



# GIS FOR QUALITY OF LIFE SCENARIO ASSESSMENT, LISBON METROPOLITAN AREA

Paulo G. Molin  
Abdulhakim Abdi  
Vanessa J.A. Anacta  
Ashwin Dhakal  
Benedict C. Mugambi

Stephanie J. Duce  
Anand R. Nandipati  
Francis M. Mwambo  
Sushil Bhandari  
Moniruzzaman MD

Universidade Nova de Lisboa  
Instituto Superior de Estatística e Gestão de Informação  
[PGMOLIN@GMAIL.COM](mailto:PGMOLIN@GMAIL.COM)

October, 2009



Itajaí, SC

## Background and Importance

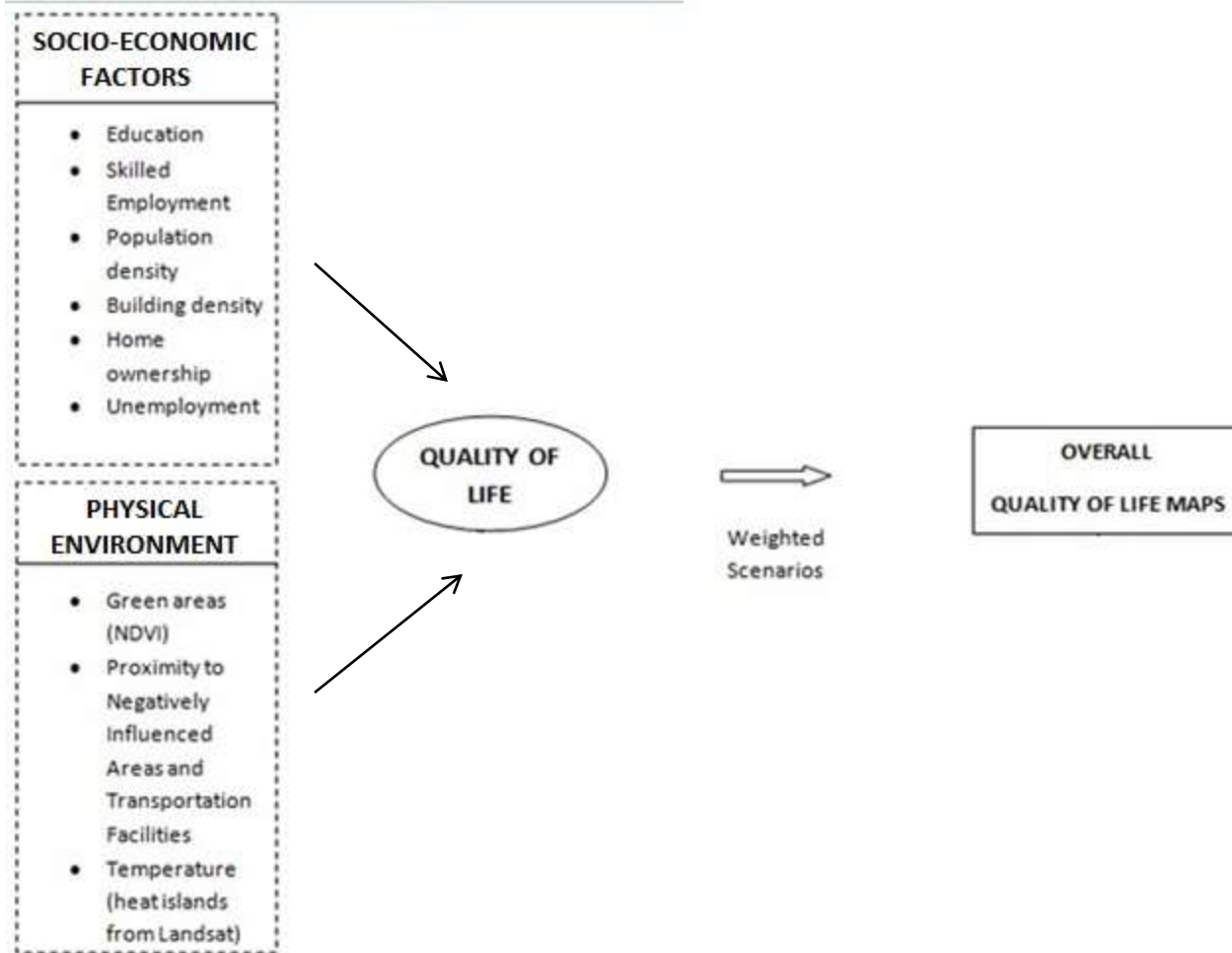
- Increasing Gross Domestic Product (GDP) has improved quality of life and led to urbanization and growth of the Lisbon Metropolitan Area (LMA) (*World Bank, 2008*)
- Urbanization trends increase the importance of sustainable urban environments and quality of life.

## Objectives

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- ❑ Assess quality of life in the Lisbon Metropolitan Area based on different scenarios.
- ❑ Provide information to town planners, residents and potential residents.
- ❑ Use free and widely available data.
- ❑ **Near Future:** Cross QoL with Climate Change information and visualize its impacts

# Methodology



# Methodology

$$QoLLMA = (w_1)QLV_1 + (w_2)QLV_2 + (w_3)QLV_3 + (w_4)QLV_4$$

Factors taken into account:

QLV1 - Socio-Economic Factors

QLV2 – Environmental Factors (Greenness (NDVI) + Temperature)

QLV3 - Proximity to Transport Facilities (Metro and Train Stations)

QLV4 – Distance from NIAs

W – weighting factor

		Variables Weightings			
		Socio-economic	Greenness, temperature, environment	Proximity to Transport	Proximity to NIA
SCENARIOS	1 – The Environmentalist	0.1	0.5	0.1	0.3
	2 - The Urbanite	0.2	0.2	0.5	0.1
	3 – The Good Neighborhood	0.5	0.2	0.1	0.2
	4 – Equal Weighting	0.25	0.25	0.25	0.25

# Methodology



## **SOCIO-ECONOMIC FACTORS** **Quality of Life**

- ❑ 2001 Census Data grouped using GeoSom
- ❑ GeoSom = Data Mining tool - Self-organizing map

## Methodology

# ENVIRONMENTAL FACTORS

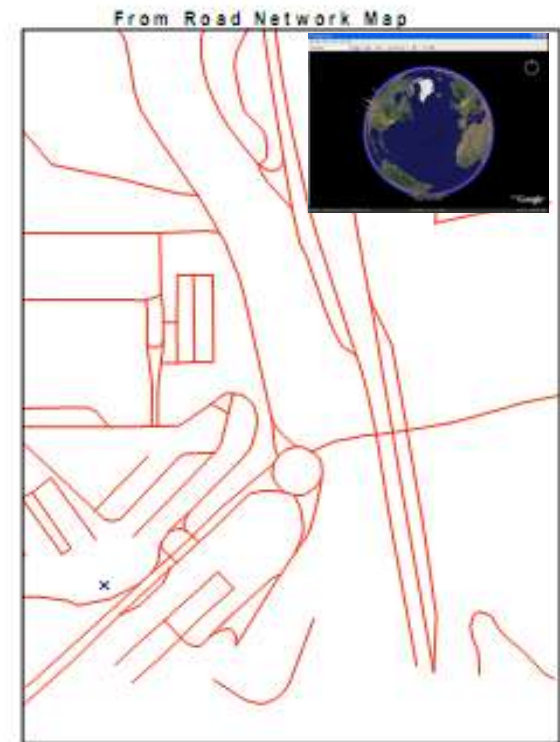
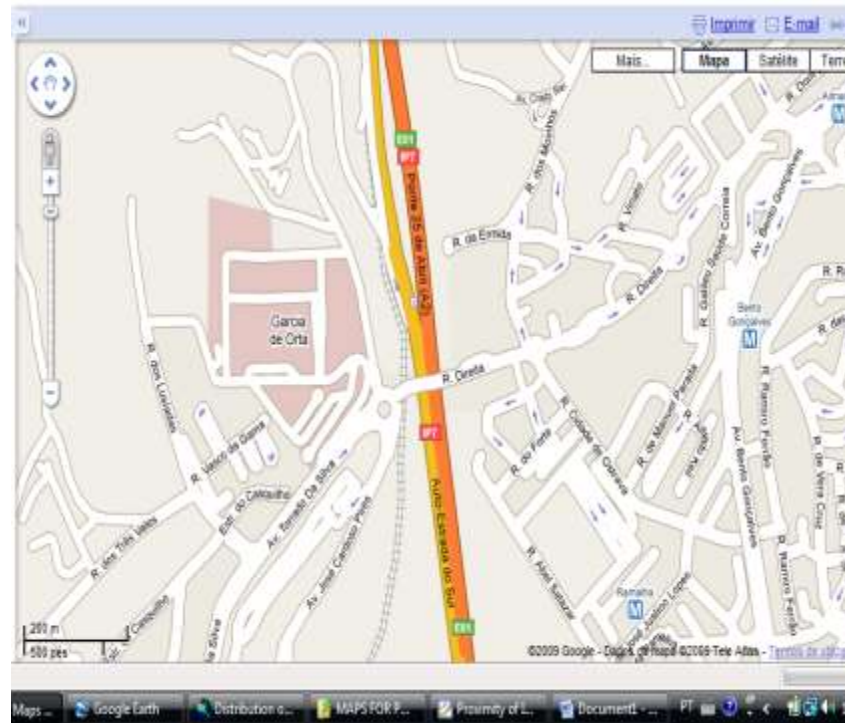
- Landcover (NIAs and transportation facilities)
- Green Areas (NDVI)
- Temperature



# Methodology

## Transportation facilities

Digitization of Metro and Train Stations from Google Maps and Google Earth



# Methodology

## Green Areas - (NDVI)

$$NDVI = \frac{NIR - R}{NIR + R}$$

NIR - stands for near-infrared (Band 4) and

R - stands for the visible red reflectance (Band 3)

## Greenness

$$P = \left( \frac{N_v}{N} \right) * 100\%$$

(Xiao and Moody, 1998)

Estimated percentage (from Orthophoto)

$$X = NDVI + \frac{0.153}{0.005}$$

(Percentage of greenness)

# Methodology

## Temperature

Landsat 7 ETM+ – June 8, 2000



Band 6 (10.4 - 12.5  $\mu\text{m}$ )

- Spatial resolution of 60m at nadir
- Captures the intra-urban temperature



# The RESULTS

- **Socio-economic**
  - **Landcover**
  - **Greenness**
- **Land Surface Temperature**

## Socio-Economic Clustering (Geosom)

### Cluster 1: Lowest QoL

- Low home ownership
- Lowest no. of secondary or university graduates
- Highest unemployment and pop. density

### Cluster 2: 2<sup>nd</sup> Lowest QoL

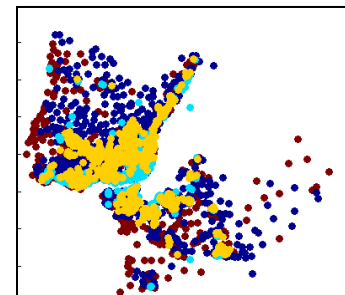
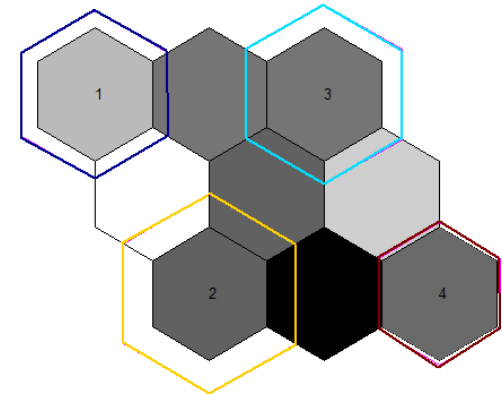
- Most retired people and no economic activity
- Lowest home ownership and highest rented
- Mostly old buildings

### Cluster 3: 2<sup>nd</sup> Highest QoL

- Lowest pop. density
- Second highest home ownership and skilled employment

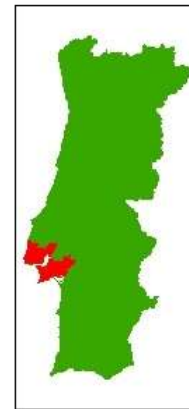
### Cluster 4: Highest QoL

- Highest home ownership, education and skilled employment
- Mostly new buildings

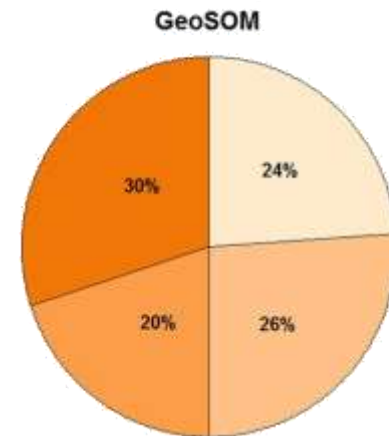
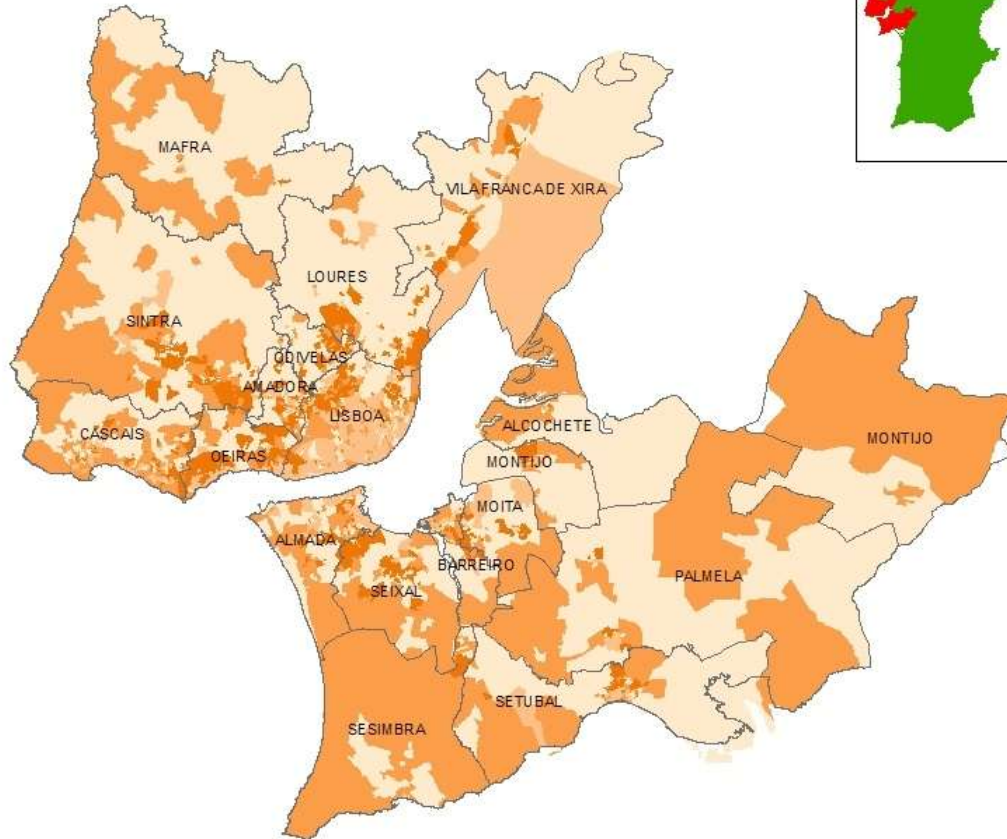




# Socio-Economic Clusters in the LMA Created using GeoSOM



## Socio-Economic

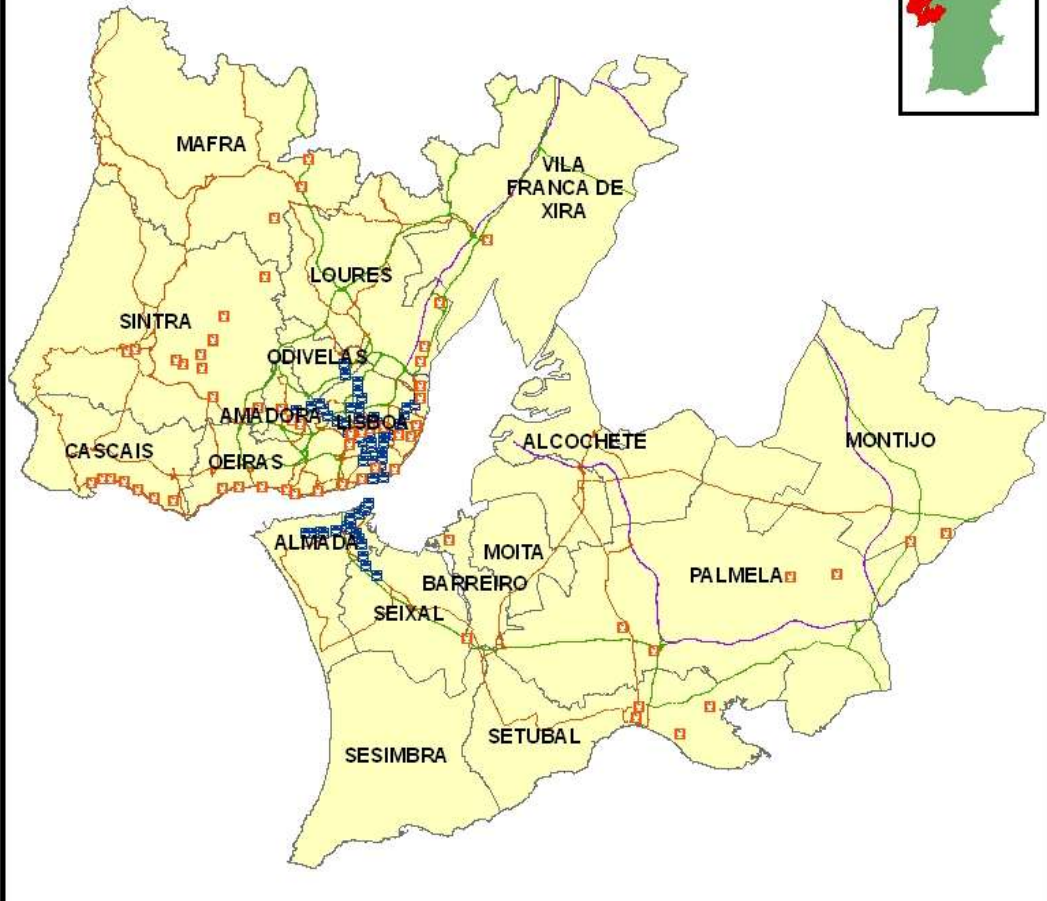




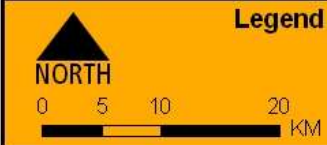
# Transportation



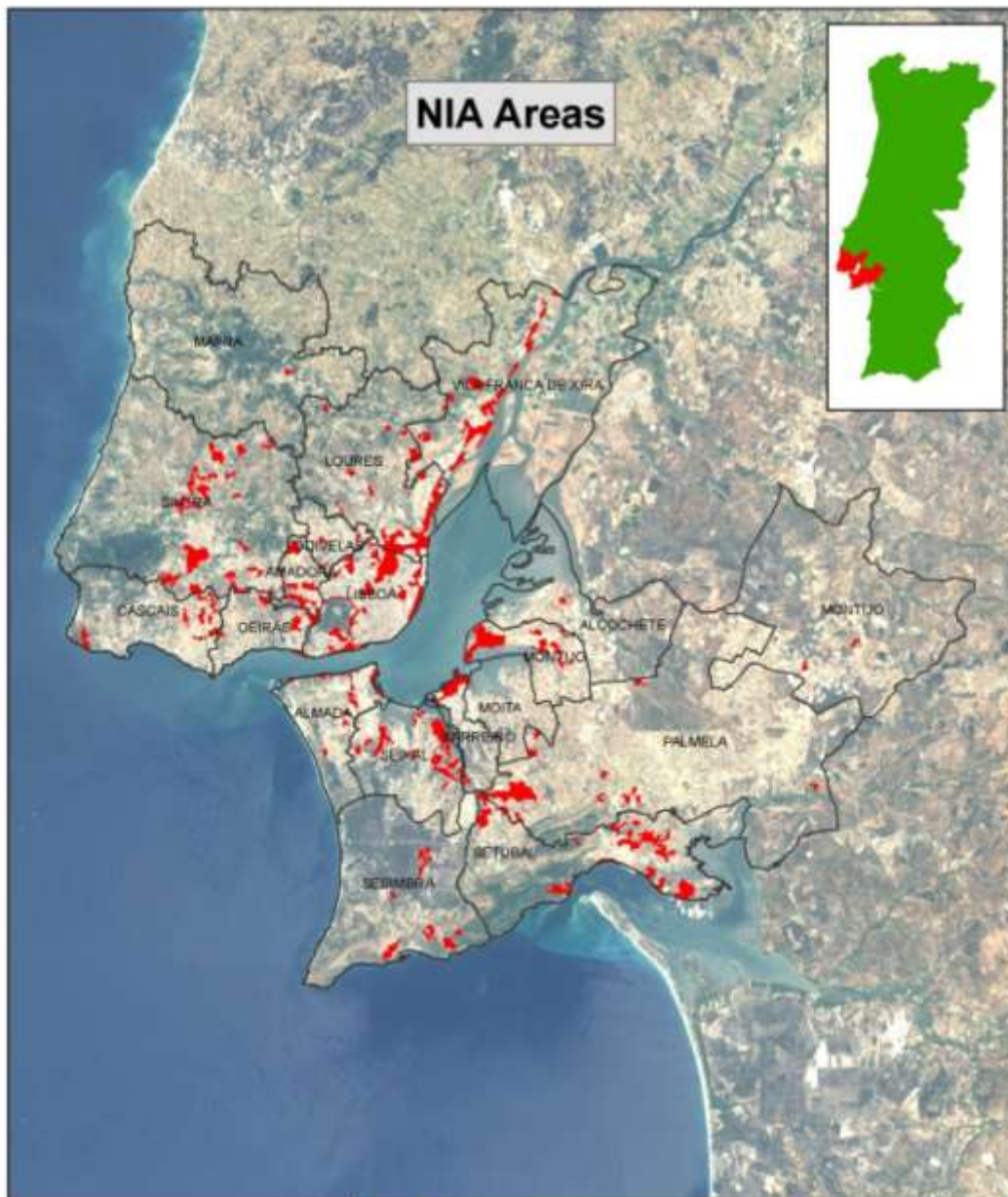
## Landcover



Group Project Seminar  
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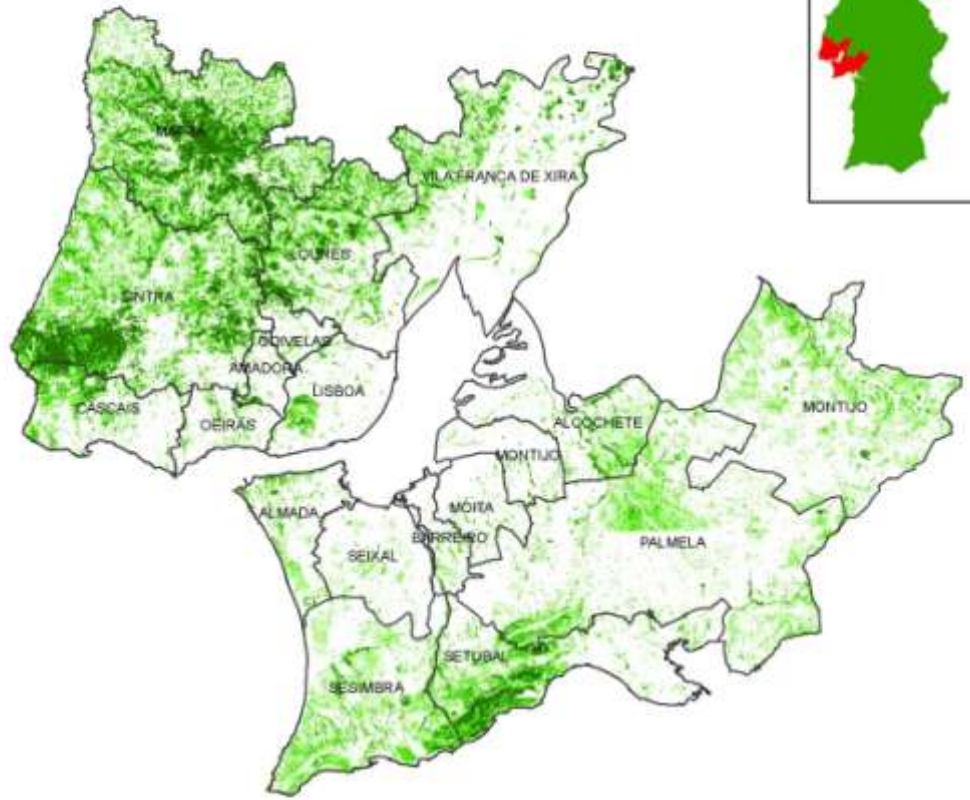
-  Metro Stations
-  Rail Stations
- Roads**
-  Class 1
-  Class 3



## Landcover



# Percentage of Greenness

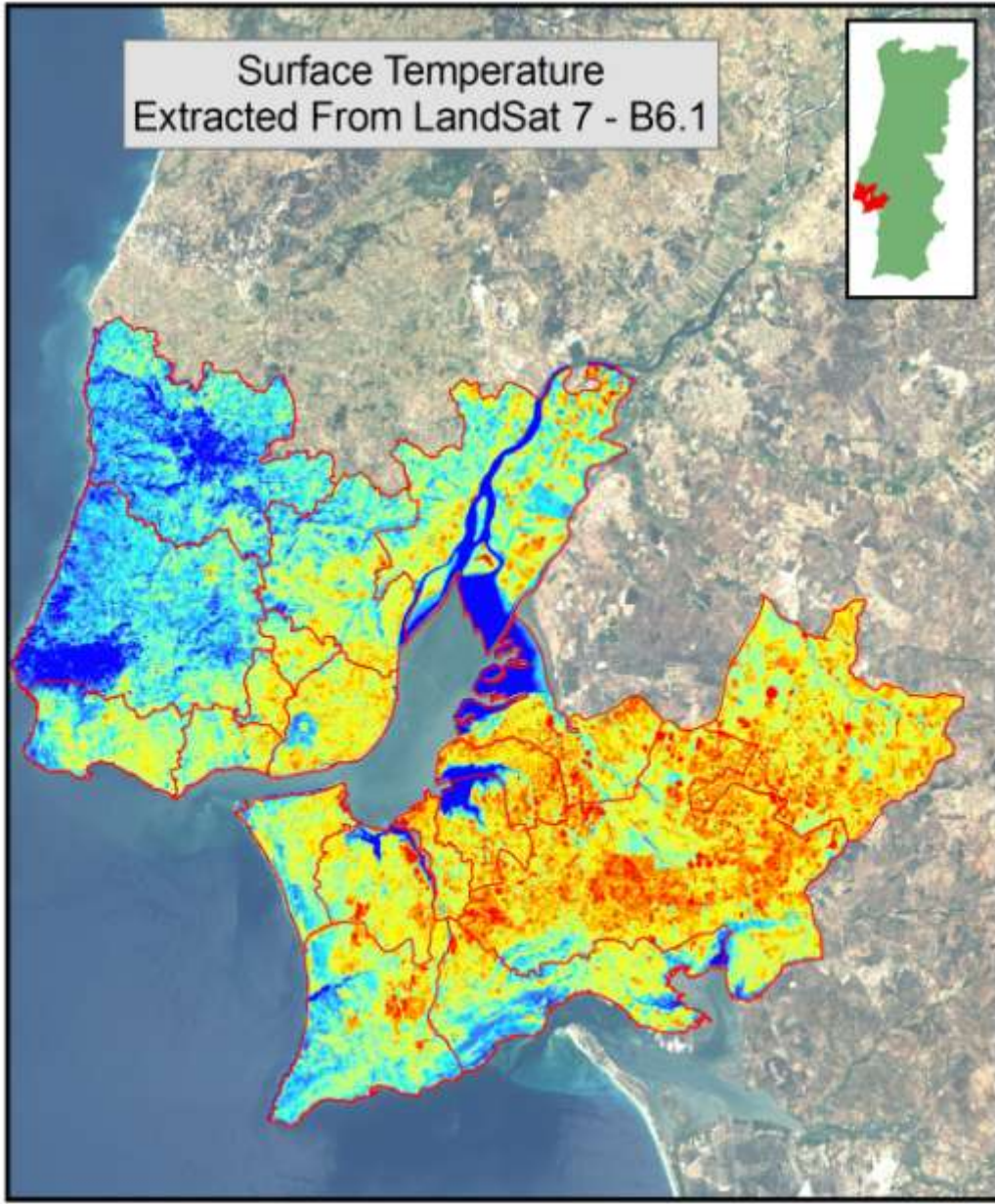


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## Greenness





## Temperature

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Legend  
AML

Surface Temp (°C)  
High : 30,13  
Low : 25,08

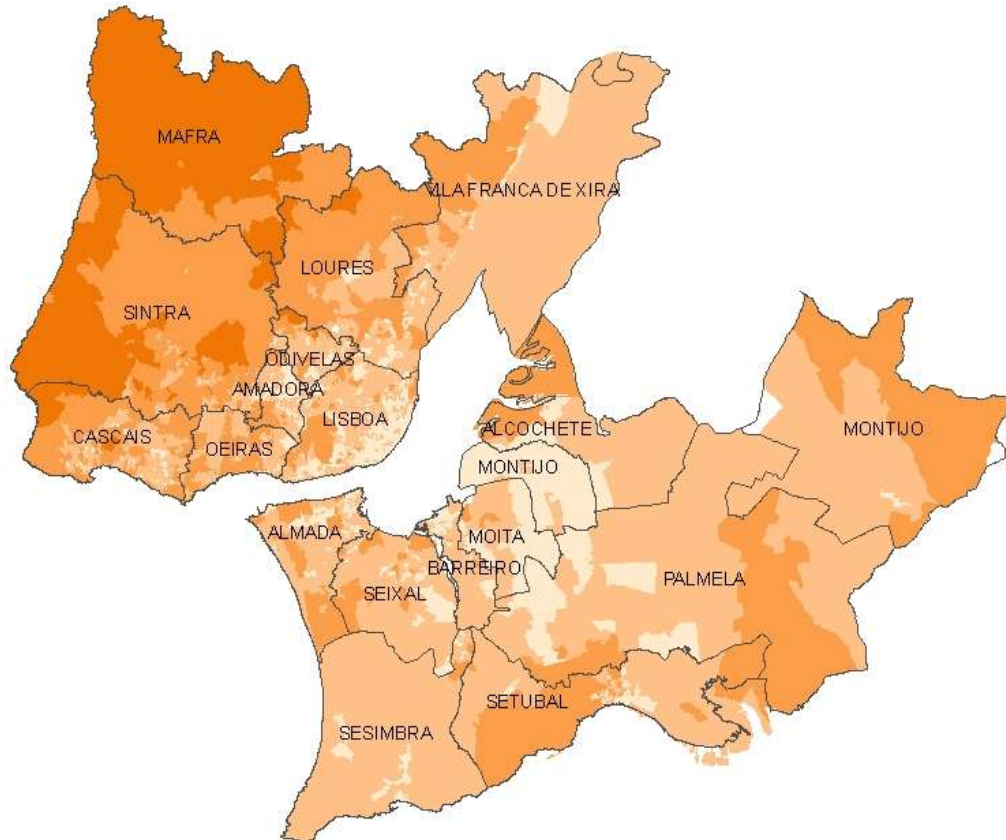
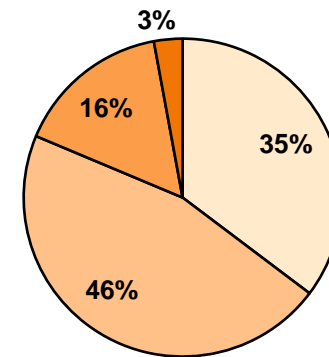
A north arrow and a scale bar in kilometers, ranging from 0 to 20 km.

# Quality of Life based on Scenario 1



## 1 – The Environmentalist

Quality of Life in LMA  
Scenario 1: Population



	VARIABLES				
	Socio-economic	Greenness, temperature, environment	Proximity to Transport	Proximity to NIA	
SCENARIOS	1	0.1	0.5	0.1	0.3
	2	0.2	0.2	0.5	0.1
	3	0.5	0.2	0.1	0.2
	4	0.25	0.25	0.25	0.25

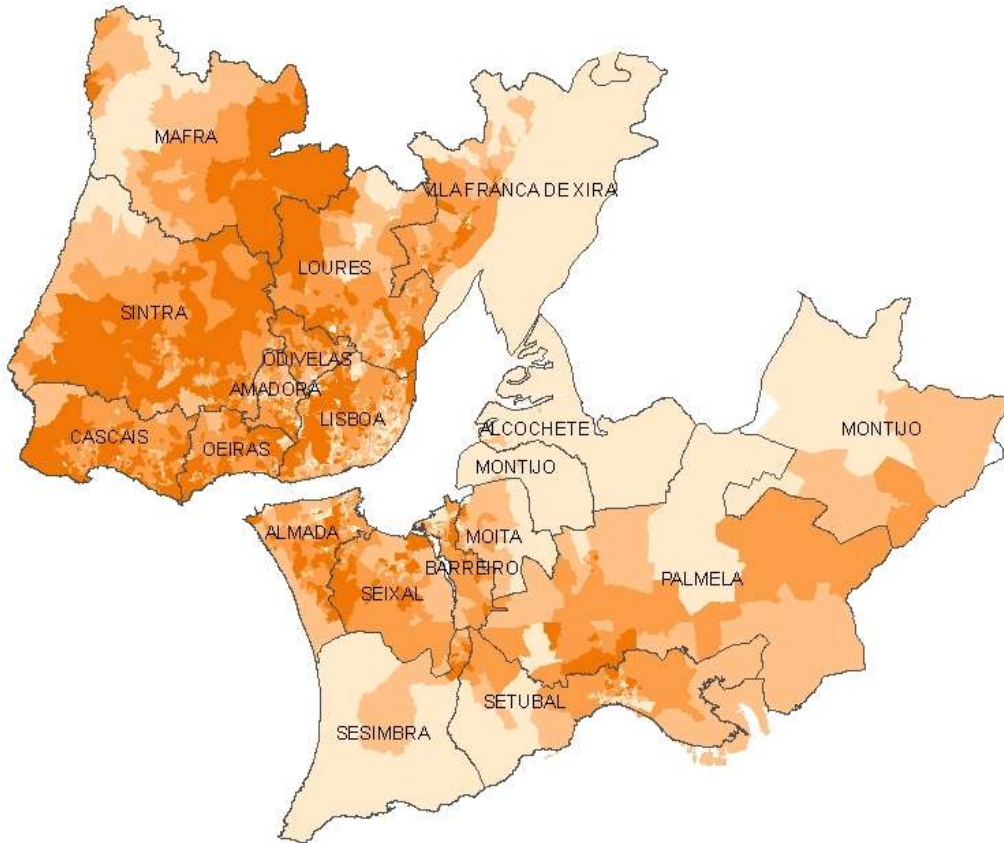
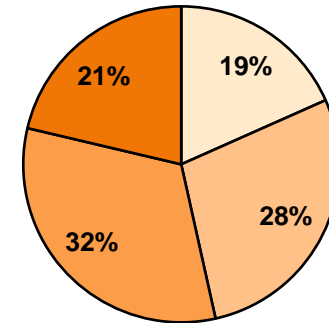


# Quality of Life based on Scenario 2



## 2 - The Urbanite

### Quality of Life in LMA Scenario 2: Population



SCENARIOS	VARIABLES			
	Socio-economic	Greenness, temperature, environment	Proximity to Transport	Proximity to NIA
1	0.1	0.5	0.1	0.3
2	0.2	0.2	0.5	0.1
3	0.5	0.2	0.1	0.2
4	0.25	0.25	0.25	0.25

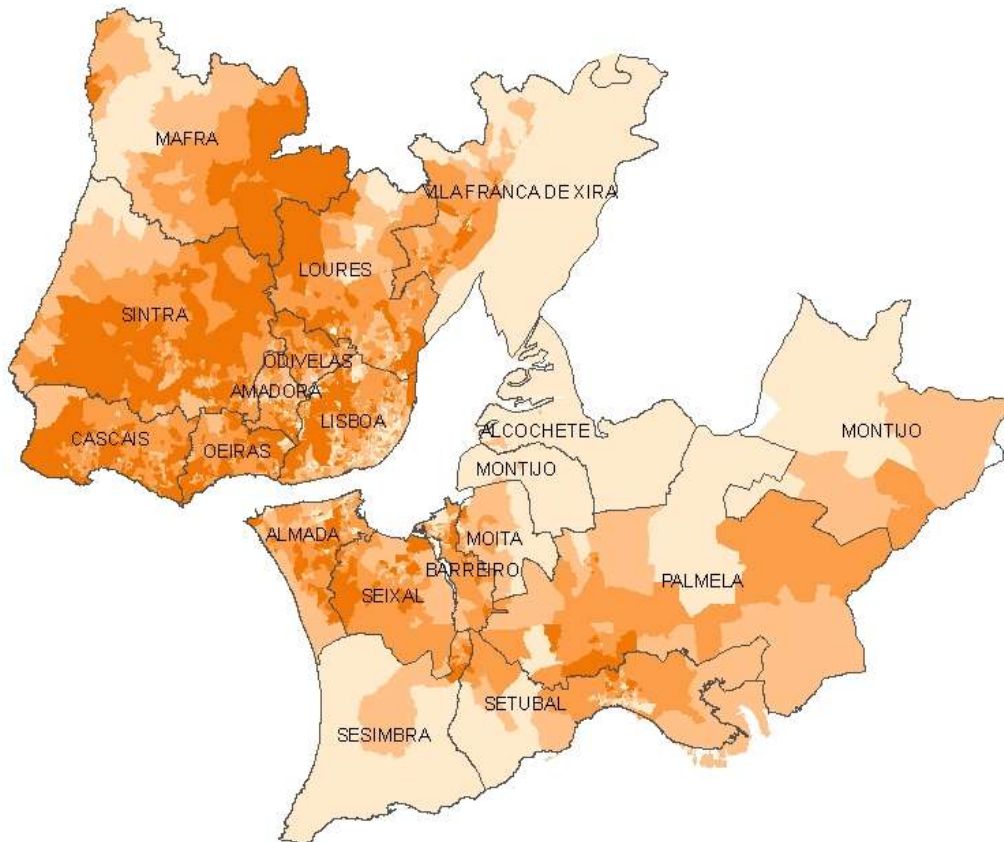
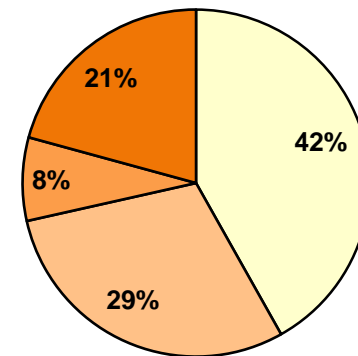


# Quality of Life based on Scenario 3



## 3 – The Good Neighborhood

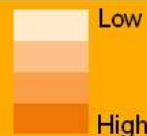
Quality of Life in LMA  
Scenario 3: Population



SCENARIOS	VARIABLES			
	Socio-economic	Greenness, temperature, environment	Proximity to Transport	Proximity to NIA
1	0.1	0.5	0.1	0.3
2	0.2	0.2	0.5	0.1
3	0.5	0.2	0.1	0.2
4	0.25	0.25	0.25	0.25



Legend

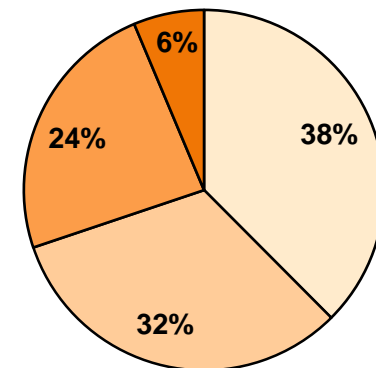
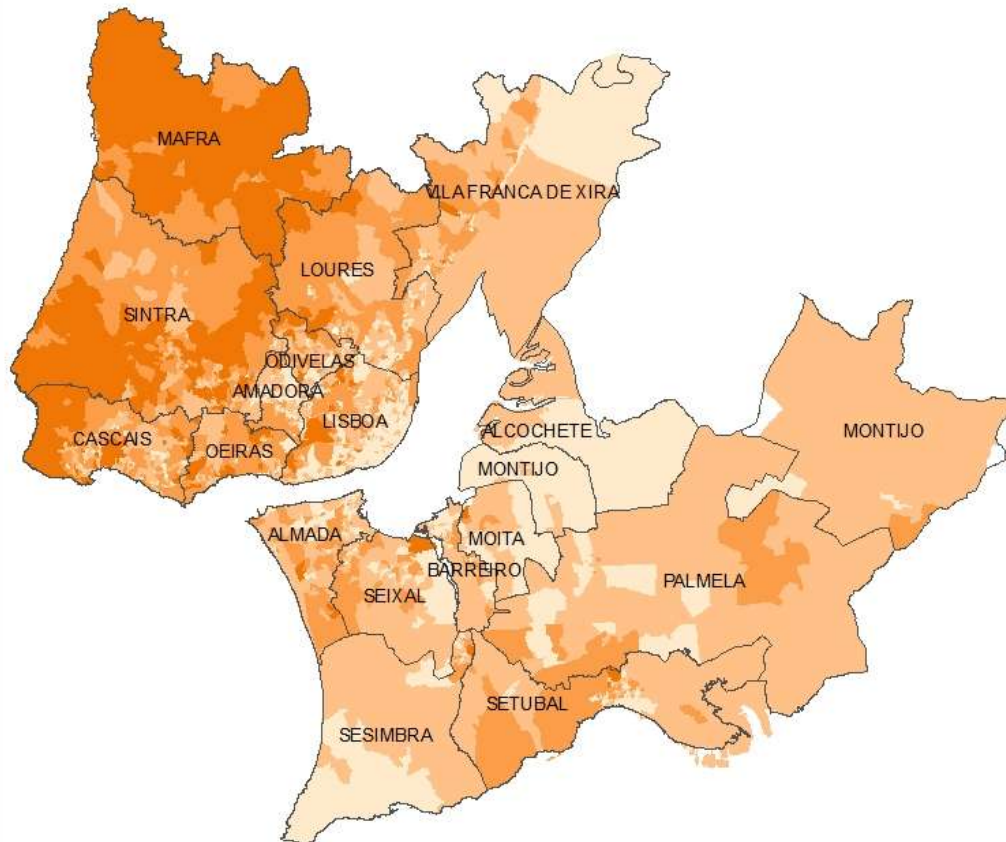


# Quality of Life based on Scenario 4



## 4 – Equal Weighting

### Quality of Life in LMA Scenario 4: Population



SCENARIOS	VARIABLES			
	Socio-economic	Greenness, temperature, environment	Proximity to Transport	Proximity to NIA
1	0.1	0.5	0.1	0.3
2	0.2	0.2	0.5	0.1
3	0.5	0.2	0.1	0.2
4	0.25	0.25	0.25	0.25

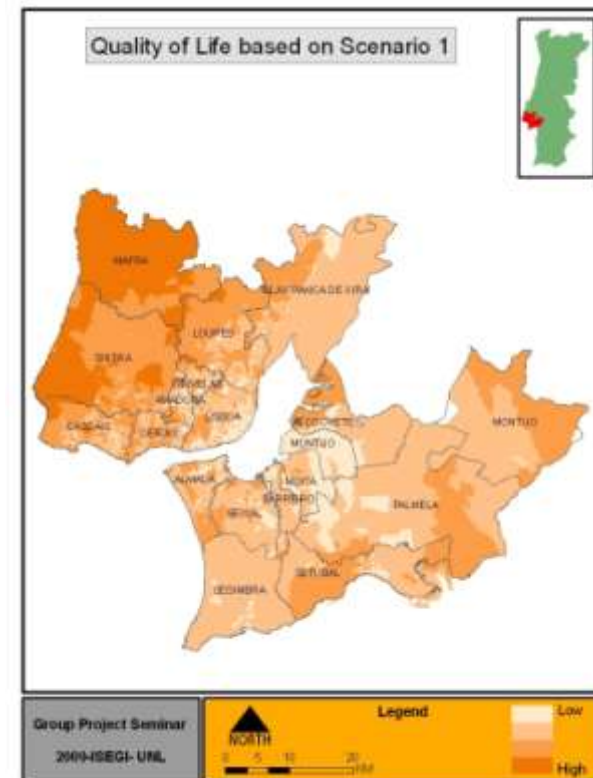
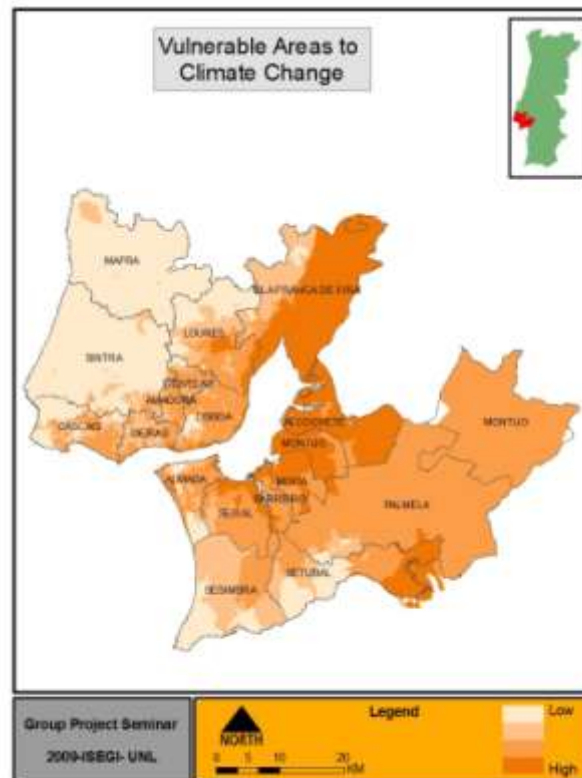


## CONCLUSION

- QoL decreases when environmental factors are given priority
  - **LMA requires better use of Green Spaces**
- 40% of sections were classed as having the lowest QoL when socio-economic factors were given priority
  - **Socio-economic conditions need improvement**
- This study provides valuable information to town planners to improve quality of life throughout the LMA
- Methodology presented uses readily available data and is repeatable elsewhere with the possibility of new variables

# NEXT STEPS

Put together QoL and Climate Change information to address how QoL may be affected by CC.



# MUITO OBRIGADO!

- Prof. Dr. Marco Painho
- Prof. Dr. Mario Caetano
- Prof. Dr. Pedro Cabral
- Prof.ª Dra. Ana Cristina Costa
- Prof. Dr. Fernando Bação
- Roberto Henriques
- ISEGI
- Antonio Nunes of IGP

