into the country-side."* (www.fao.org)

-The promotion of the ovine Saloia Breed is important for conservation of genetic diversity.

# Conclusions

The Azeitão Cheese production system is an important “tool” regarding the issue of conserving Arrabida’s biodiversity. The system’s continuity requires a deeper study of the presented subjects.

Nature conservation in AML should be addressed in an integrated approach, conciliating the needs of urban development and sustainability of agro-forestry systems that support it.

It’s important a new vision of urban-rural interfaces, which considers the environmental and economic benefits of land uses associated to low density spaces, that in the Mediterranean Region are mainly rural areas.

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# *Landscape changes in the Algarve region, Portugal (‘85- ‘07) – diagnosis, prospective and a proposal for a green-infrastructure in the Algarve central coast*

*Presented by André Botequilha Leitão, PhD  
Faculty of Sciences and Technology, University of Algarve; and  
CVRM – Geosystems Center of IST, Technical University of Lisbon*

*The presented research was developed at UAlg with  
Rúben Cruz (MLA candidate) and Francisco Aguilera, PhD*

# “LANDSCAPE ALGARVE” (1)

- Research project developed (2010-2011) at the Centre for Studies on Landscape, Territory, and Urbanism (CEPTU <sup>(1)</sup>) – a research group at the Faculty of Sciences and Technology, University of Algarve;
- Research team:
  - **André Botequilha-Leitão**, PhD – Assistant Professor in Spatial Planning, project coordinator (CEPTU, UAlg and CVRM-IST);
  - **Francisco Aguilera-Benavente**, PhD – post-doc at UAlg, environmental planning (presently at the Department of Geography, University of Alcalá-Henares, Madrid, SP);
  - **Rúben Cruz**, MLA candidate, UAlg;
  - **Emílio Diáz-Varela**, PhD, project consultant, “Profesor contratado” of Rural Planning, Universidad de Santiago de Compostela, SP.

(1) presently in a merging / integration process with other research centres at UAlg



# Material and Methods

- **Digital Cartography**

- **CORINE Land Cover (CLC)** (1:100.000)- raster data sets for 1985 (CLC 1990 for the Algarve reports to 1985), 2000 and 2006. at the third level of the legend;
- **Land cover maps (COS)** (1:25.000, Portuguese Geographical Institute) for 1990 and 2007; first 2 levels (available free of charge for 2007);
- CRIF’10 (Map of Wildfires Risks, 2010), incorporates the urban areas of COS’07; At the time the trend scenario was developed COS’07 was not yet available; only later, when designing the green infrastructure, COS’07 was made available.

- **Methods**

- Contingence table + landscape metrics (Botequilha-Leitão et al. 2006) for the three CLC datasets: landscape dynamics analysis;
- PCA & CA: id. landscape patterns, processes and dynamics based both on CLC and COS datasets - forthcoming scientific articles;
- GIS: map preparation, TREND scenario, GI proposal;
- Fieldwork: study areas recon; validity of CLC and COS maps, and GI proposal at the ELC.

# Multi-Scale, Multi-temporal

- **Algarve Region**

- Broad analysis of landscape changes (1985-2006):  
Corine Land Cover (**1:100.000**) - CLC '90 ('85), '00, '06;

- Coastal section (Lagos – Olhão) (ELLO)

- Analysis of urban processes at 2 different scales:  
CLC (1:100.000); COS'90 + CRIF'10 (COS'07) (1:25.000)

- Smaller study area at ELLO center (ELC):

- Trend scenario: CLC, COS'90, CRIF'10 (COS'07)
- Proposal of a green infrastructure (COS'07)

Analysis & Diagnosis

Detail of analysis


# Multi-Scale, Multi-temporal

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    - Analysis of urban processes at 2 scales: CLC (1:100.000);  
COS'90 + CRIF'10 (COS'07) (1:25.000)
  - **Smaller study area at ELLO center (ELC):      Prognosis**
    - Trend scenario: CLC, COS'90, CRIF'10 (COS'07) (= 2 scales)
    - Proposal of a green infrastructure (COS'07)

# Multi-Scale, Multi-temporal

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- Algarve Region
    - Broad analysis of landscape changes (1985-2006):  
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  - Coastal section (Lagos – Olhão) (ELLO)
    - Analysis of urban processes at 2 scales: CLC (1:100.000);  
COS'90 + CRIF'10 (COS'07) (1:25.000)
  - **Smaller study area at ELLO center (ELC):**
    - Trend scenario: CLC, COS'90, CRIF'10 (COS'07) (= 2 scales)
    - Proposal Green Infrastructure (COS'07) (**1:25.000**)     **Syntheresis**

# Study Areas

- Quick overlook at some important characteristics

# THE ALGARVE REGION



- Regional landscape units (RLU) and landscape units (LU) for the region of Algarve:
  - **RLU “Serra”** - LU 122 and 123 (red dark – summits); 2/3 of the Algarve; geological strata: schist; steep relief; regional headwaters; “skeletal” soils; Mediterranean forest + shrubs; 2 large NATURA2000 sites; depopulated;
  - RLU “Barrocal” - LU 125; karstic (calcareous) formations; large aquifer systems; rolling hills (med. shrubs, traditional med. Orchards - extensive) and flat valleys (citrus orchards - intensive);
  - RLU “Litoral” LU 117, 119, 114, 126 and 127; holocenic; sandy + alluvial soils; 90% of region’s population and urban areas; tourism.

(LU extracted from Cancela de Abreu et al. 2004)

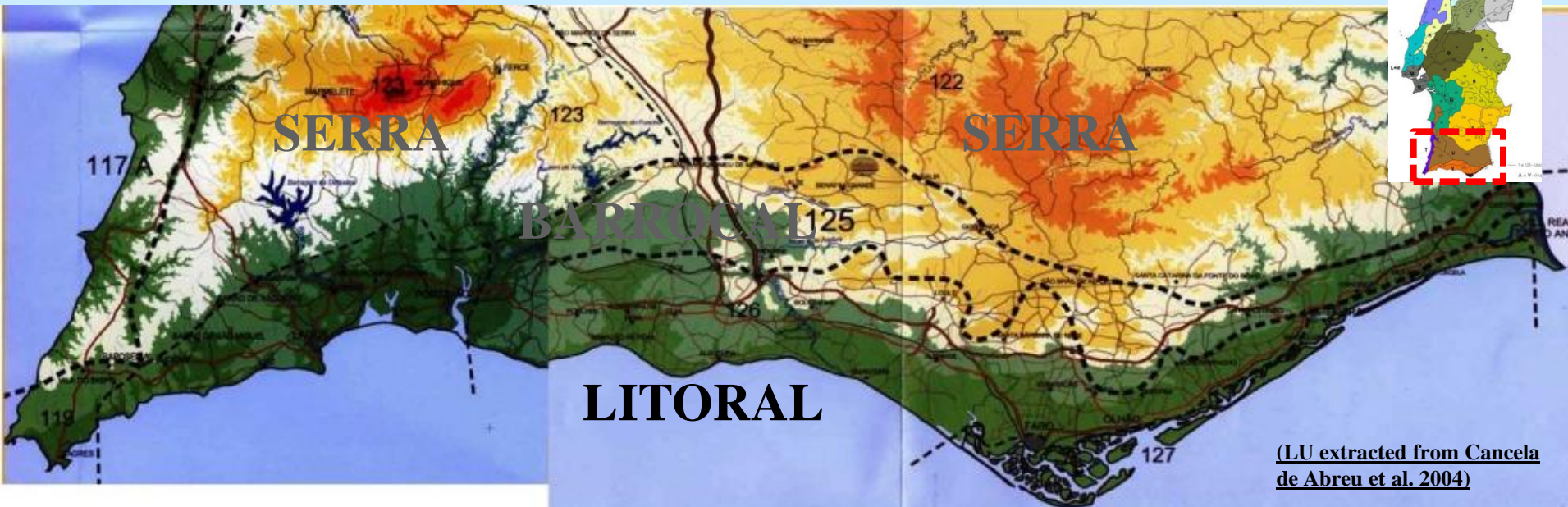
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# THE ALGARVE REGION



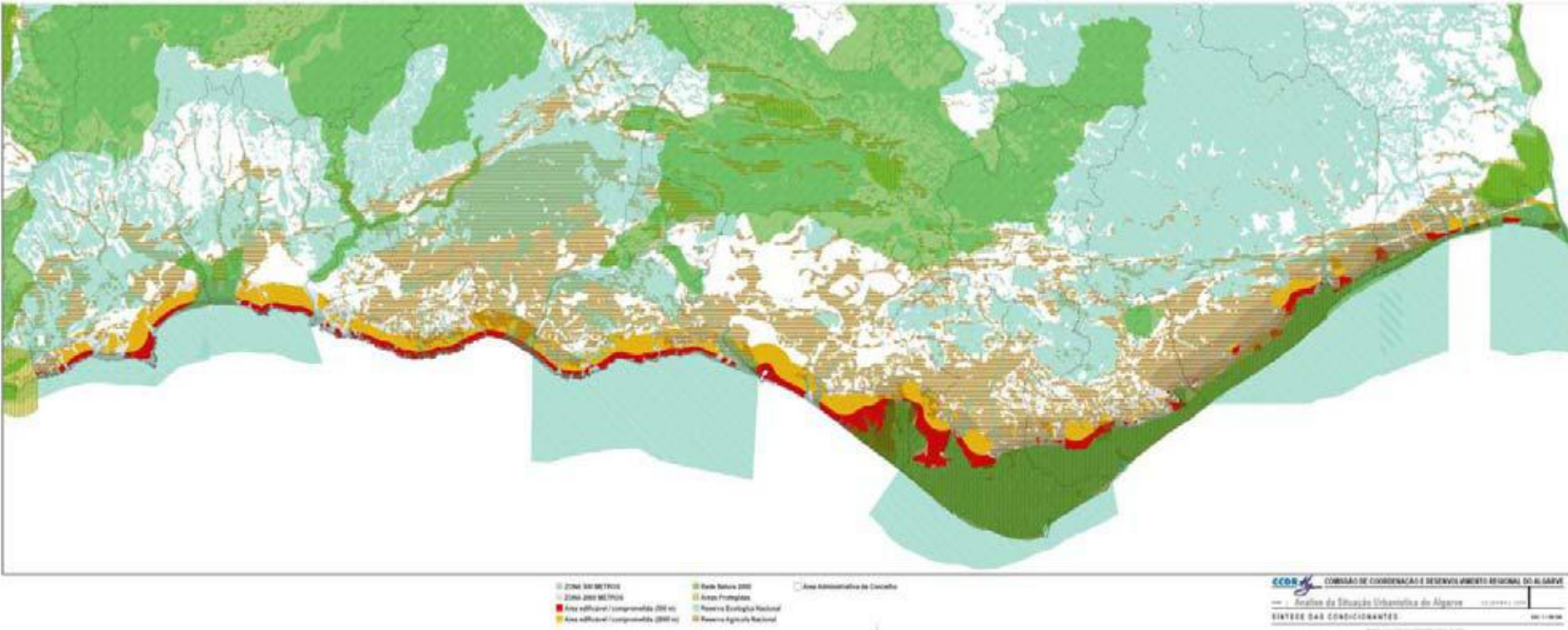
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  - **RLU “Litoral”** LU 117, 119, 114, 126 and 127; Holocene; sandy + alluvial soils; 90% of region’s population and urban areas; tourism (principal economic activity: 45% GRP; 60% employment; estimates of WTTC in 2003).

# ELLO (Central Coastal Area)



- Coastal Area of the Central Algarve (Eixo Litoral Lagos-Olhão or ELLO)
- Territory: 732,6 km<sup>2</sup> (15% of the region's total area); Average Urban Density: 7%
- Selected based on the parishes that showed higher (above the region's average) population dynamics (1991-2001) and urban growth (1990-2007), and territorial continuity;
- COS'90 and COS'07 (CRIF'10) dataset were used to compute urban densities per parish and to identify key urban processes (aggregation, dispersion, and linear development);





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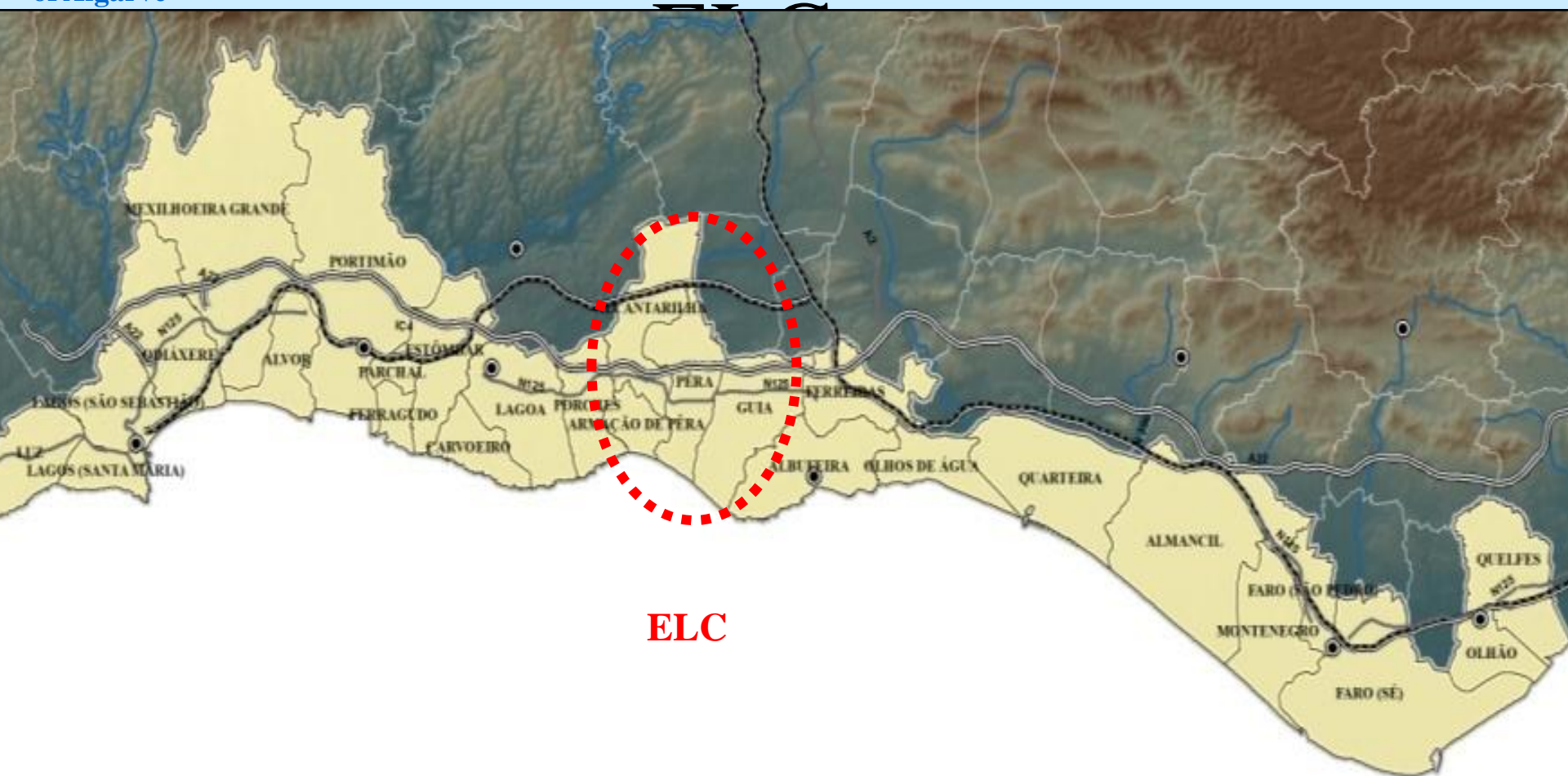
**CVRM**  
Geo-Systems Center, IST  
Tech. University of Lisbon



# ELC (Small Coastal Area)



- ELC represents 13% of the ELLO territory; average urban density of 10%;
- ELLO parishes included in the ELC were selected based on the following criteria:
  - Urban growth above 100%;
  - Representativeness of the 3 urban processes identified in the ELLO;
  - Territorial continuity;



- 5 parishes: Porches, Armação de Pêra, Pêra, Alcantarilha, Guia

# The ELC





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# RESULTS

- Algarve region as a whole: changes in rural landscapes;
- Focusing on coastal areas: urban dynamics
  - Central Coastal Areas - ELLO
  - ELC
    - TREND scenario
    - Green Infrastructure

---

# CHANGES IN RURAL LANDSCAPES (‘85-’06) (1)

- Results taken as a whole (CLC classes):
  - Major changes detected (**13,3%**) dominated by a significant growth of **new forest plantations** (class 324) in the **Serra** (12,9%).
  - An increase of **orange groves** (0,4%) (class 222) occurred in the **Barrocal**.
  - Remaining land uses **lost area** proportionally (**-13.8%**), basically due to **4 land use classes**;

---

# CHANGES IN RURAL LANDSCAPES ('85-'06) (2)

## Losses in 4 CLC classes:

### 1. Natural Vegetation (Serra)

- Low shrubs (class 323) in the oriental part, e.g. plateau of Martinlongo: **-6.3%**;
- Deciduous forests (class 311) in the western Serra (Monchique, Caldeirão): **-3.8%**;

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# CHANGES IN RURAL LANDSCAPES (‘85-’06) (3)

## 2. Areas of Extensive Agriculture (Barrocal, Serra, Litoral):

- Areas of extensive agriculture mixed with natural or semi-natural areas (class 243): **-1.7%**;
- Traditional Mediterranean dry orchards (almonds, figs, olives and carobs) (class 241): **-1.1%**.

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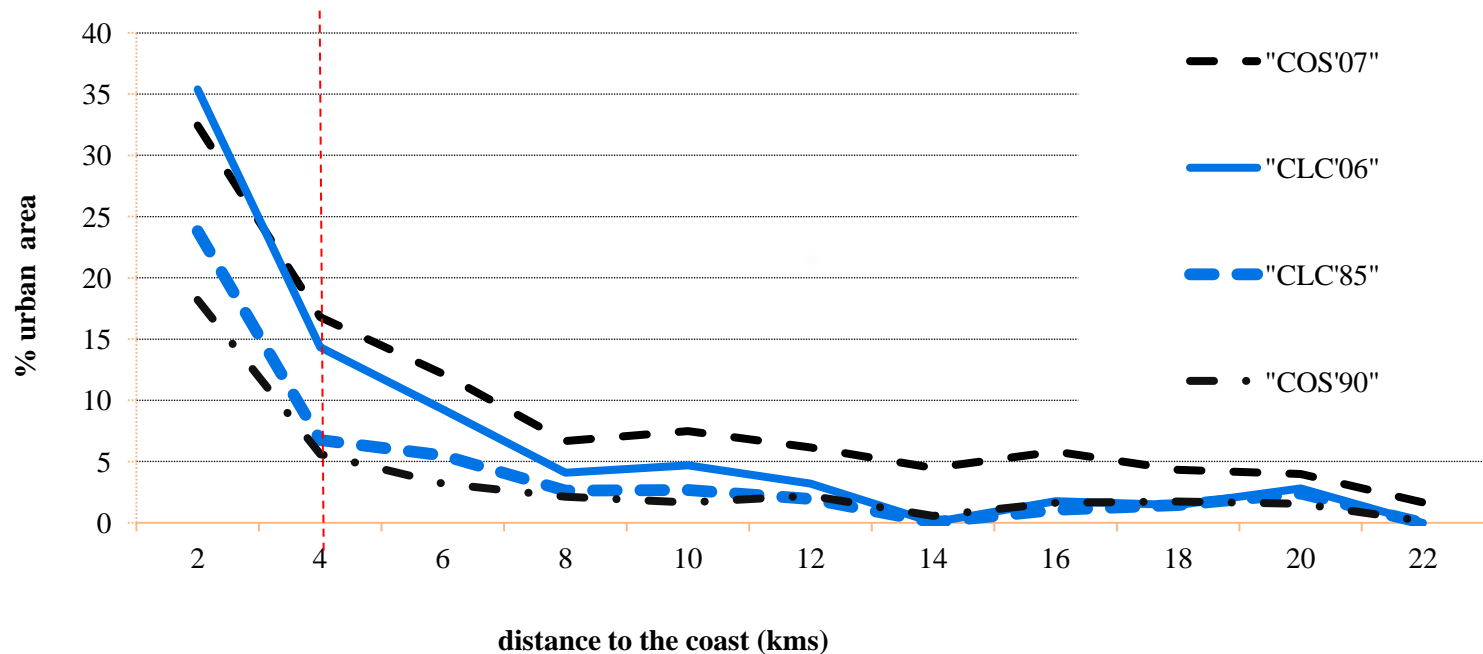
# INTENSIFICATION OF RURAL LANDSCAPES

- Process of intensification of Algarve traditional Mediterranean rural landscapes (‘85-’06) – potentially could affect regional ecosystem services (& the coast):
  - Hydrological cycle: headwaters (Serra) & aquifers (Barrocal);
  - Ecological functioning: NATURA 2000 sites in the Serra (Monchique, Caldeirão);
  
- Results confirm general descriptions based on 1990-2000 data (CCDR Algarve, 2004; Pinto-Correia *et al* 2006) and on more recent and detailed studies (Botequilha-Leitão 2009).



# CENTRAL COASTAL AREAS

## Urban Dynamics ('85-'07)



Overall correlation of 0.97 between CLC / COS datasets for this section.

Urban areas growth computed based on CLC underestimate those based on COS by -3.1%, in average, i.e.  $[CLC'06-'85] - [COS'07-'90]$

# Central Coastal Areas - ELLO

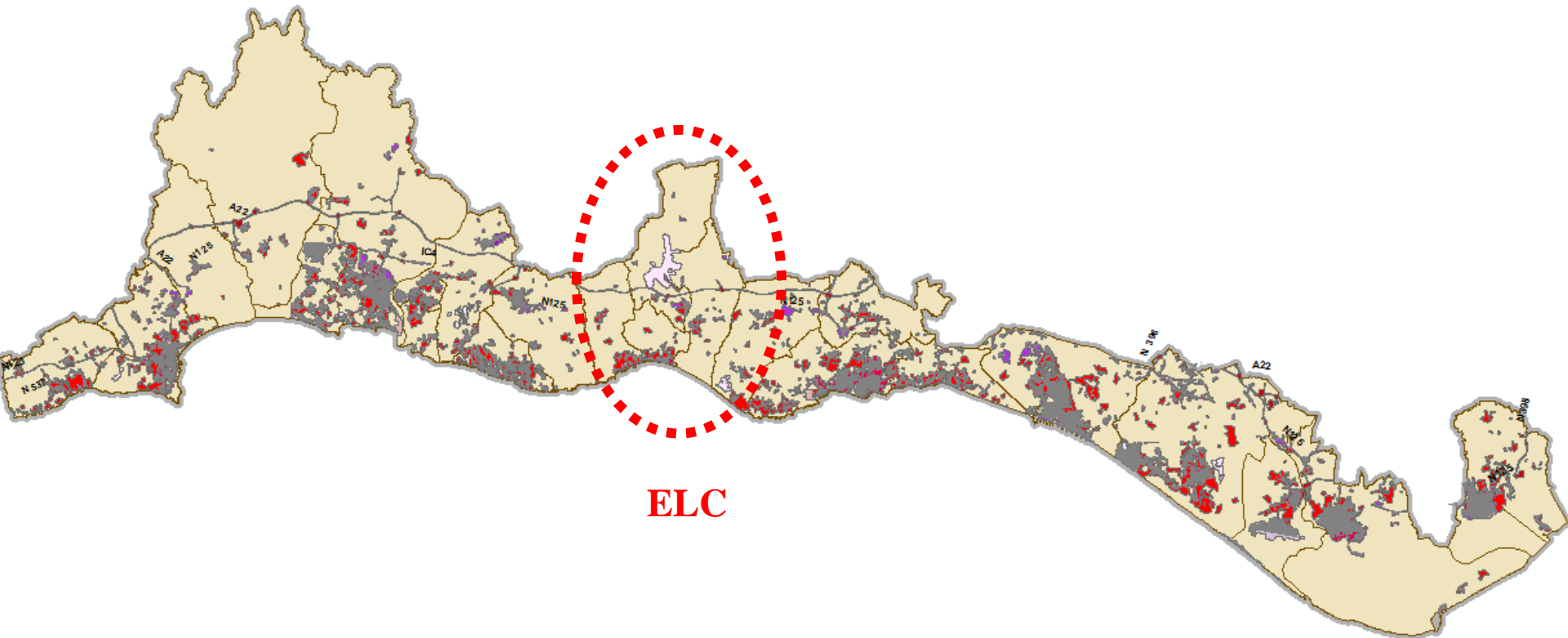
- 15% of the territory (732,6 Km<sup>2</sup>);
- 63% of Algarve population (2001);
- 73% of the population growth (1990-2001);
- Characterized by a **rural matrix** composed by:
  - extensive agriculture mixed with natural or semi-natural areas (CLC 243);
  - low shrubs (CLC 323);
  - some areas of agriculture, either extensive – dry orchards (CLC 241) or intensive – citrus (CLC 222);

# ELLO Urban dynamics (1)

- 80% of Algarve urban areas ('07);
- Urban growth: 46% (5.426 ha) ('90-'07);
- Average urban density: 7%;
- 3 dominant urban processes identified:
  - Aggregation: 61%
  - Dispersion: 26%;
  - Linear development: 14%



# ELLO Urban dynamics (2)



- Urban growth (in red) from 1990 to 2007 (COS datasets)

# Key landscape cultural processes

- Urban sprawl is fragmenting this matrix and affecting seriously its identity;
- +
- Intensification of agricultural uses in some areas, e.g.
  - Peri-urban agricultural landscape around Faro (Botequilha-Leitão 2009).

# ELC – THE TREND (1)

- TREND projected urban areas were based on a multi-scale, spatially-explicit approach:
  - i) baseline – 2007; ii) target – 2025 (18 yrs  $\approx$  ‘90-’07);
  - iii) drivers:
    - a) urban processes identified within the ELLO (COS’90 - ‘07);
    - b) most important LUC transitions for the Algarve region (based on CLC ’85, ’00 and ’07);

# ELC – THE TREND (1)

- iv) morphological rules to simulate new urban patches:
  - a) average values for urban growth, i.e. composition, and
  - b) geographical location, number, and shape of urban patches, i.e. configuration.
  
- The ELLO is almost a continuum of built-up areas, but 2 sections remain still relatively open, one being the ELC.

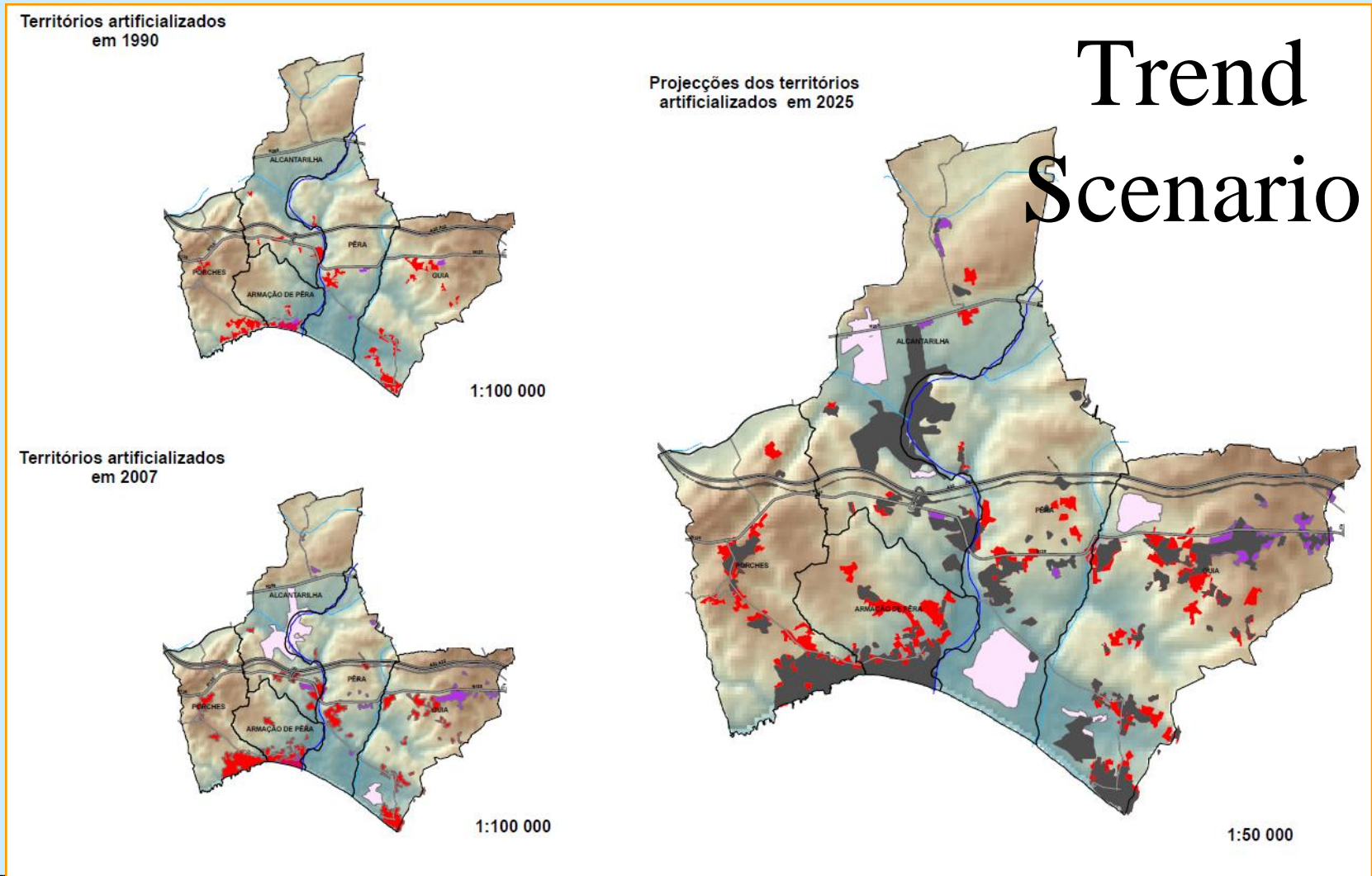


---

# TREND

## Processes forecasted

- Expansion of urban areas along the coastline;
- Urban sprawl and linear development along National Road (EN) 125 (just below A22);
- 2 new golf courses:
  - 1) Praia Grande, which is already approved, located nearby another golf course - the Salgados,
  - 2) located northwest above another existent golf course “Amendoeiras” (large grey blob above A22). The main stream – of the ELC watersheds flows across this golf course.



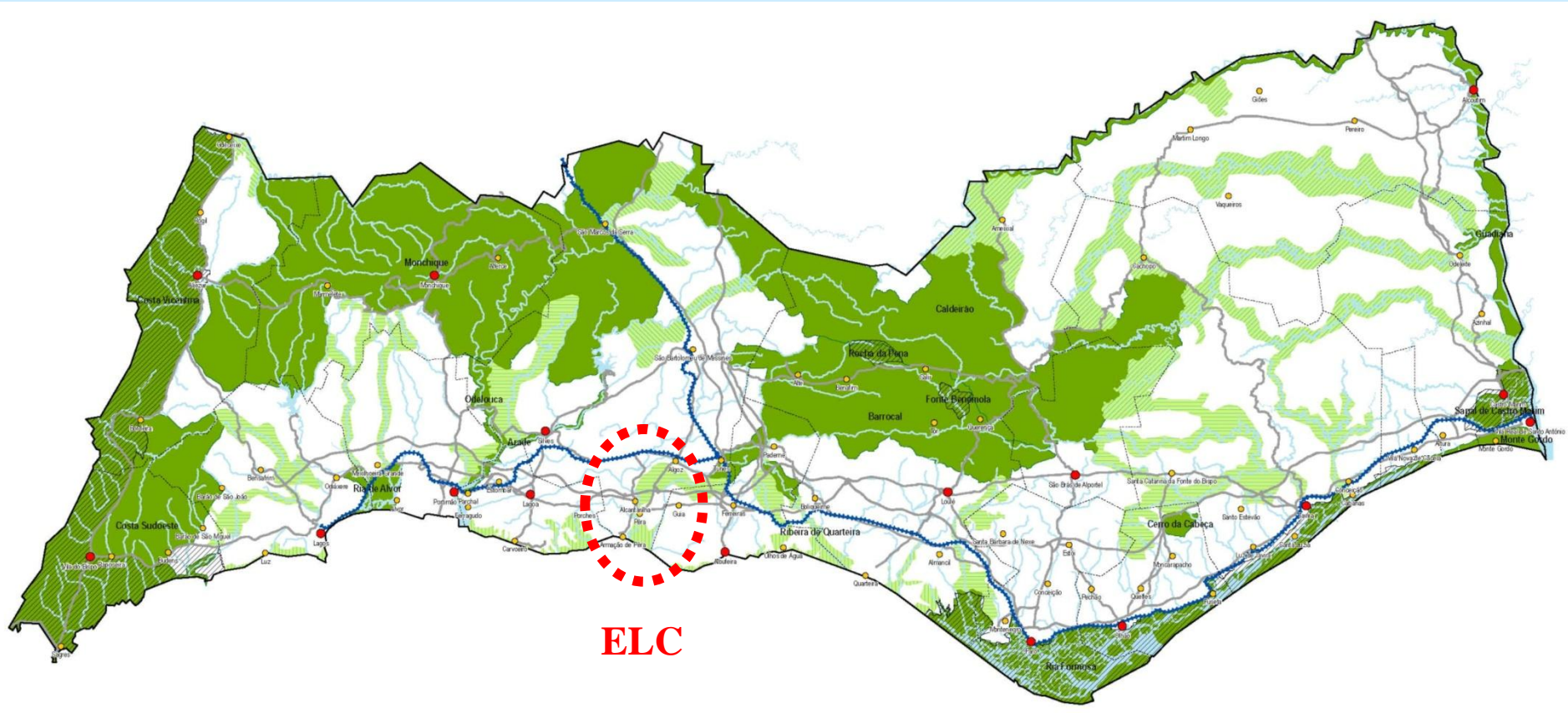
# A Green Infrastructure proposed for the ELC

- GI drawn to counteract identified spatial conflicts in the TREND scenario (proactive, anticipative approach);
- Based on landscape ecological principles;
- Provides a cohesive framework for protection:
  - » hydrological & ecological functions,
  - » recreation amenities (golf & beach activities).

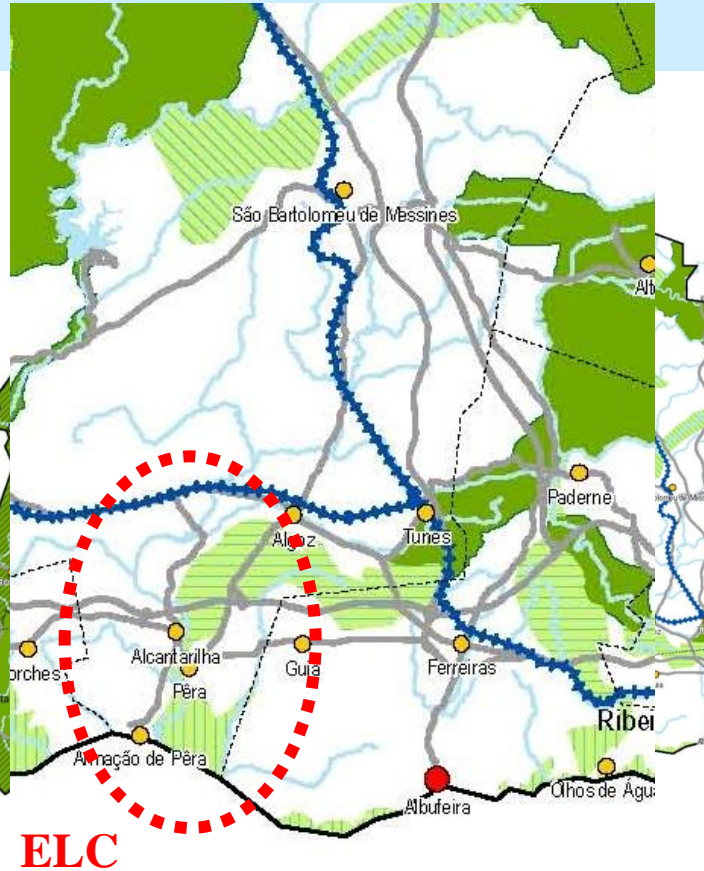
# GI & Landscape Context

- Landscape context (nested systems)
  - provided a regional perspective about the horizontal (chorological) relationships of this watershed with its neighbouring areas.
- Articulation at the inter-municipal level
  - with the ERVPA - the Regional Structure for Environmental Protection (Algarve Regional Plan), as recommended in this plan;

# Connecting to ERVPA (1)



# Connecting to ERVPA (2)

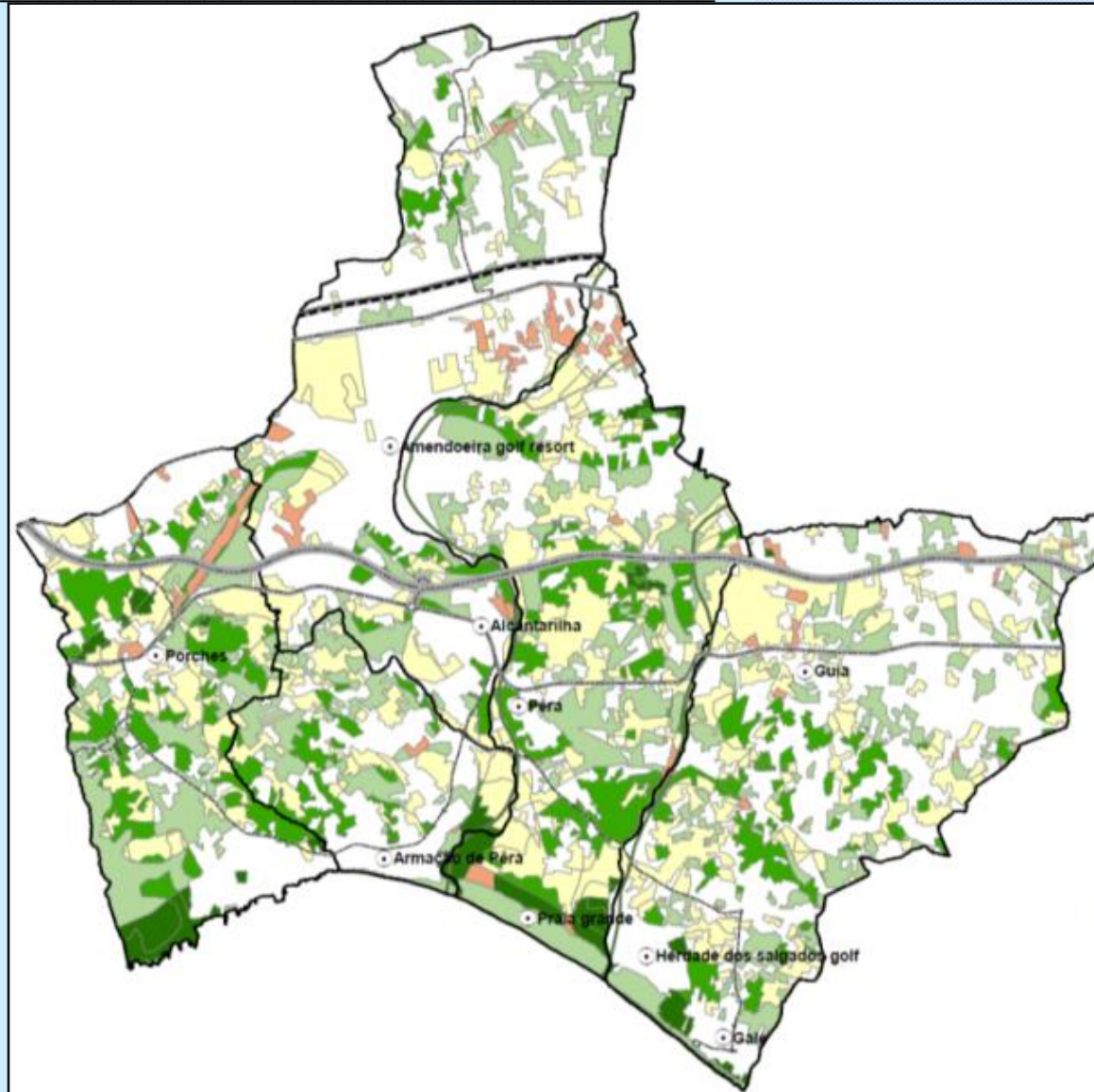
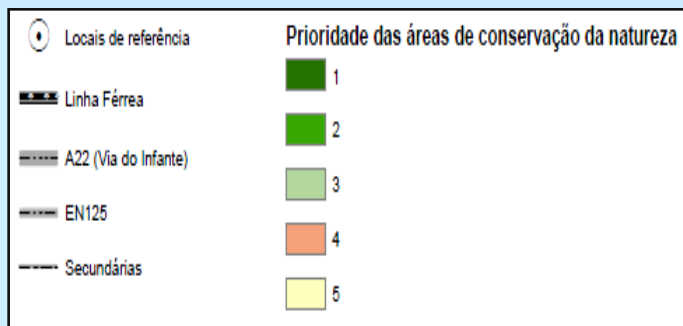


# Landscape Structure

- Principal hydrological network (Ahern 2007)
  - dominated by a stream: “ribeira de Alcantarilha” (regional ecological corridor);
  - 2<sup>nd</sup> main stream: “ribeira de Espiche”;
- Set of patches of natural vegetation and aquatic ecosystems:
  - identified and classified according to its potential ecological value (criteria adopted based on ERVPA methodology)

# Ecological Evaluation

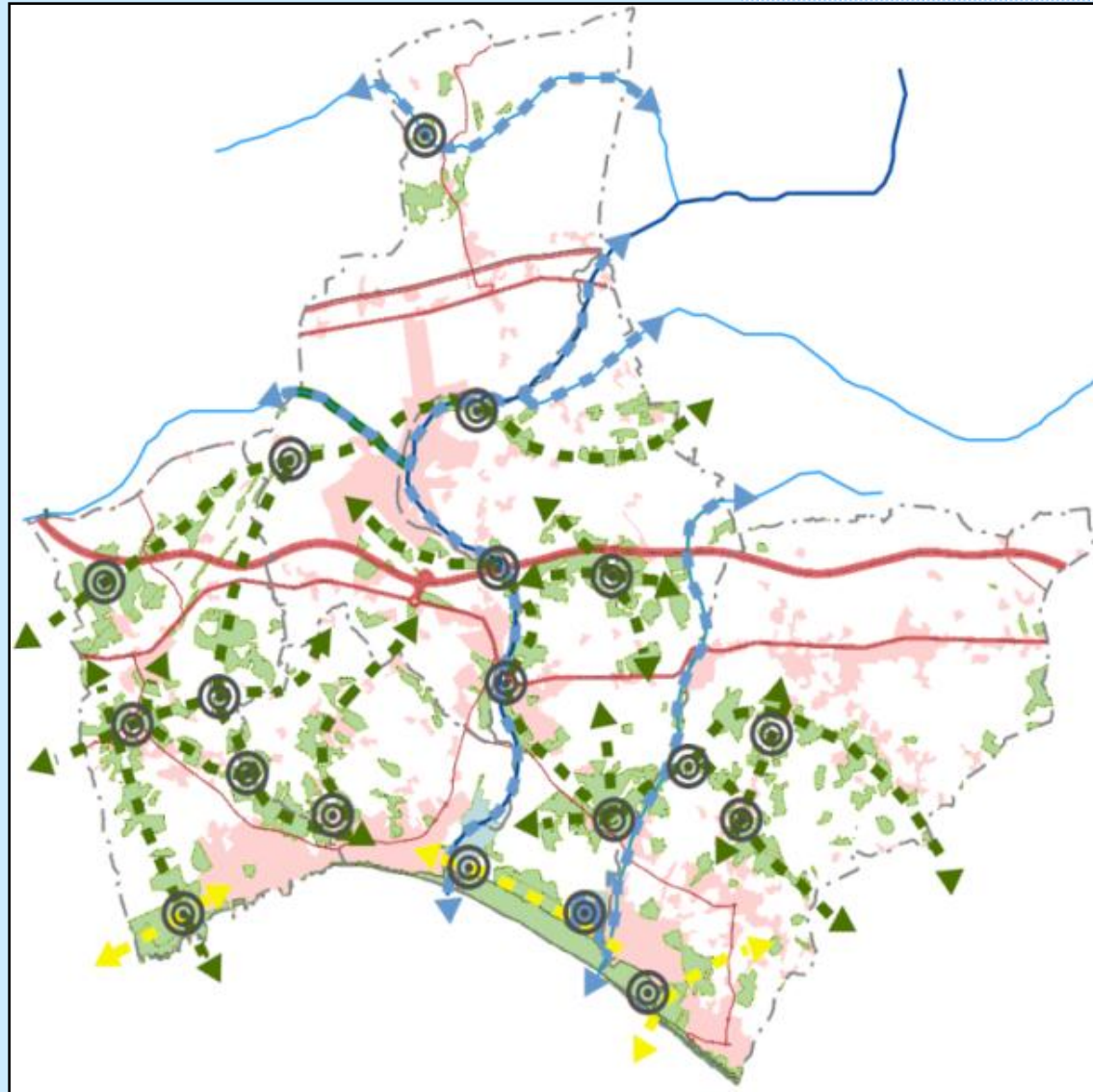
- The ecosystems identified were classified in 5 priorities (accordingly to the ERVPA criteria)





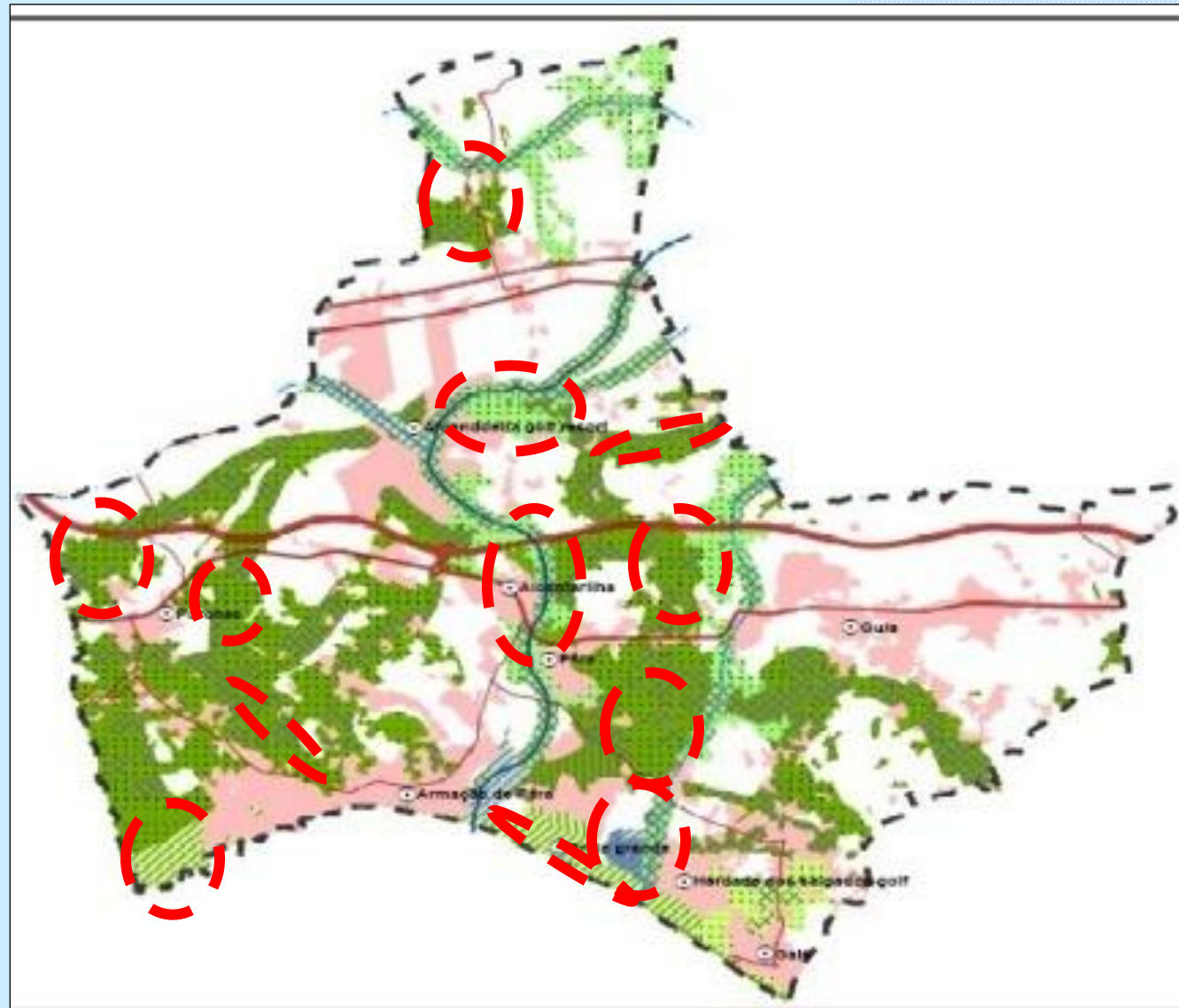
# The Spatial Concept

- Preserving important habitats;
- Promoting linkages across the landscape;
- Providing for recreation opportunities,
- Thriving for smart development.



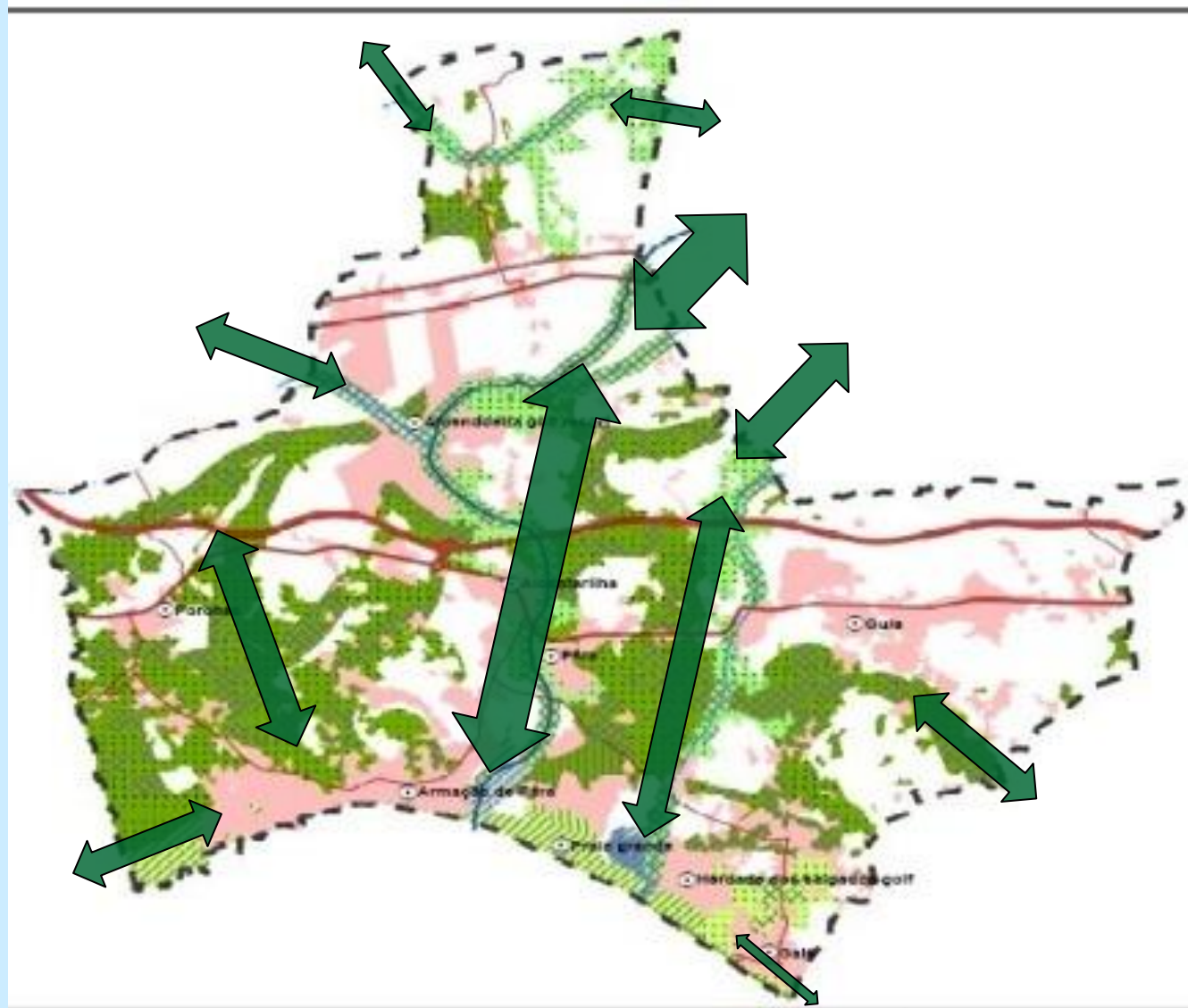
# GI Goals

- A. Protect **patches** where ecological value is deemed high;



# GI Goals

- B. Promote potential landscape **connectivity** between these ecosystems



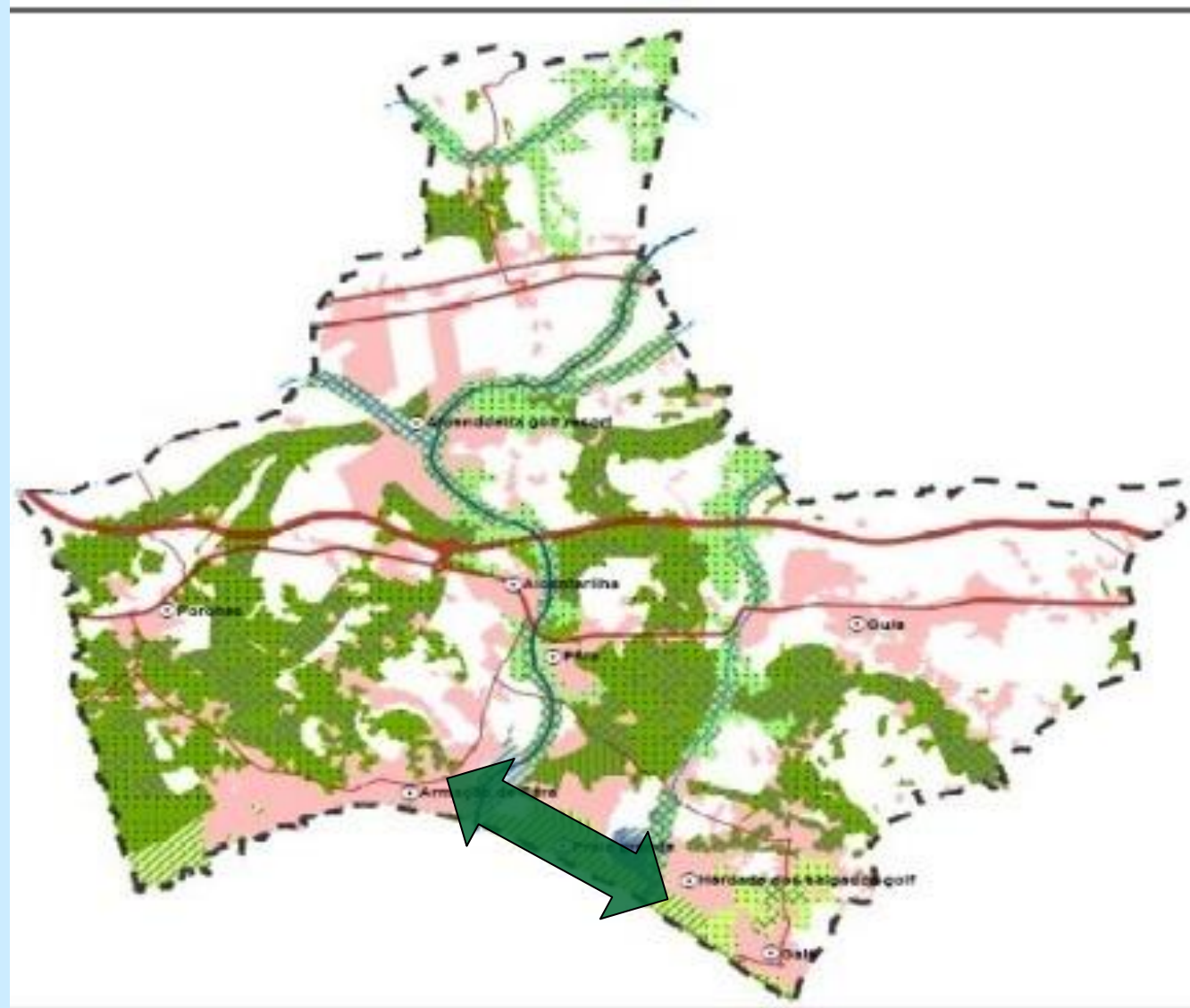
# GI Goals

- B. Promote potential landscape **connectivity** between these ecosystems, including the coastal ecosystems, e.g. Salgados lagoon), a biodiversity “hotspot” adjacent to the coastline.



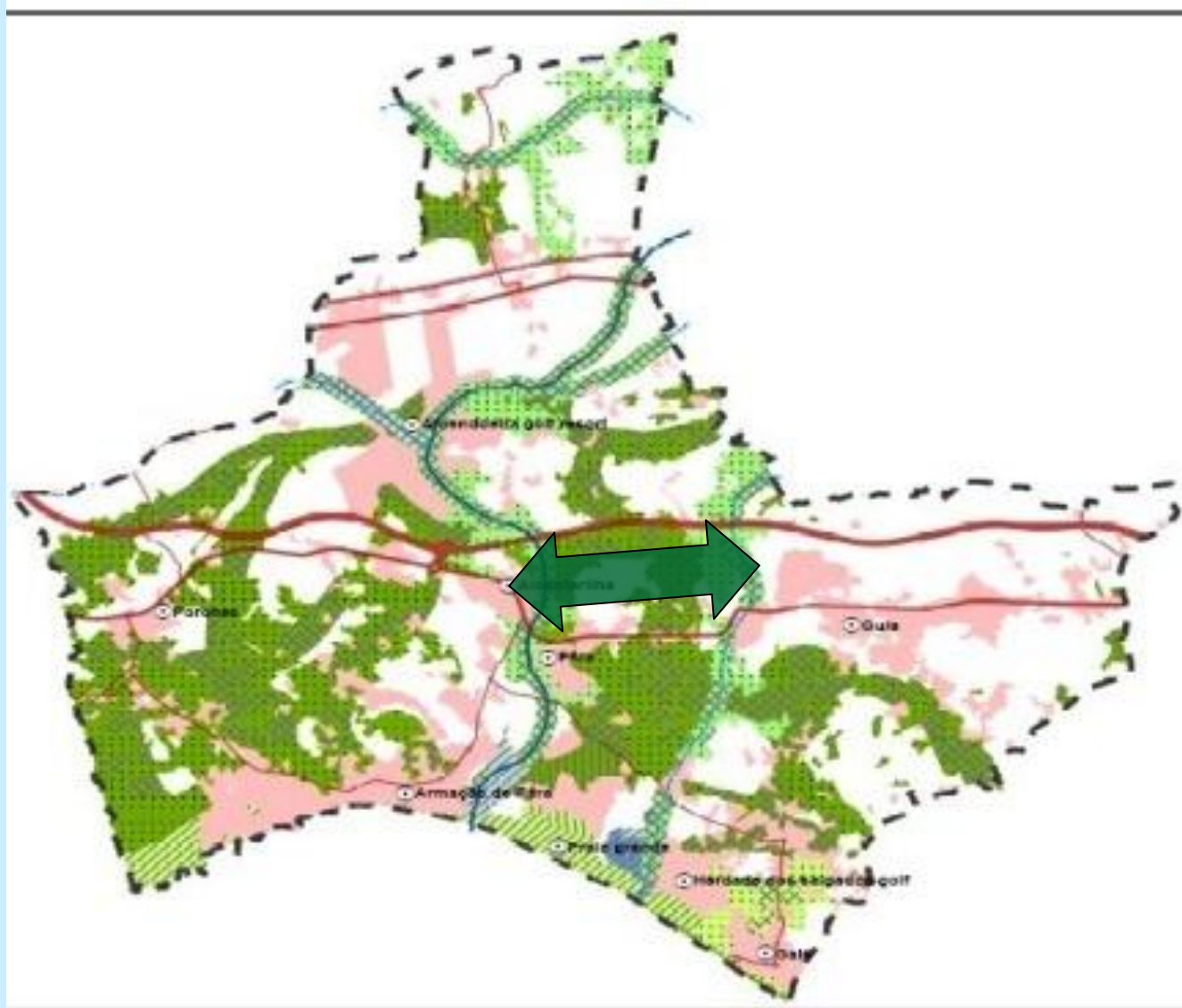
# GI Goals

- **Ecological linkages** (connectivity) - the dune system along the beaches of “Galé” and “Praia Grande” provides a transversal connection between the two major streams nearby the shore.



# GI Goals

- **Ecological linkages** (connectivity):  
a proposed green corridor along highway A22 connects the major streams more to the interior.



# Conclusions (1)

- The Algarve landscapes are being subjected to significant pressures:
  - Forested Serra + Rural Barrocal => intensification: possible effects on ecosystems services, namely the coast where are concentrated most of the people and economy;
  - Coastal Areas: urban & resorts sprawl (mainly tourism oriented) – note that negative landscape effects by tourism can affect the activity in itself.

## Conclusions (2)

- Pressures induced by the identified urban trends at the coast include the expansion of existent urban areas via different urban processes:
  - in a more compact form,
  - in a linear pattern following the coastline and road infrastructures,
  - in a dispersed pattern (i.e. salt-and-pepper).



## Conclusions (3)

- “Sprawl-like” patterns have serious effects:
  - municipal management level, causing a tremendous financial effort to extend and maintain basic infrastructures, i.e. roads, water, sewers, electricity, waste disposal, etc.;
  - fragmentation of the existent landscapes, affecting its functioning, e.g. by golf courses
  - (study by UAlg points to max.  $\pm$  40 golf courses for the region; but there are 39 already in 2010, and projected much more for a near future)

# Conclusions (4)

- Landscapes = ecological and cultural value;
- Landscapes = also an economic value, e.g. for tourism;
- Landscape care (e.g. ELC) = contribution to the overall sustainability of coastal areas;

# Conclusions (5)

- Proposed GI:
  - based on landscape ecological principles
  - focusing on connectivity
  - coupled with a multi-scale approach
  - under a protective / defensive strategy (Ahern 2007),
- Aimed at providing for ecological, hydrological and cultural functions, for the ELC “soon-to-be” urban coastal landscape.

# From Agronomy to Landscape & Greenway Planning

By  
Julius Gy. Fábos, Ph.D., Fellow of ASLA  
Professor Emeritus  
University of Massachusetts  
Amherst, MA USA



# Introduction

---

Our previous conferences in the USA were:

- In 2004
- In 2007
- In 2010 – in Budapest

# The thesis of my paper

---

“My Early Experiences in Agronomy, (on my father’s farm and at a state farm in Hungary) were invaluable for my professional life in the USA”

# Three Phases of my Life and Career

---

- Phase 1: 1940 – 1956 – Agronomy **16 years**
- Phase 2: 1966 – 1985 – Landscape Planning **19 years**
- Phase 3: 1985 – 2010 – Greenway Planning **16 years**

# Phase 1: 1932-1956 in *Agronomy*

---

See Farm Activities

- ▣ On Our Family Farm  
and
- ▣ A Large State Farm



# Some examples ( among dozens) of my Farming Life

---

## (a) Raising and Butchering pigs



## (b) Me Plowing with Tractor



## (c) Threshing grains for farmers

---



(d) I am in our vineyard with my mother and sister

---



## (e) Persecution as Kuláks in 1949-53

---



Our Caricature



The real Kulák sentenced to 15 years in jail

## (f) Followed by

---

- ❑ Jails, torture for father
- ❑ Become undercover agronomist
- ❑ Our innovations assembly line process – advantages = huge time saving & extra money for workers



- ❑ 93 % Success

# My rewards

---

- ❑ 2 years in slave labor camp, 15 months in jail
- ❑ After my release – 1956 revolution started
- ❑ Followed by my escape to USA
- ❑ My delayed education started in 1957
  - Rutgers
  - Harvard/ Olmsted exhibition
  - And was introduced to Landscape Planning by Phil Lewis in 1963

## Phase 2: 1956-1985 in Landscape Planning

---

A project work - Nantucket Island of MA Planning study as a path finding in 1966

To shift from project to research & publication of results



---

# Metlands Research in Three Book size bulletins

METLAND Part I – (1970-73)

METLAND Part II – (1973-77)

METLAND Part III – (1975-78)

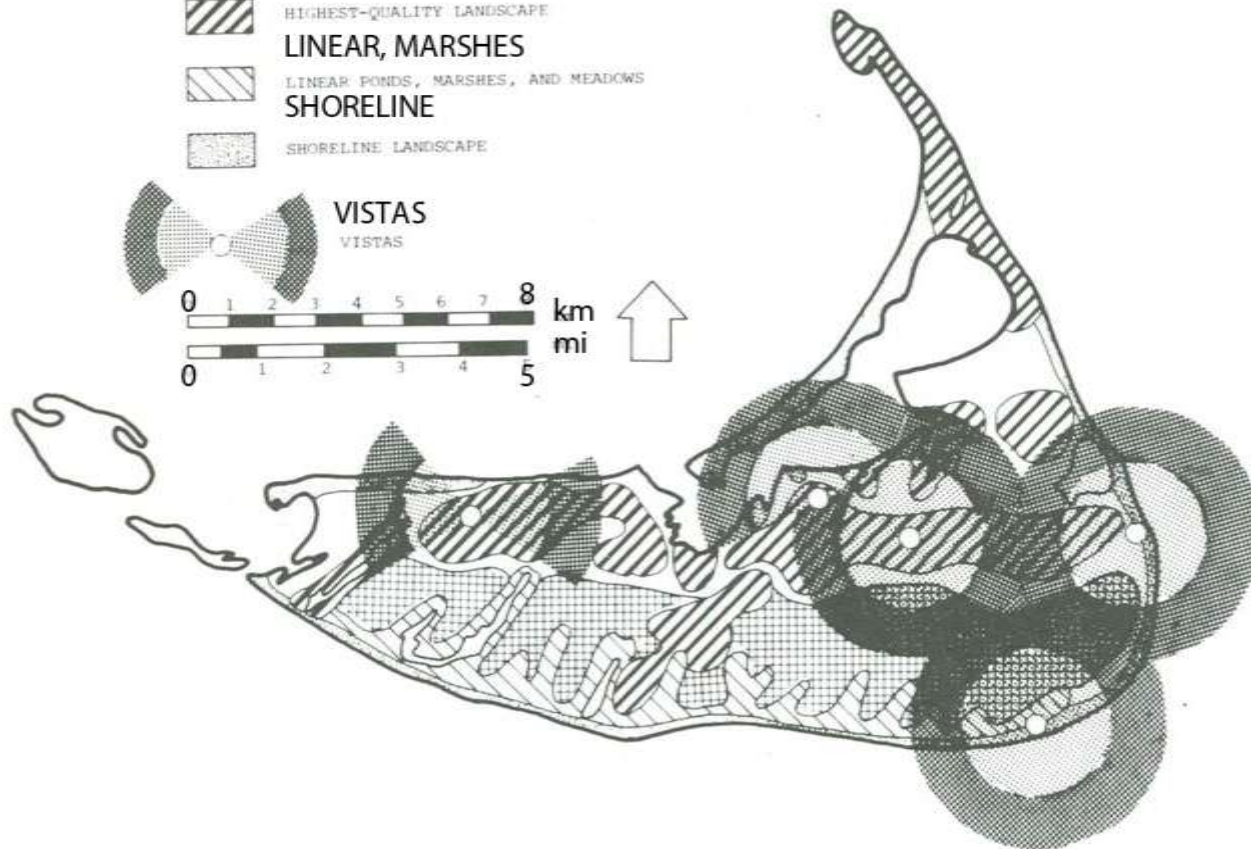
With focus on Literature and development of Knowledge base or recipes

This change was huge: from practicing planning, to became researchers.

-  HORIZONTAL = FLAT  
HORIZONTAL LANDSCAPE
-  HIGHEST QUALITY  
HIGHEST-QUALITY LANDSCAPE
-  LINEAR, MARSHES  
LINEAR PONDS, MARSHES, AND MEADOWS
-  SHORELINE  
SHORELINE LANDSCAPE



VISTAS  
VISTAS



# Composite Landscape Assessment:

**Assessment Procedures for Special Resources,  
Hazards and Development Suitability;  
Part II of the Metropolitan Landscape  
Planning Model (METLAND)**

**Julius Gy. Fabos  
and Stephanie J. Caswell**

# The Impact of Phase 2

---

- It made our team internationally known
- It attracted ample funding
  - To pay research assistants & co principal invest.
  - Buy computers
  - Pay for travel
- We tested our models on dozen of cases, hence helped many
  - Agencies
  - Communities

# 5000 Of Our Research Bulletins Distributed Worldwide

---

## **Model for Landscape Resource Assessment**

### **Part I of the “Metropolitan Landscape Planning Model” (METLAND)**

JULIUS GYULA FABOS

with

RICHARD CAREAGA

CHRISTOPHER GREENE

STEPHANIE WILLISTON

Department of Landscape Architecture & Regional Planning

---

**The METLAND Landscape  
Planning Process:  
Composite Landscape Assessment,  
Alternative Plan Formulation  
and Plan Evaluation;  
Part 3 of the Metropolitan  
Landscape Planning Model**

**Julius Gy. Fabos  
Christopher M. Greene  
Spencer A. Joyner, Jr.**

## Phase 3: 1985-1920 cont. in Greenway Research

---

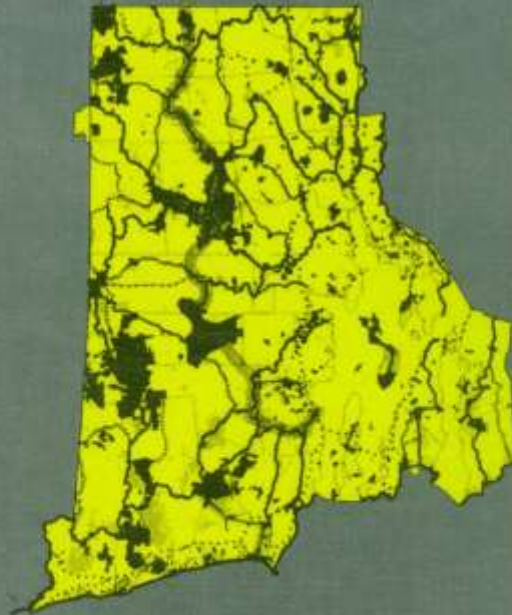
- Greenway Research Part I – (1985-1995)
- Greenway Research Part II – (1998-2006)
- Greenway Research Part III – (2007-2010)

**Having Yearly Conferences at UMass & Published Proceedings**

JULIUS GY. FABOS  
JACK AHERN  
EDITORS

# GREENWAYS

THE BEGINNING OF  
AN INTERNATIONAL MOVEMENT



ELSEVIER





VOLUME 76, Issues 1-4, 30 April 2004

ISSN 0169-2046  
LAPCZ 76(1-4) 1-298 (2004)

# LANDSCAPE AND URBAN PLANNING

EDITOR **Jon Rodiek** | AN INTERNATIONAL JOURNAL OF LANDSCAPE ECOLOGY, PLANNING AND DESIGN



Special Issue: Greenway Planning around the World



VOLUME 88, Issues 2-3, 30 May 2004

ISSN 0169-2046  
LAPCZ 88(2-3) 143-342 (2004)

# LANDSCAPE AND URBAN PLANNING

EDITOR **Jon Rodiek** | AN INTERNATIONAL JOURNAL OF LANDSCAPE ECOLOGY, PLANNING AND DESIGN



Special Issue: International Greenway Planning  
Guest Editors: J.S. Fabos and R.L. Ryan

Our Part I – (1985-1995 period) with Jack Ahern

---

# The beginning

Including:

- 25 papers
- From 5 countries

## Part II Greenways (1998-2006) with Ryan & Lindhult

---

- A truly international publication, representing 13 countries worldwide
- 2 book size special issues by Landscape & Urban Planning

## Part III 2010

---

Done jointly University of Massachusetts, in Amherst and Corvinus University of Budapest in Hungary

- The largest, most extensive to date
- Over 90 presenters
- From 33 countries worldwide
- Proceedings = 700 ± pages



# Wildlife Corridors: Connecting Protected Areas

Ana Luisa Gomes  
(IGP)



Wildlife Corridors:  
Connecting protected areas

**FCT** Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



# Introduction

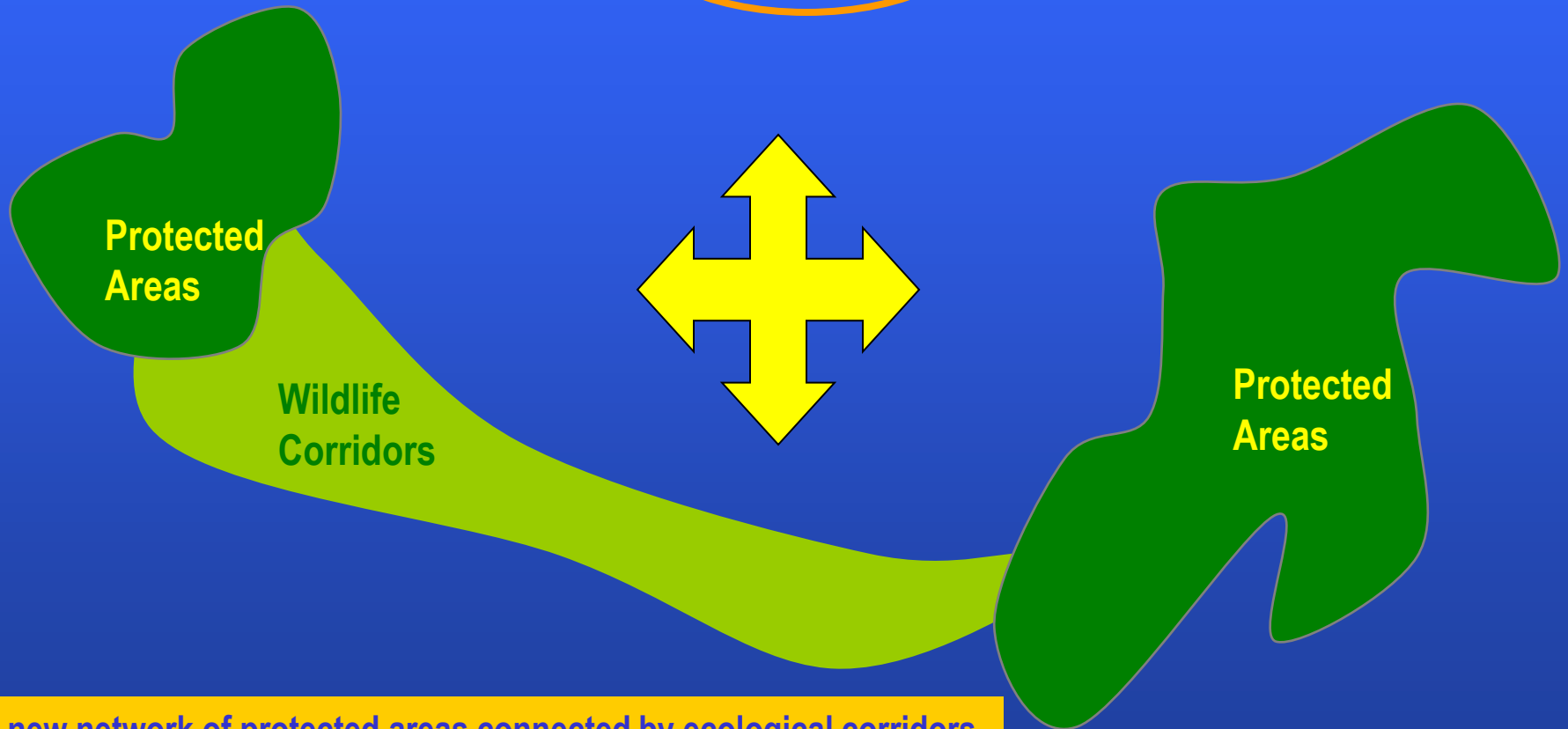
- Habitats Loss
- Habitats Degradation
- Habitats Fragmentation
- Habitats Isolation



**Biodiversity  
Reduction**



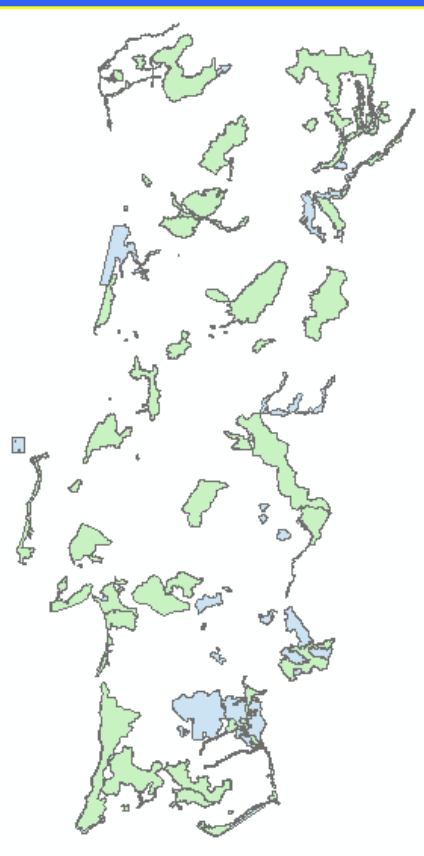
• Climate Change



A new network of protected areas connected by ecological corridors

# Protected Areas in Portugal

## Nature2000 Network



## Conservation in Portugal: Protected Areas

**Nature2000**  
• Birds Directive  
• Habitats Directive

**Internacional**  
- Ramsar Convention  
- Bona Convention  
- Berna Convention

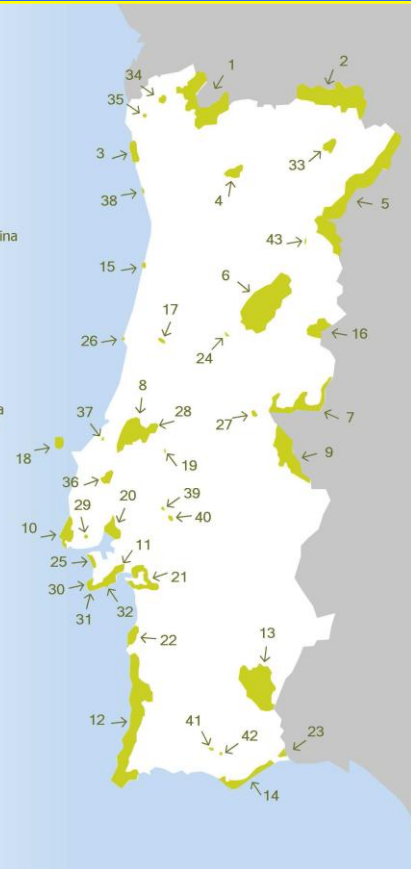
**National Designated Areas**

The selection of protected areas is associated with the **Rarity** criteria.

Oriented for the conservation of natural habitats and wild fauna and flora which are considered threatened.

## National Designated Areas

- 1 Peneda-Gerês
- 2 Montesinho
- 3 Litoral Norte
- 4 Alvão
- 5 Douro Internacional
- 6 Serra da Estrela
- 7 Tejo Internacional
- 8 Serra de Aire e Candeeiros
- 9 Serra de São Mamede
- 10 Sintra-Cascais
- 11 Arrábida
- 12 Sudoeste Alentejano e Costa Vicentina
- 13 Vale do Guadiana
- 14 Ria Formosa
- 15 Dunas de São Jacinto
- 16 Serra da Malcata
- 17 Paul de Arzila
- 18 Berlengas
- 19 Paul do Boquilobo
- 20 Estuário do Tejo
- 21 Estuário do Sado
- 22 Lagoas de Santo André e da Sancha
- 23 Sapal C. Marim - Vila R. S. António
- 24 Serra do Açor
- 25 Arriba Fóssil da C. da Caparica
- 26 Cabo Mondego
- 27 Portas de Ródão
- 28 Pegadas de Dinossáurios de Ourém / Tores Novas
- 29 Carenque
- 30 Pedra da Mua
- 31 Lagosteiros
- 32 Pedreira do Avelino
- 33 Albufeira do Azibo
- 34 Corno do Bico
- 35 Lagoas de Bentiados e São Pedro de Arcos
- 36 Serra de Montejuento
- 37 Paul de Tornada
- 38 Litoral de Vila do Conde e Reserva Ornitológica do Mindelo
- 39 Açude da Agolada
- 40 Açude do Monte da Barca
- 41 Rocha da Pena
- 42 Fonte Benémola
- 43 Faia Brava



**ENCNB - Estratégia Nacional da Conservação da Natureza e da Biodiversidade**



**Wildlife Corridors:**  
Connecting protected areas

**FCT** Fundação para a Ciência e a Tecnologia

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



INSTITUTO GEOGRÁFICO PORTUGUÊS

# Wildlife corridors: Spatial modelling of human pressure and its usefulness for Iberian-wolf conservation

FCT (PTDC/AAC-AMB/111457/2009)



## Team:



IGP - Instituto Geográfico Português (Portuguese Geographic Institute)

- Ana Luisa Gomes (Coordenadora)
- Alexandra Fonseca



CBA - Centro de Biologia Ambiental - FFC/FC/UL (Centre for Environmental Biology)

- Francisco Petrucci-Fonseca
- Clara Grilo



GL - Grupo Lobo (Association for the Wolf Conservation and its Ecosystem)

- Gonçalo Costa
- Ana Margarida Guerra



**Wildlife Corridors:**  
Connecting protected areas

**FCT** Fundação para a Ciência e a Tecnologia

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR





# Project main goals

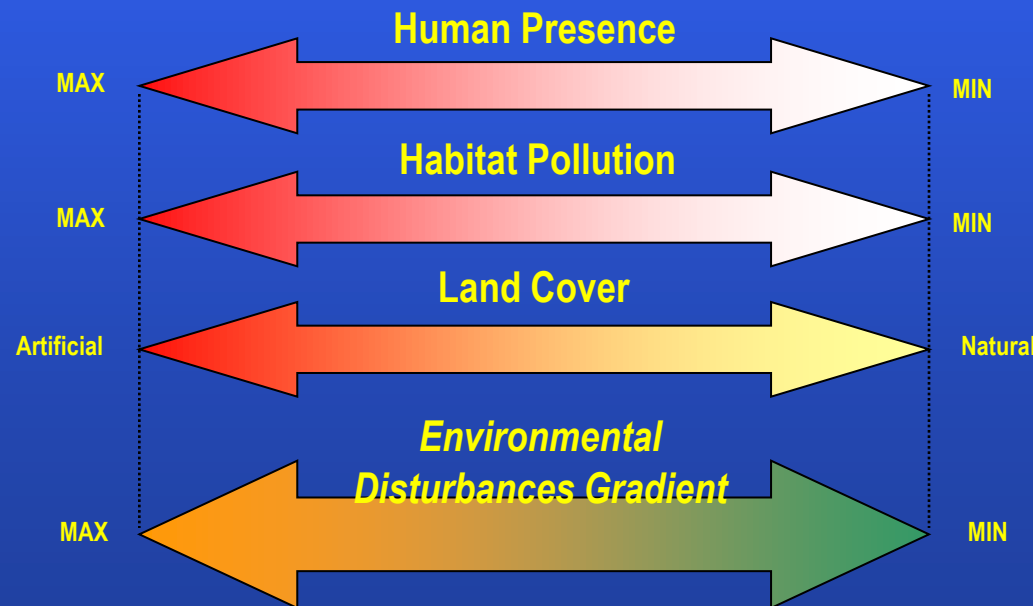
- developed and implemented an innovative methodology based on spatial modelling of environmental disturbances resulting from human activities.
- identify preferred paths for wildlife linking the protected areas, on a gradient representative of the human presence and influence in the territory.
- intent to validate this new strategy for the identification of ecological corridors through the study of the location and movement of the Iberian-wolf, a species considered sensitive to human presence and activities.

**Create scenarios to support the identification of  
Wildlife Corridors Connecting Protected Areas**

# Environmental Disturbances Gradient

It is considered that the spatial modeling of human influence is based on three themes, considered representative of the main environmental disturbances: human presence, habitat pollution and land cover.

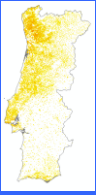
1. **Human Presence** - aims to quantify the environmental disturbance as a direct consequence of the individual's dispersion in the landscape.
2. **Habitat Pollution** - aims to quantify the disturbance from environmental degradation, as a result of the linear and point pollution sources.
3. **Land Cover** - aims to quantify the artificiality of the landscape, as a measure of the human intervention.



**Human Presence**



*Dispersion of resident population*



*Dispersion of individuals from roads*



**Habitat Pollution**



*Environmental disturbances from linear pollution sources*



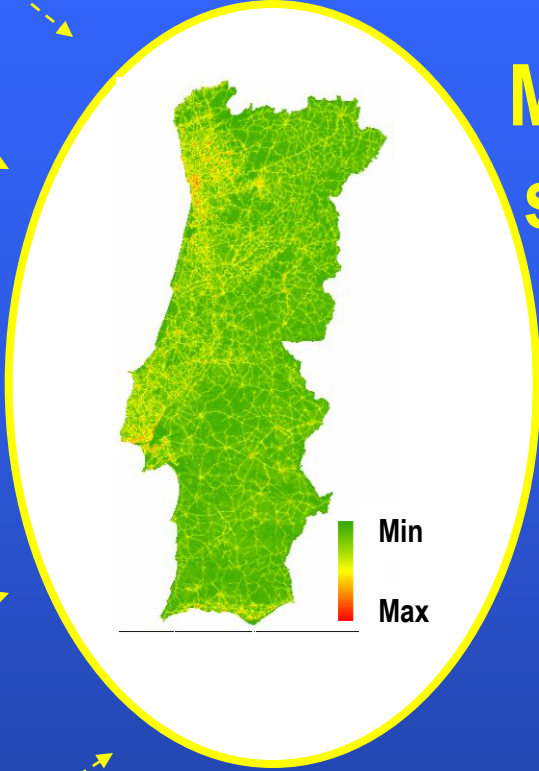
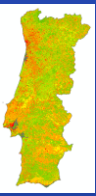
*Environmental disturbances from point pollution sources*



**Land Cover**



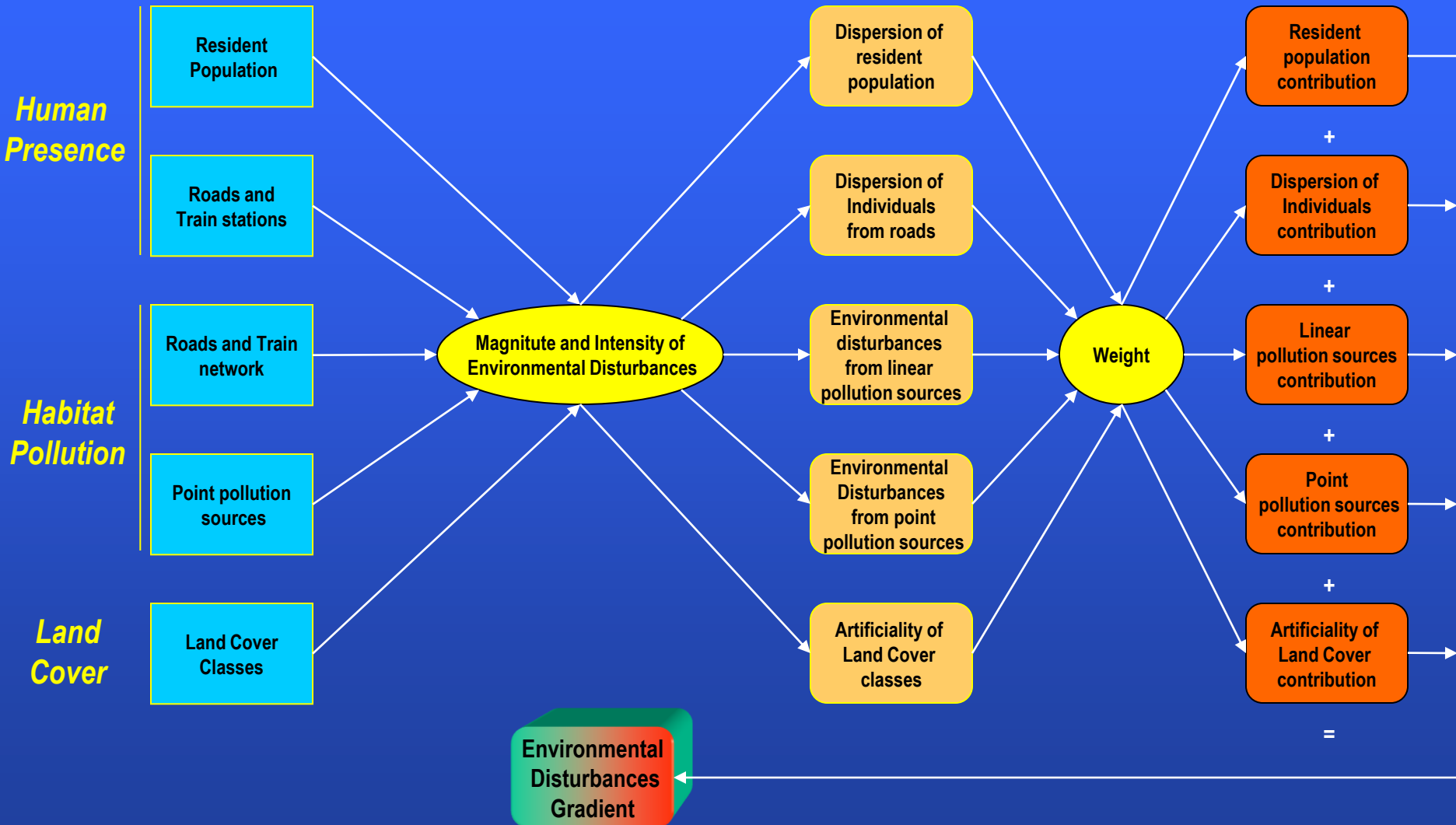
*Artificiality of Land Cover classes*



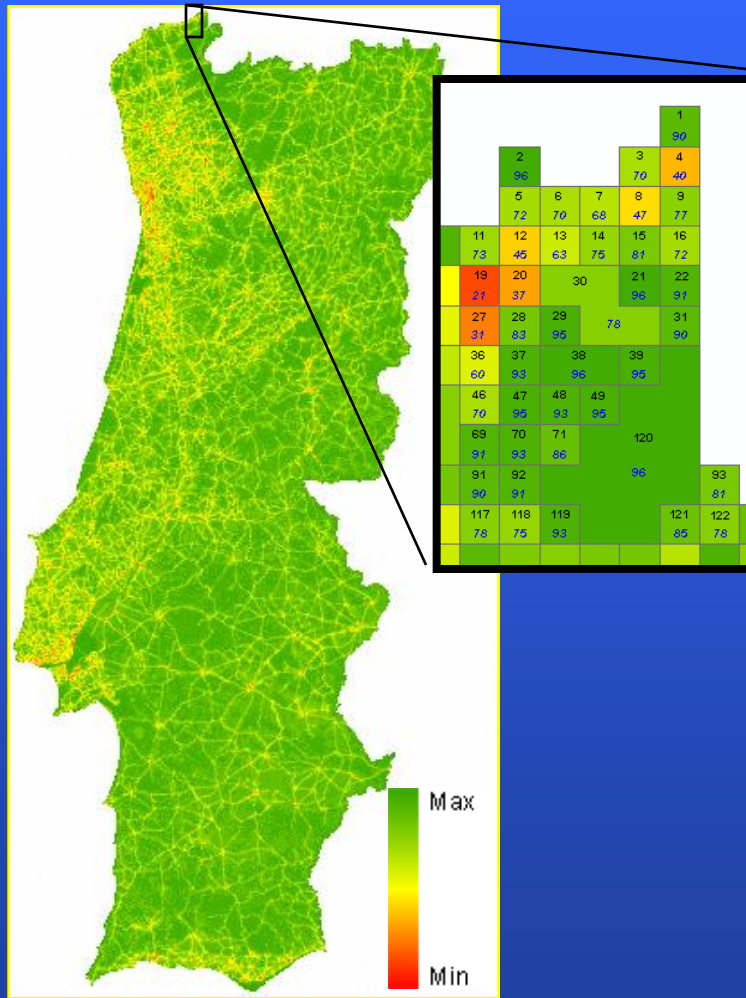
**Methodological scheme for the spatial modeling of environmental disturbances**

**Environmental Disturbances Gradient**

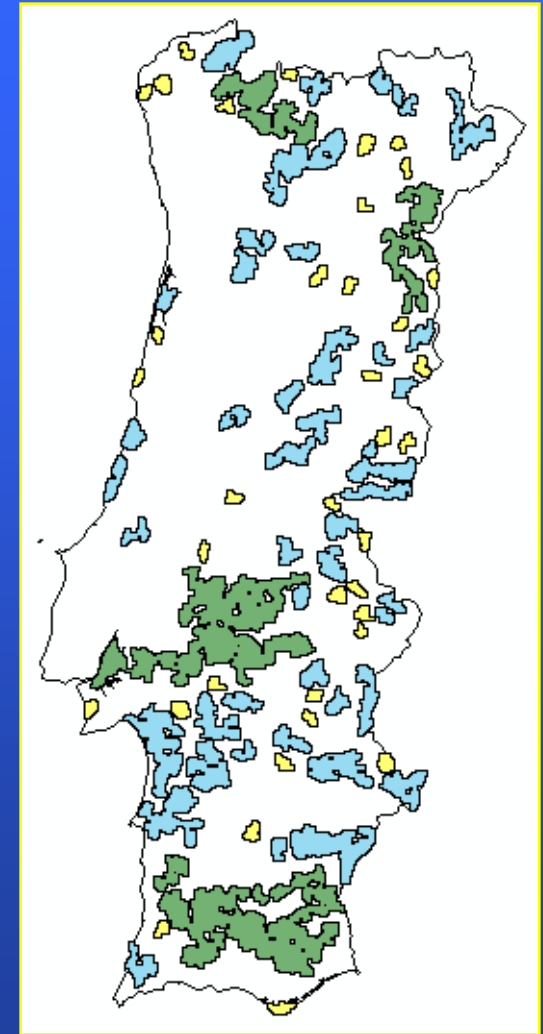
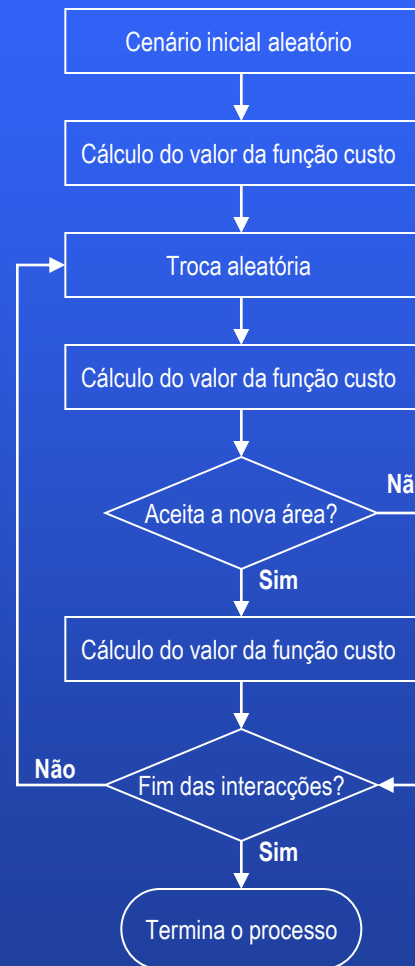
# Expert System: spatial modeling of environmental disturbances



# Environmental Disturbance Gradient: Selection Areas for Nature Conservation

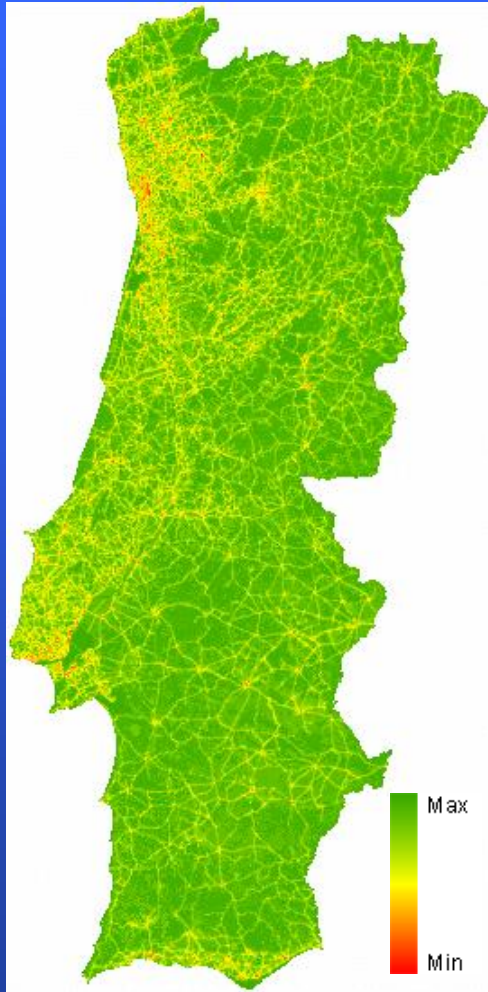


## Algorithm: "Simulated annealing"



Environmental Disturbances Gradient

# Environmental Disturbance Gradient: Connecting Protected Areas



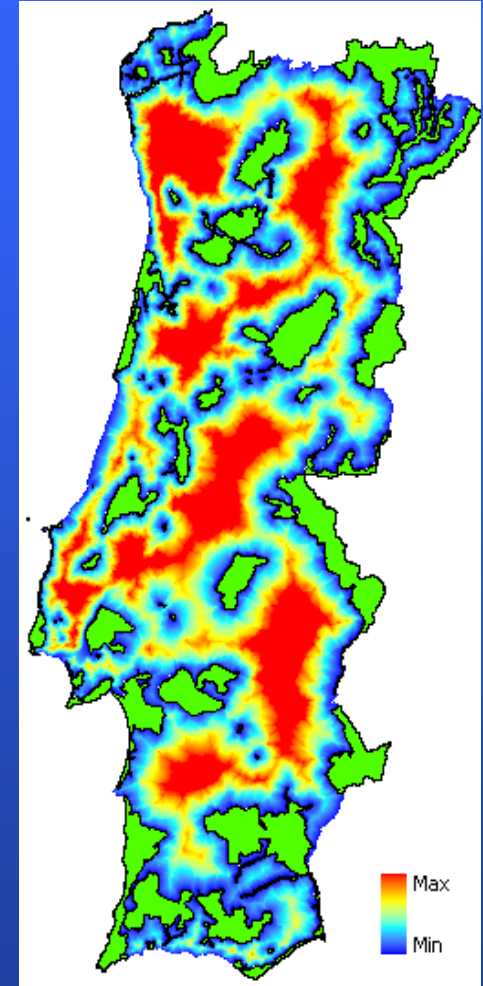
*Environmental Disturbances Gradient*

The use of the gradient of environmental disturbances for identifying the connectivity between protected areas

*Cost Surface*

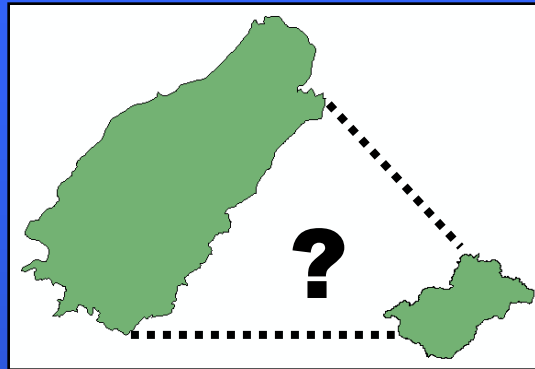


This cost surface intends to represent, in quantitative terms, the accumulated difficulty that species have in getting far from the protected areas.

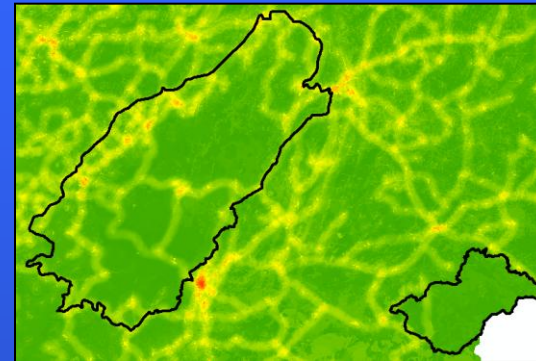


*Cost surface between protected areas*

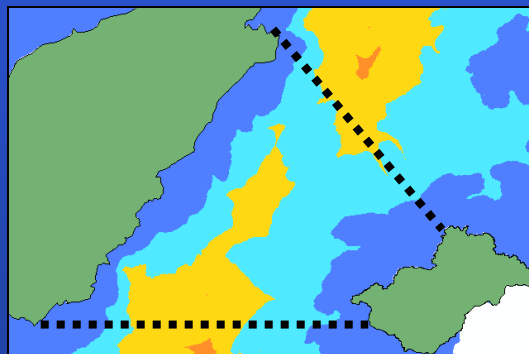
# Proposals of corridors connecting two protected areas: PNSE and RNSM



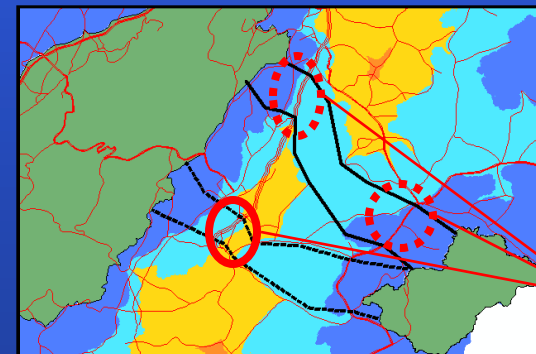
a) PNSE and RNSM



b) Environmental Disturbance Gradient



c) Cost distance



Critical zones ?

d) Proposals of corridors connecting the protected areas PNSE and RNSM

# Evaluate the corridors between protected areas based on the distribution of the Iberian-wolf

In this project, the Iberian-wolf will be used to evaluate the corridors between protected areas, as this wild species is considered sensitive to environmental perturbations and to human activities.

Distribution of the Iberian-wolf in Portugal, observed and potential:

- Modeling the Iberian-wolf habitat
- Collect and Update data of the Iberian-wolf distribution
- Public attitudes towards the wolf





# Modeling the Iberian-wolf habitat

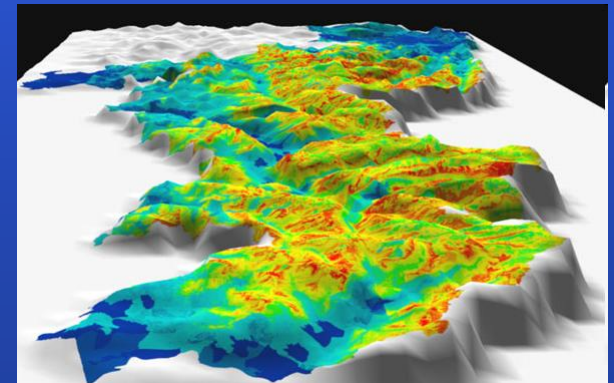
## Main Factors

Topography	Land Cover	Human Disturbance
Elevation	Land Cover Classes	Human density
Slope	Distance to streams	Distance to urban areas
Topographic position	Trees Density	Distance to roads

## Habitat suitability

The result is a map of habitat suitability for wolf divided into classes, ranging from inadequate to best:

- best habitat and reproductive success
- consistent use
- occasional use for non-breeding activities
- avoided



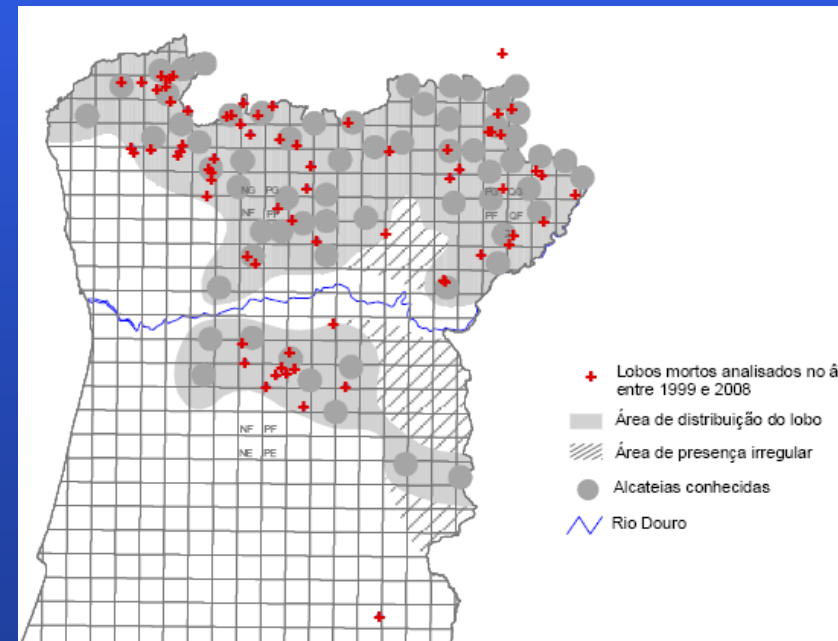
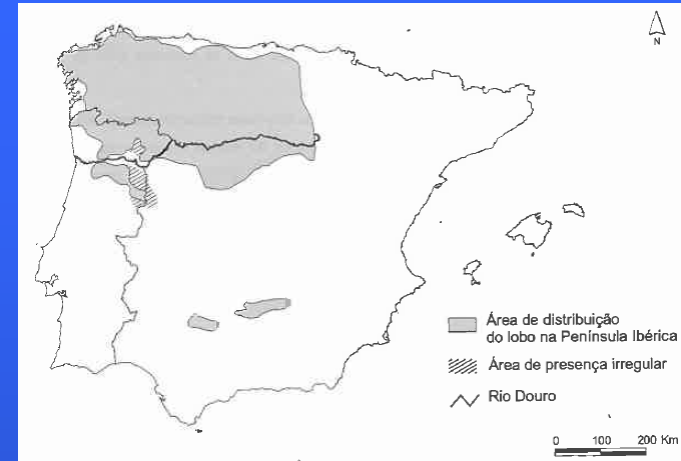
# Iberian-wolf distribution in Portugal

The Iberian-wolf is the largest predator in Portugal and is also one of the most endangered species in our country.

According to the last national Iberian-wolf census, in 2003

The Portuguese Iberian-wolf population is about 300 individuals, 90% of them reside in the area north of Douro River, and are in connection with the Spanish population.

The remaining individuals (~30) are concentrated in south of Douro River and isolated from the Iberian-wolf population from the north or Spain.



# Update Iberian-wolf distribution

The surveys for assessing the presence and distribution of Iberian-wolf will be conducted during the project in order to update information within the proposed corridors.

The assessment of the Iberian-wolf presence include direct and indirect methods:

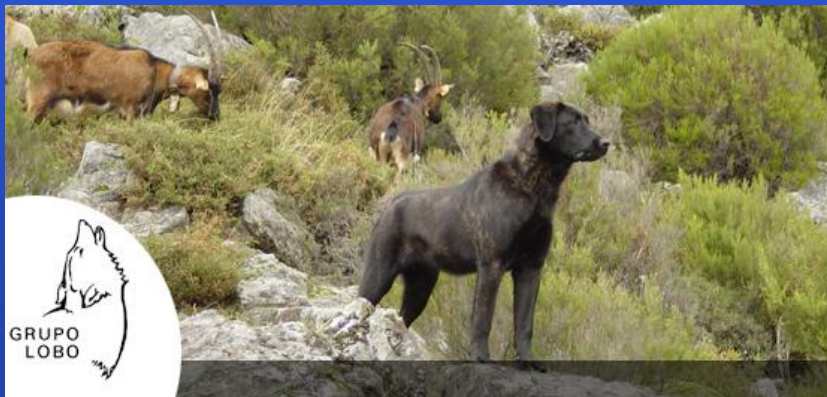
- interviews to local people
- detection of signs of presence such as scats or tracks
- wolf howling
- field cameras



# Public attitudes towards the wolf

As with many other large carnivores the coexistence of the wolf and man is very complex.

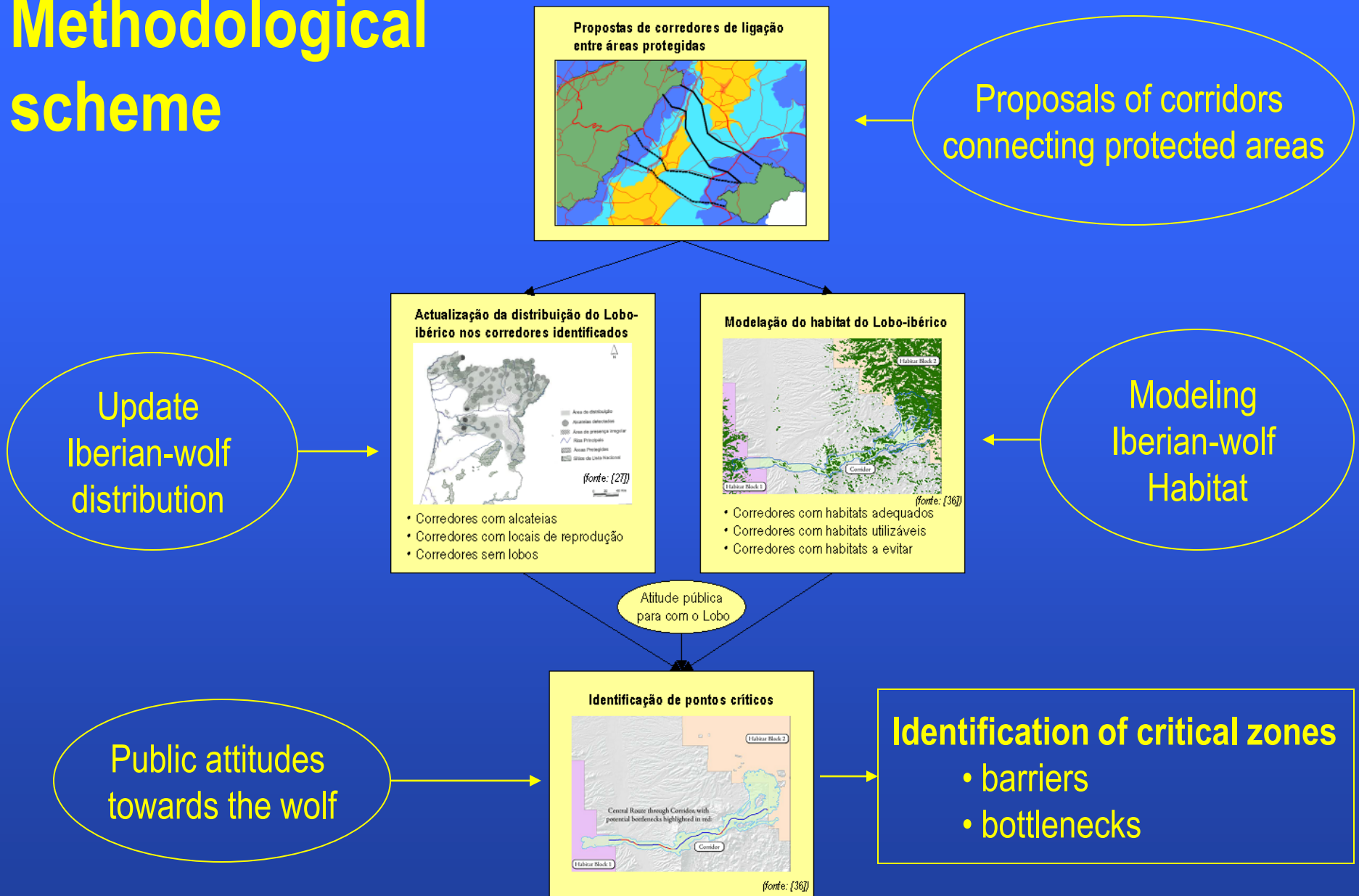
Understanding this conflict is a prerequisite for a successful conservation of the Iberian-wolf.



Large Guard Dogs (LDG)

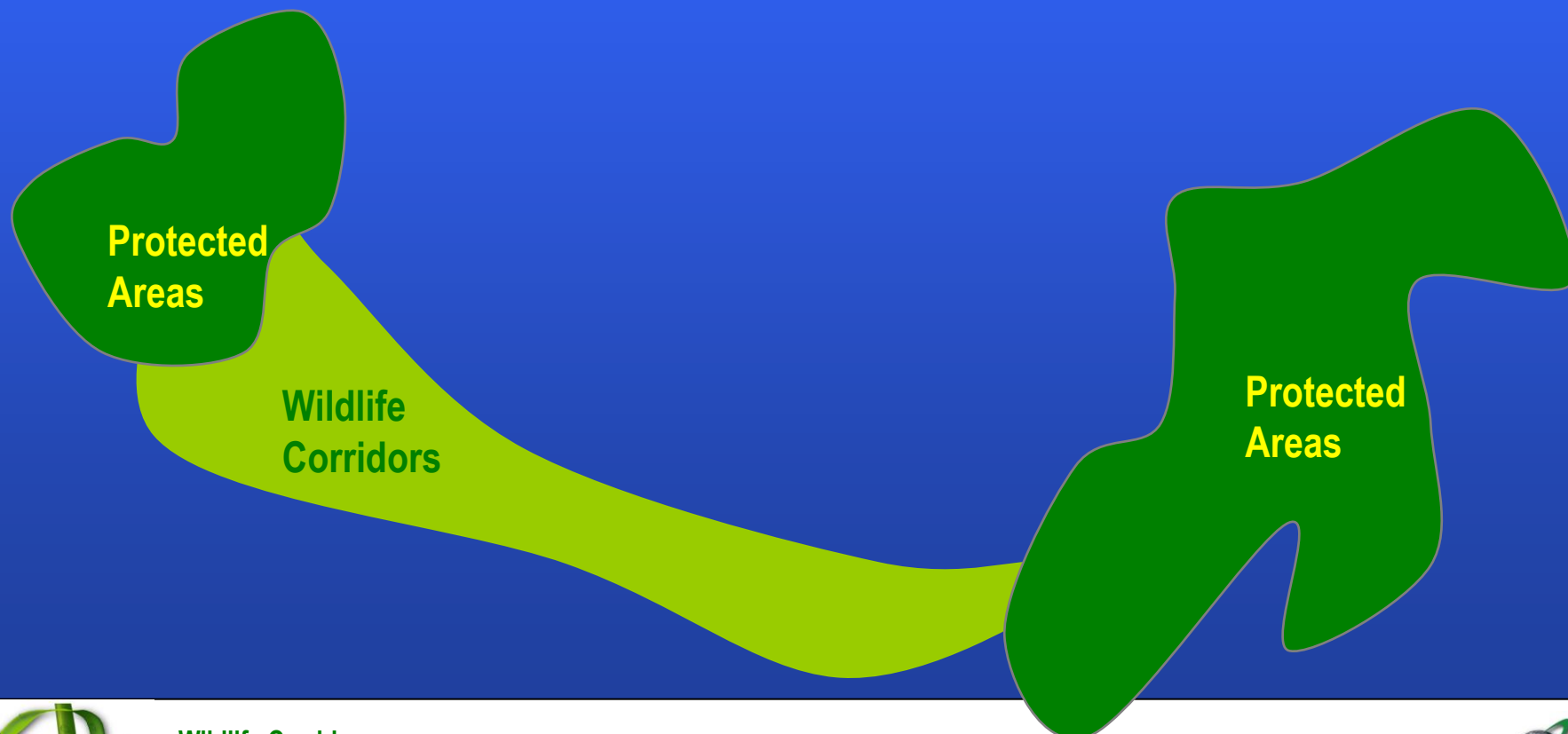


# Methodological scheme



# Summary

In summary, the project intent to increase the mobility of wildlife between protected areas, therefore, aims to promote biodiversity within and outside the protected areas.





Thank you for your attention

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Wildlife Corridors:  
Connecting protected areas

**FCT** Fundação para a Ciência e a Tecnologia  
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