Melhorar o sucesso da reflorestação em zonas semiáridas: adaptação ao cenário de alterações climáticas

Improve the success of reforestation in semi-arid areas: adaptation to climate change scenario

AdaptForChange

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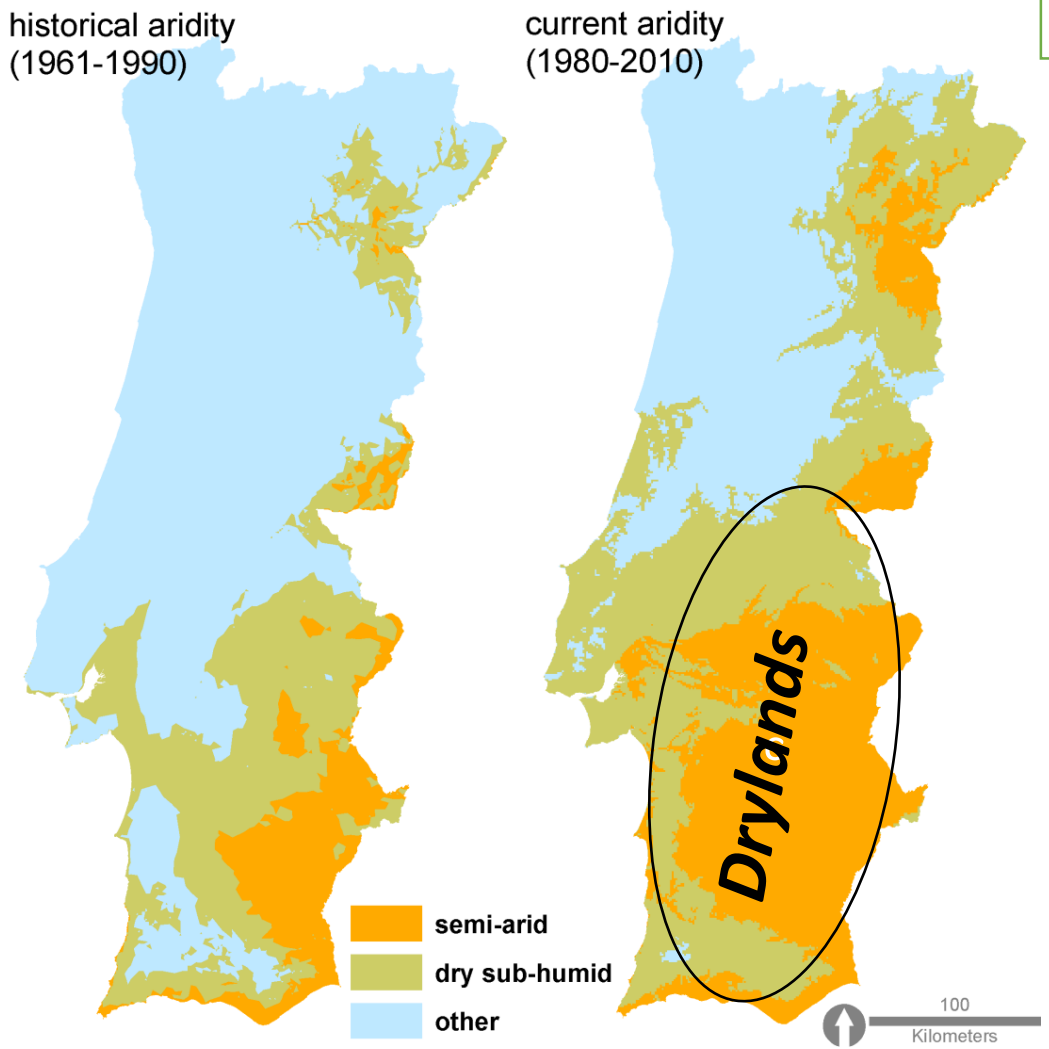
The Drylands in Portugal



Aridity Index
ICNF

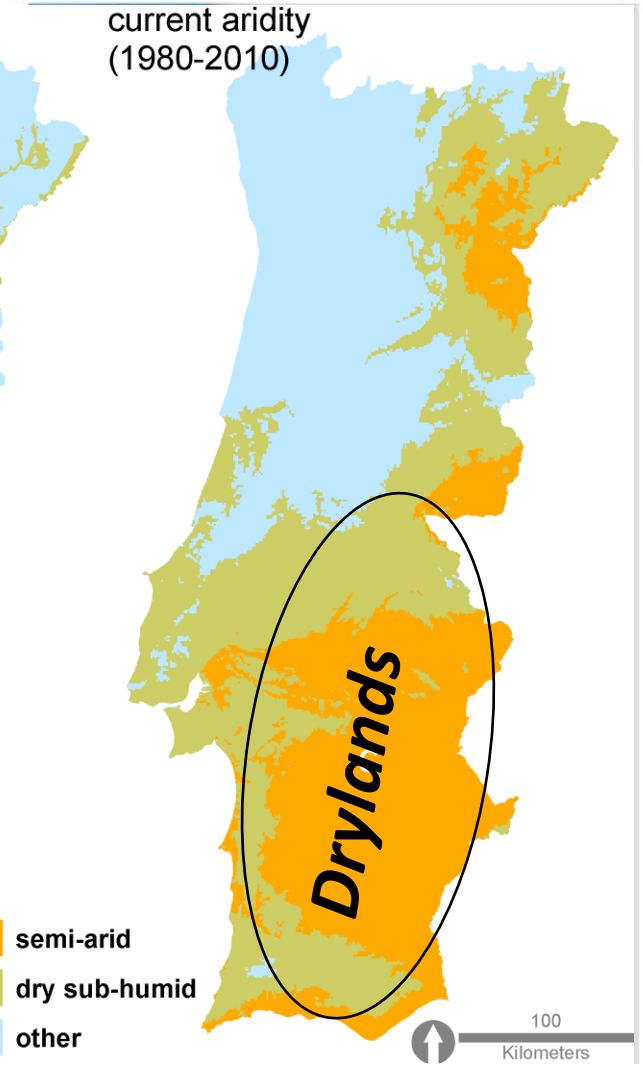
Climate Change scenario:

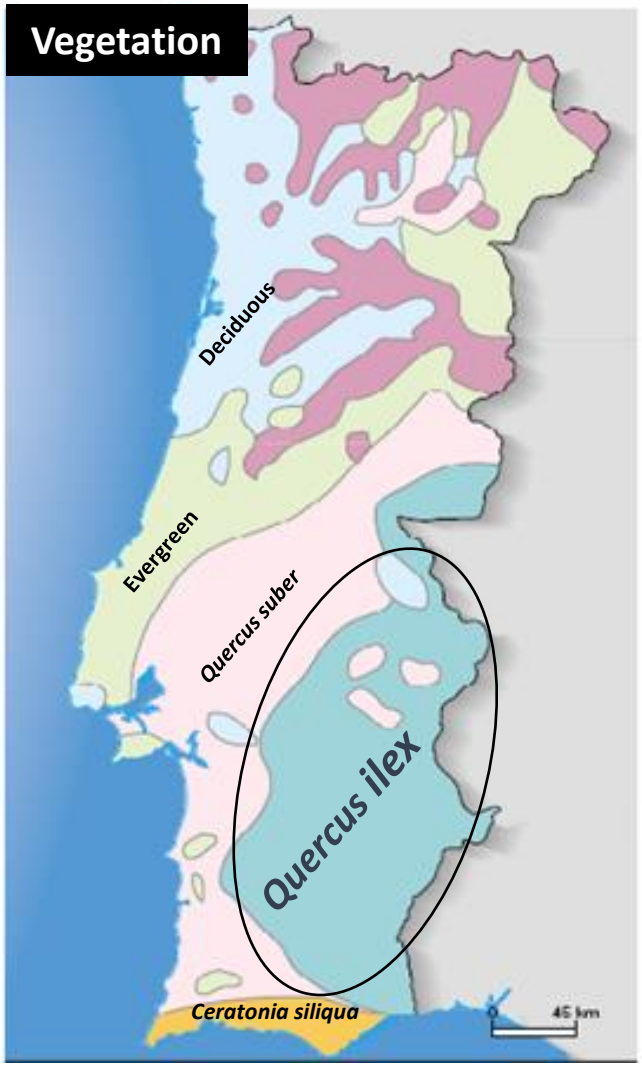
The region with a semiarid climate expanded to all the region of the Alentejo, which will be strongly affected in the future.

In Portugal the scenarios of climate change predict a rise in temperature and in droughts with a decrease in productivity.

Tree Key Species

In drylands ecosystem functionality is restricted to few species





Ecosystem services provided by forests

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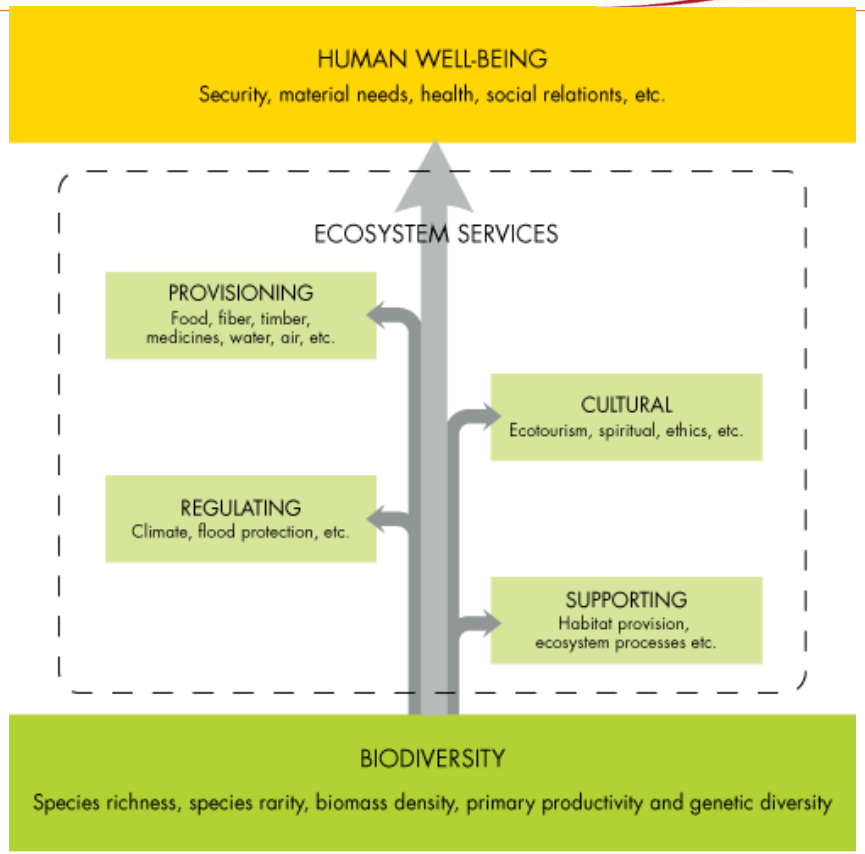
Growth of the native forest increases resilience and the ecosystem services through:
-the soil organic matter
-carbon and nitrogen
-biodiversity
-water infiltration
-decreases susceptibility to desertification



Reforestation in the Alentejo with the native species holm oak and cork oak has a low rate of success.

Main Objective of Adapt*For*Change is to:

"Improve the success of reforestation in semi-arid areas and promote adaptation to climate change scenario".

Intends to promote the adaptation of the forestry sector to climate change while reducing the cost associated with reforestations.

Team

1 – FFCUL - Fundação da Faculdade de Ciências da Universidade de Lisboa:

eChanges

CCIAM

2 - ADPM - Associação em Defesa do Património de Mértola, Mértola, Portugal.

3 - FCSH UNL - Faculdade de Ciências ~Sociais e Humanas da Universidade Nova de Lisboa, Lisboa, Portugal.

4- cChange – Private company expert in climate change, Norway.

WP1 – Modelling the potential of regeneration of the native forest in the semiarid

We intend to develop a model that gives us the rate of native forest regeneration for the entire region of the current semiarid.

Our team developed a model that was applied to the region of Moura, Alentejo, with great success and where our model clearly proved the lack of success of two reforestations that had occurred in the 90s and 2000s.

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i) easy regeneration areas;
ii) areas with the need of assisted reforestation, using methods that increase water and soil conservation;
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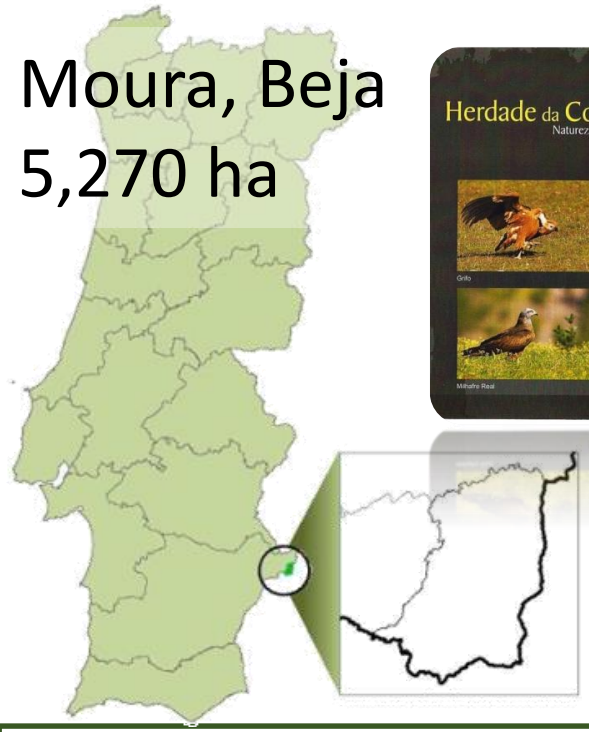
In this last point we will, along with the stakeholders, propose sustainable activities alternative to the forest.

Case-study

Moura, Beja
5,270 ha



Intensive wheat Campaigns
Cut of the tree stratum
During 1929-1949

Reforestation

Why this area?

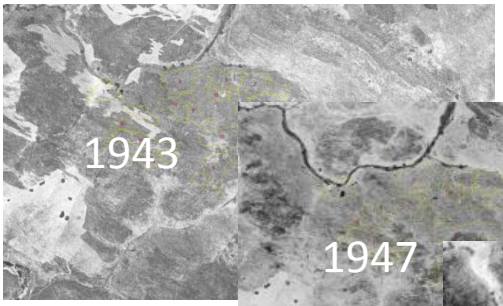
- It is a dryland.
- It has *Quercus ilex* woodlands

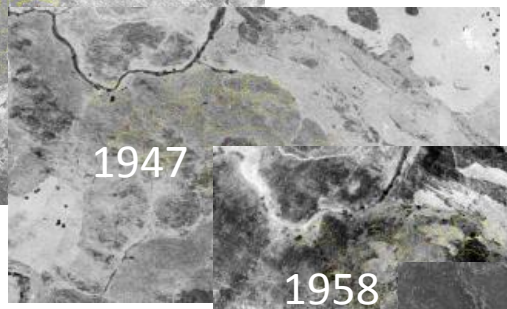
> 50 years with natural regeneration

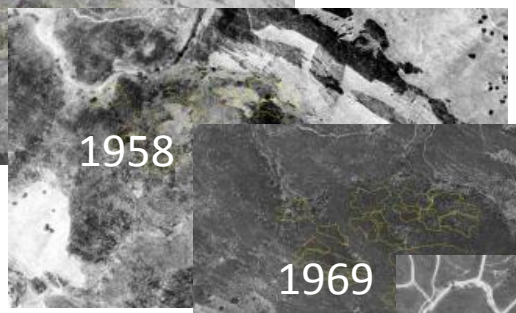
--It is a LTER Site (Long Term Ecological Research >30 years)

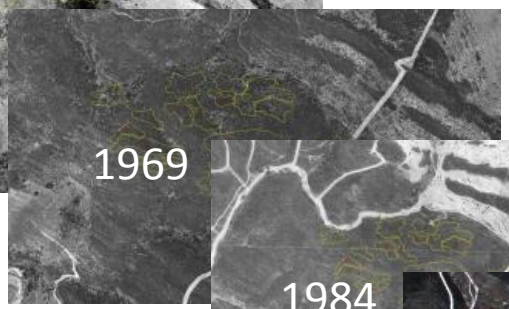
- There are historical information about the management

What´s New? – The long-term monitoring



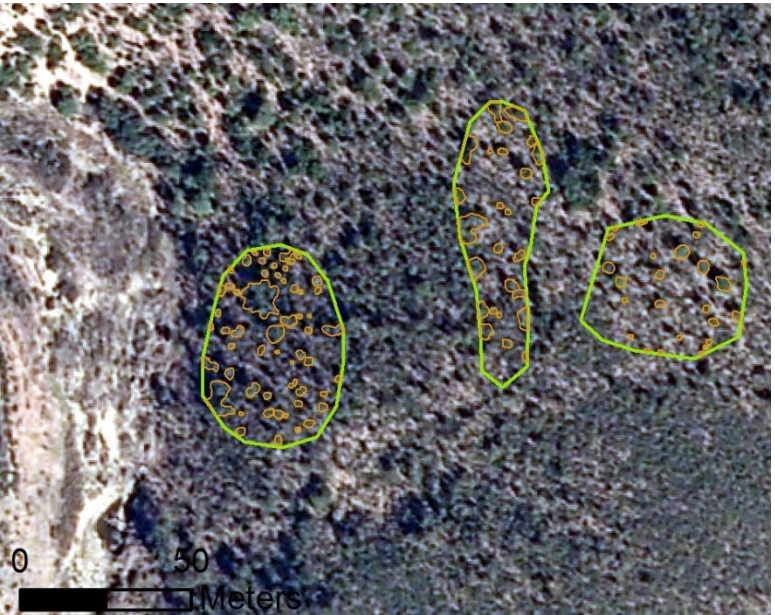






We have a time series of 67 years

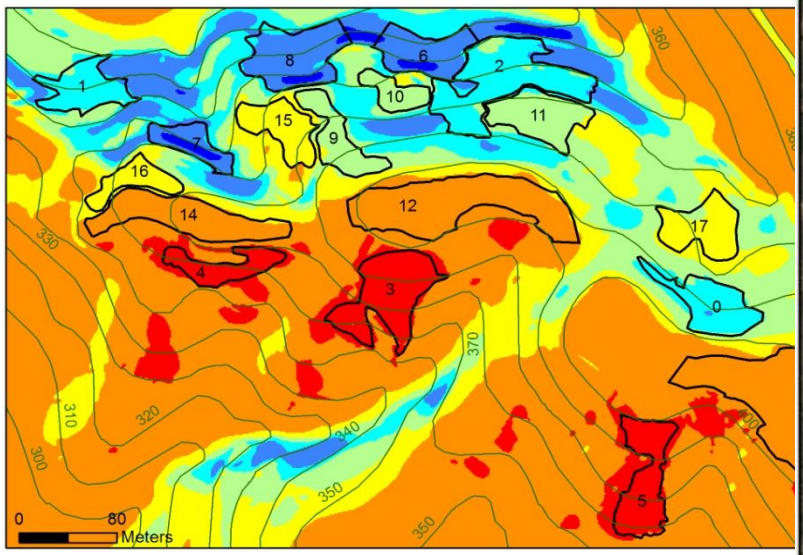
… through photointerpretation …



…we estimated the percentage of Holm oak cover along the microclimatic gradient after agricultural abandonment.

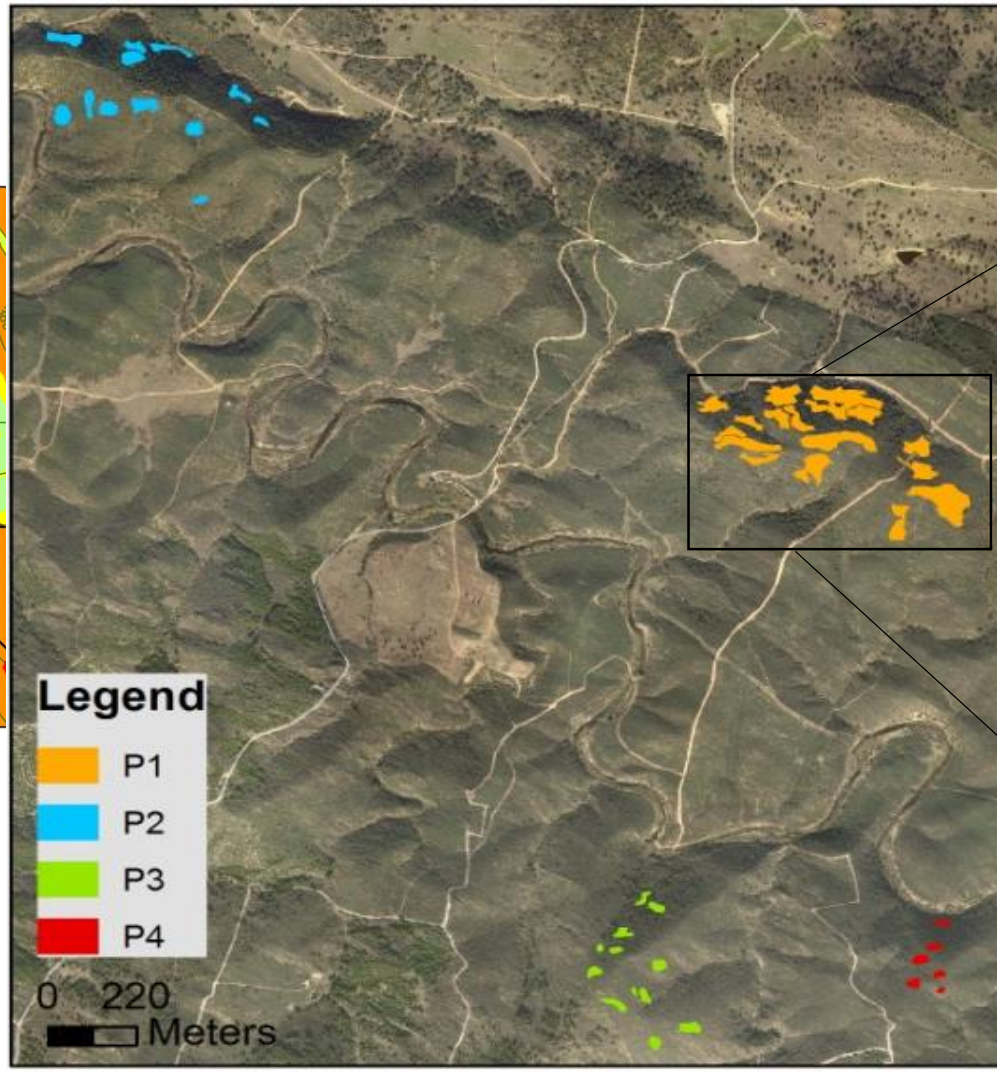
What´s New? – The Use of PSR

Potential Solar Radiation PSR average of 2011



PSR classes (kW/m^2)

- 448.043- 763.311
- 763.311 - 1.026.747
- 1.026.747 - 1.132.848
- 1.132.848 - 1.236.124
- 1.236.124 - 1.345.049
- 1.345.049 - 1.472.531
- 1.472.531 - 1.518.118

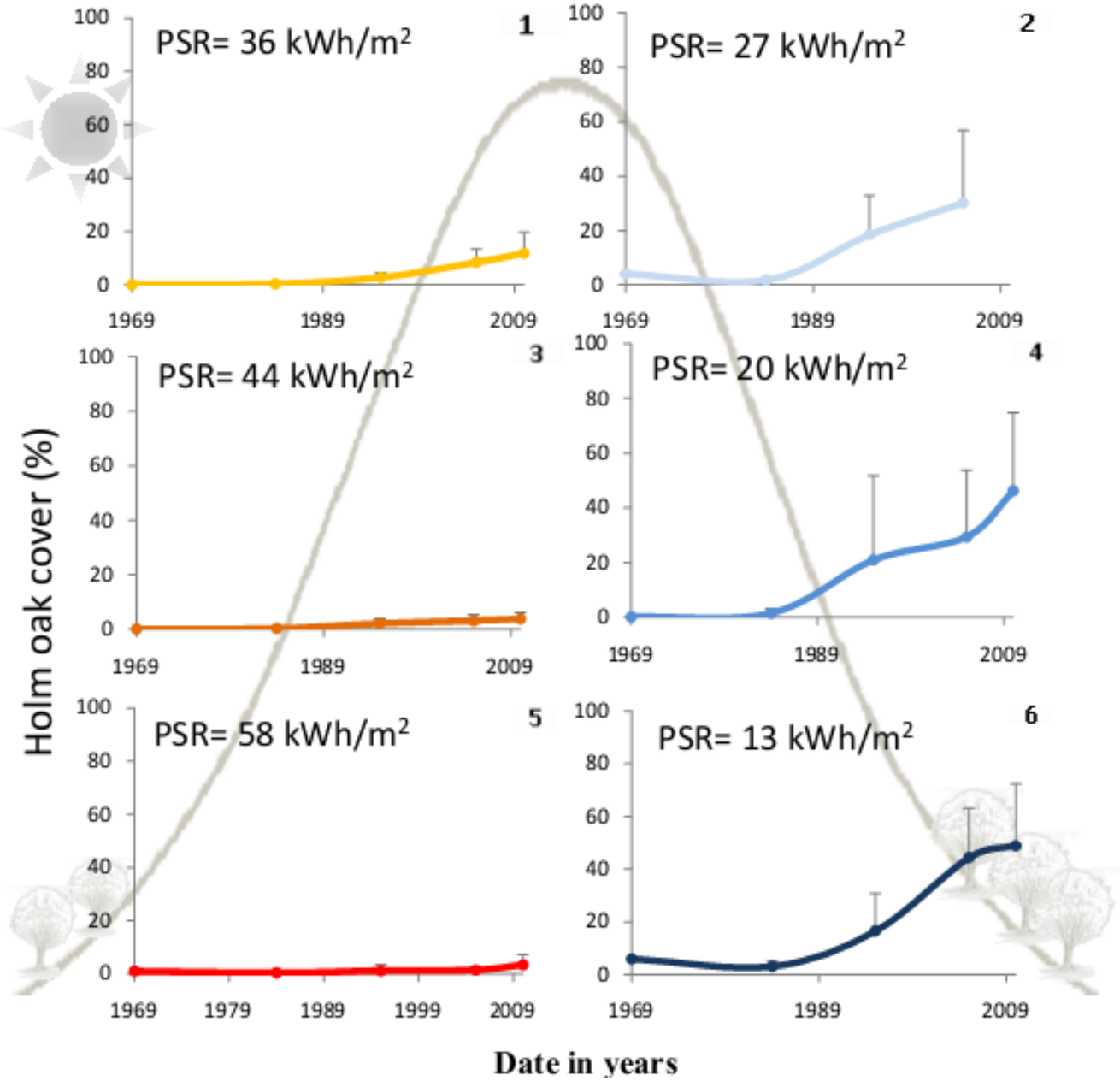


Our sampling design had 4 different sites. At each one we covered as much as possible the 6 classes of PSR resulting in a total of 48 polygons. Which were observed over time.

Rate of Natural Regeneration of Quercus Ilex at Herdade da Contenda, limited by microclimate

South

North



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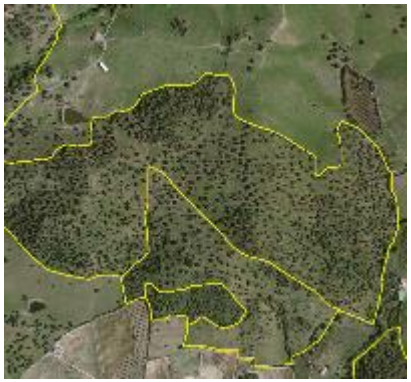
Location of holm oak natural regeneration areas

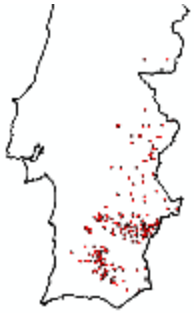
3 methodologies for holm oak regeneration points selection

IFN (Inventário Florestal Nacional) – 1995 and 2006

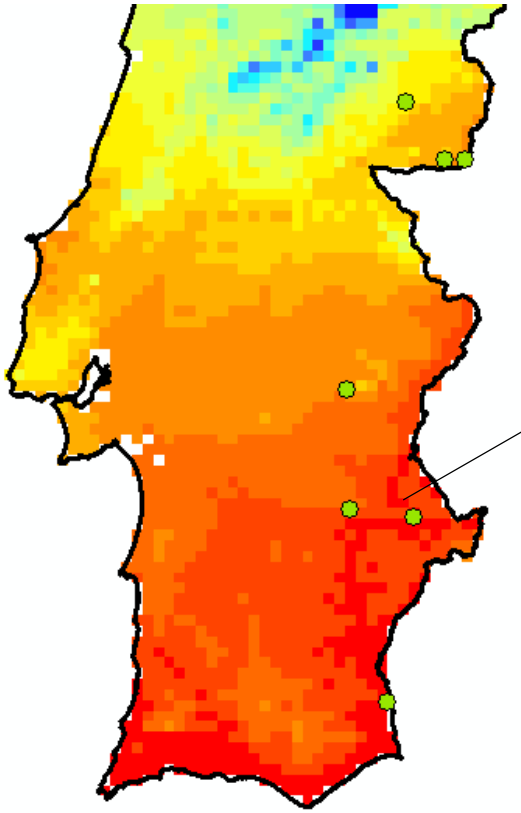
COS (Carta de Ocupação do Solo) - 1990 and 2007



NDVI - 1999 and 2014



holm oak regeneration points distributed through anual precipitation gradient



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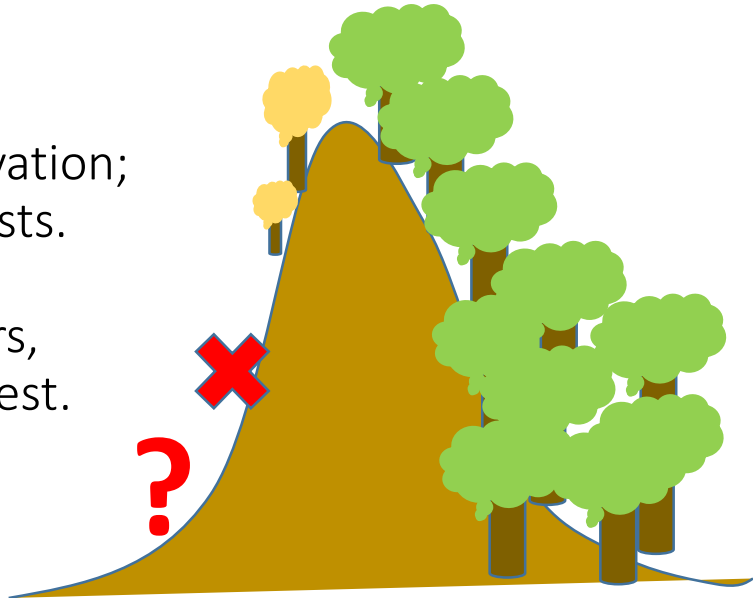
We are preparing an App for visualization of the model results;



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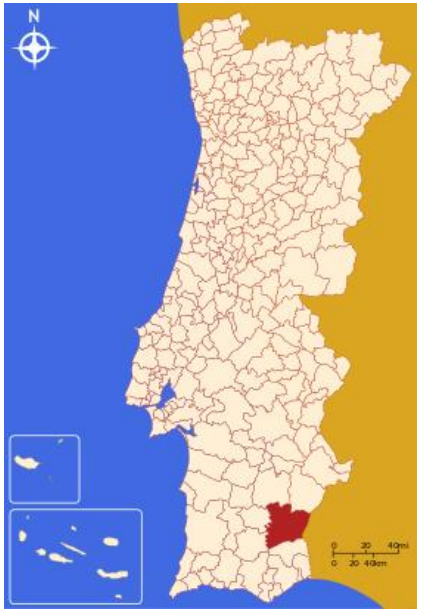
WP5 & WP2 - Creating a common vision and a strategic plan for climate change adaptation of forests

Partner: cE3c – CCIAM; Contact person: André Vizinho, andrevizinho@fc.ul.pt
Partner: ADPM; Contact person; Maria Bastidas, ambiente@adpm.pt

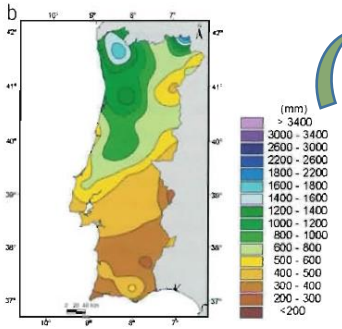




Meeting and involving stakeholders

Compiling knowledge



Creating a vision for the future

SWAP – Scenario Workshop & Adaptation Pathways

Placing the vision on the map

Plan in sub zones

Planning with tiping points

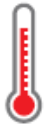
Modelling Climate Scenarios for Pilot Area: Mértola

less rain

increased temperature

less frost days

increase of extreme phenomena

Variável climática	Sumário	Alterações projetadas
	Diminuição da precipitação média anual, com potencial aumento da precipitação no inverno.	**Média anual** Diminuição da precipitação média anual, sendo mais significativa no final do séc. XXI (até -40%). **Precipitação sazonal** Mais precipitação nos meses de inverno (até +7%) e uma diminuição no resto do ano, em especial na primavera (até -54%). **Secas mais frequentes e intensas** Diminuição significativa do número de dias com precipitação, até 12 dias por ano, aumentando a frequência e intensidade das secas.
	Aumento da temperatura média anual, em especial das máximas	**Média anual e sazonal** Subida da temperatura média anual, entre 2ºC e 5ºC. Aumento significativo das temperaturas máximas na primavera e verão (até 6ºC) **Dias muito quentes** Aumento do número de dias com temperaturas muito altas (> 35ºC), e de noites tropicais, com temperaturas mínimas >20ºC. **Ondas de calor** Ondas de calor mais frequentes e intensas. Maior ocorrência de incêndios, devido à conjugação de seca e temperaturas mais elevadas.
	Diminuição do número de dias de geada	**Dias de geada** Diminuição significativa do número de dias de geada, gradualmente até ao final do século, chegando a 6 vezes menos do que no clima atual. **Média da temperatura mínima** Aumento da temperatura mínima até 3ºC no Inverno, sendo maior (até 5ºC) na primavera, verão e outono.
	Aumento dos fenómenos extremos	**Fenómenos extremos** Aumento dos fenómenos extremos, em particular de precipitação intensa ou muito intensa em períodos de tempo curtos. Tempestades de inverno mais intensas, acompanhadas de chuva e vento forte.

in partnership with ClimAdapt.Local

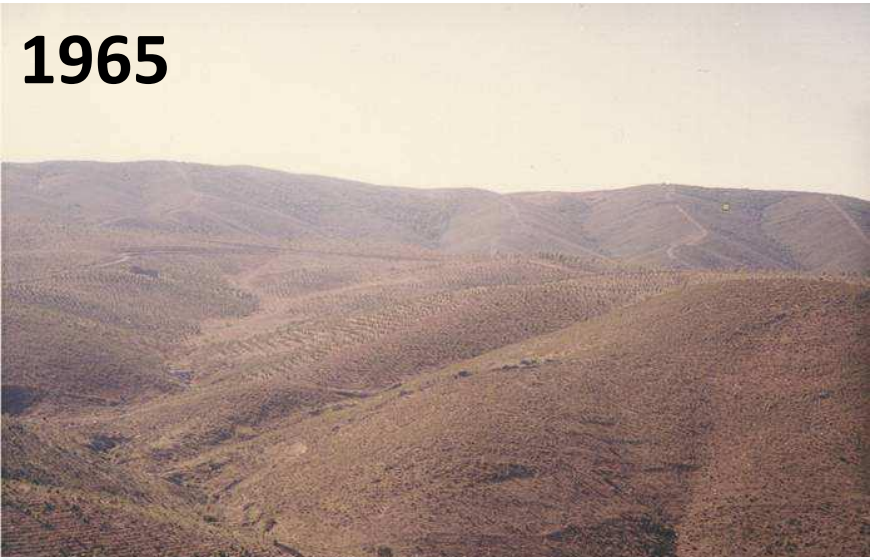
WP3 – Sixty years of reforestations in the semiarid: lessons from the past to adapt

- Characterize and evaluate reforestation interventions performed in the semiarid region of Alentejo over the last 40-60 years (**different species, techniques, climate**)

- Identify successful practices

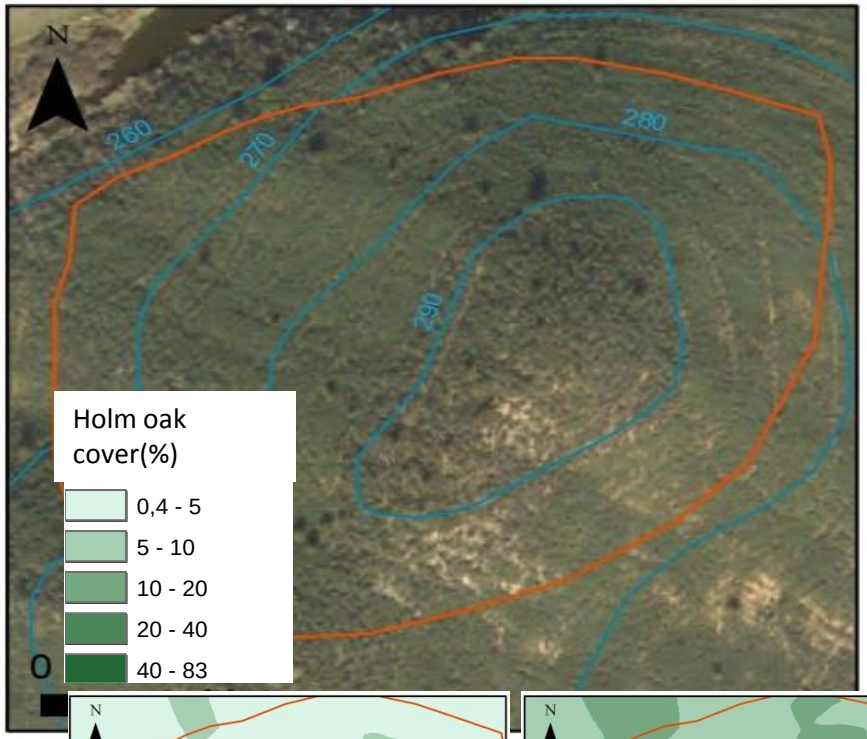
- Transfer the knowledge to areas currently affect by increased aridity and adapt reforestation practices to climate change scenarios

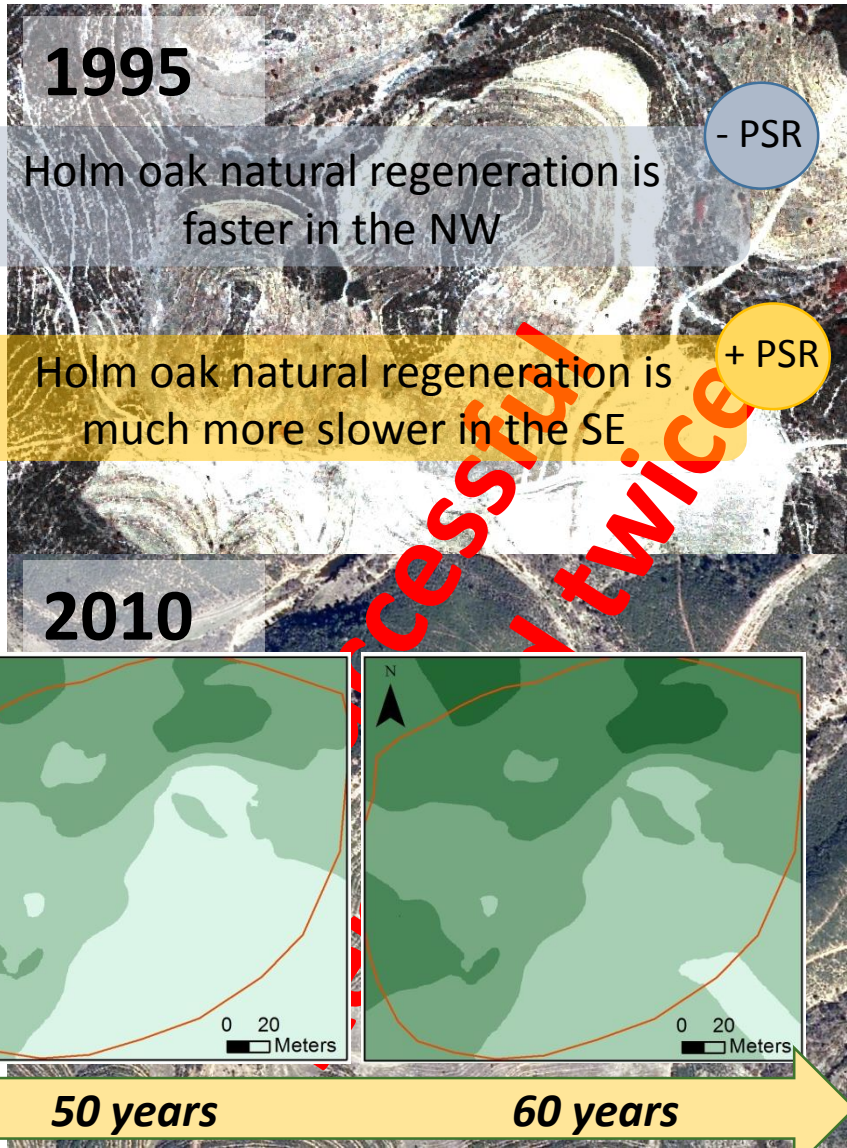
Reforestation efforts since agriculture abandonment in the 50`s-60´s

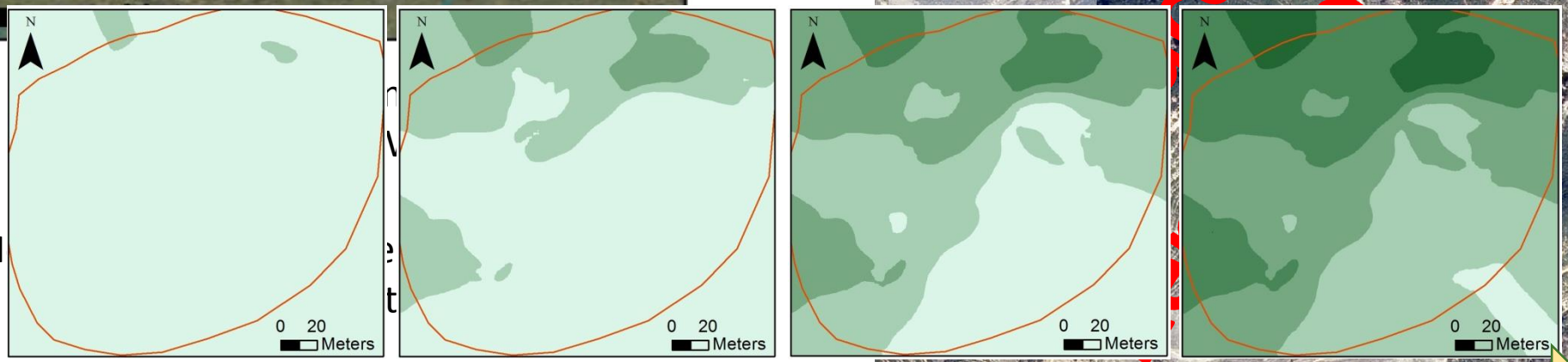


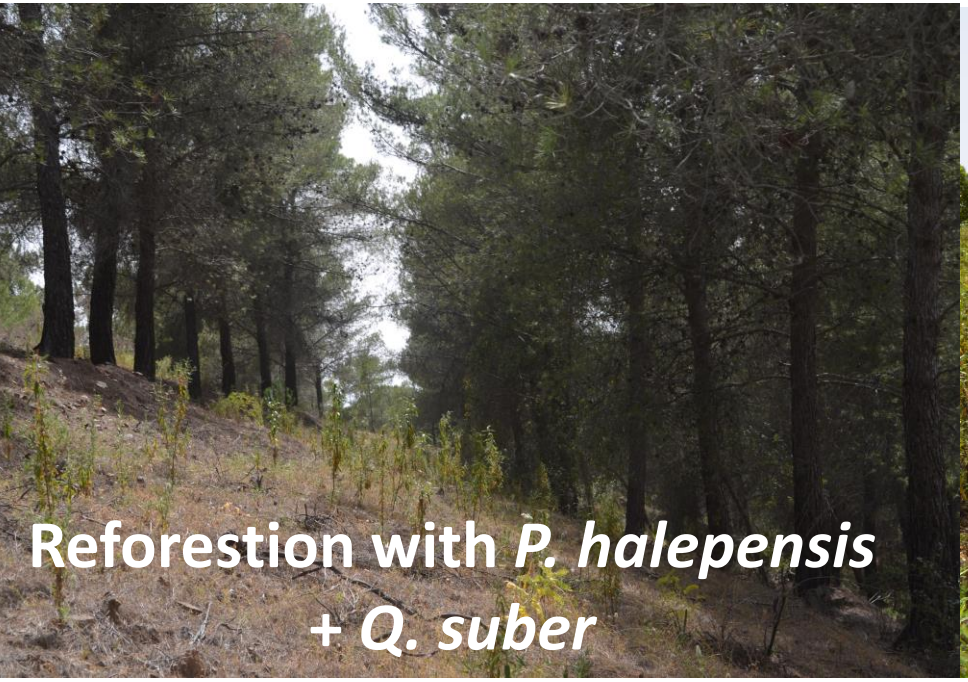
Validating the Model

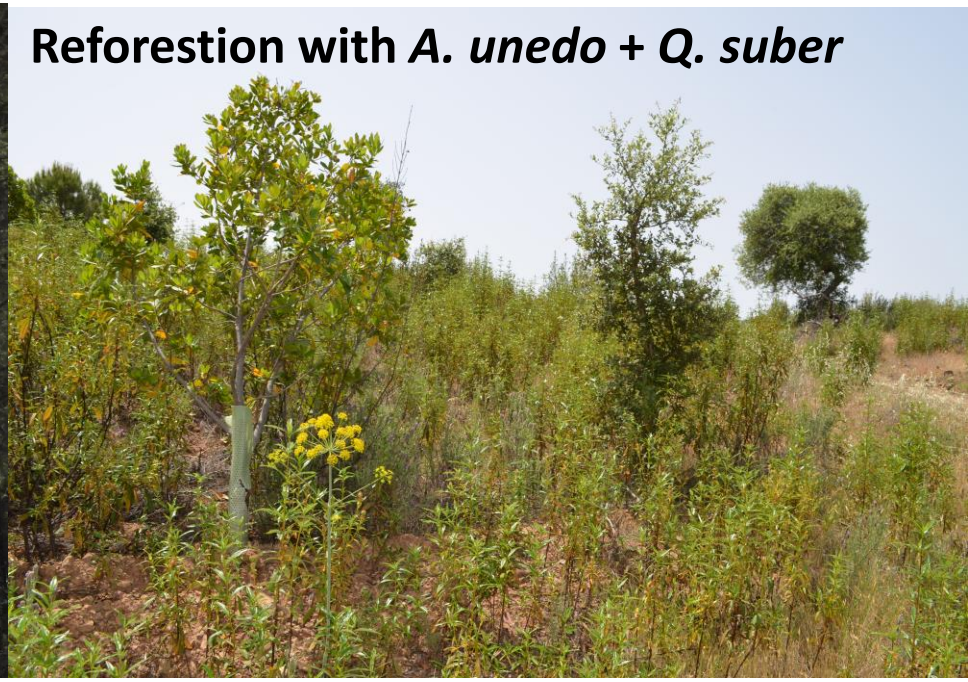
The cost of this mistake was 28000€x2

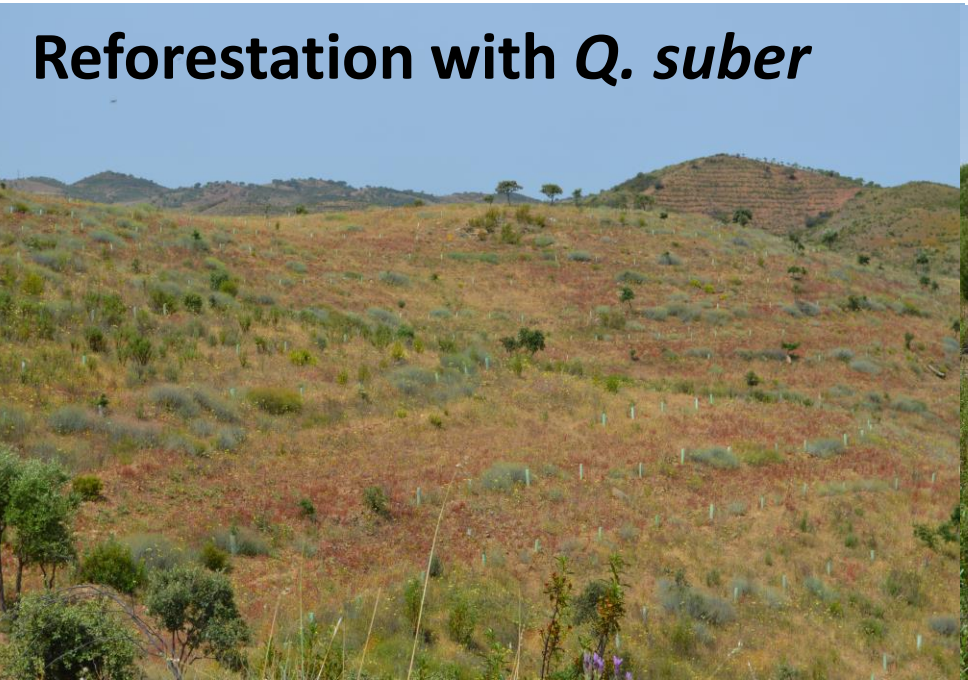


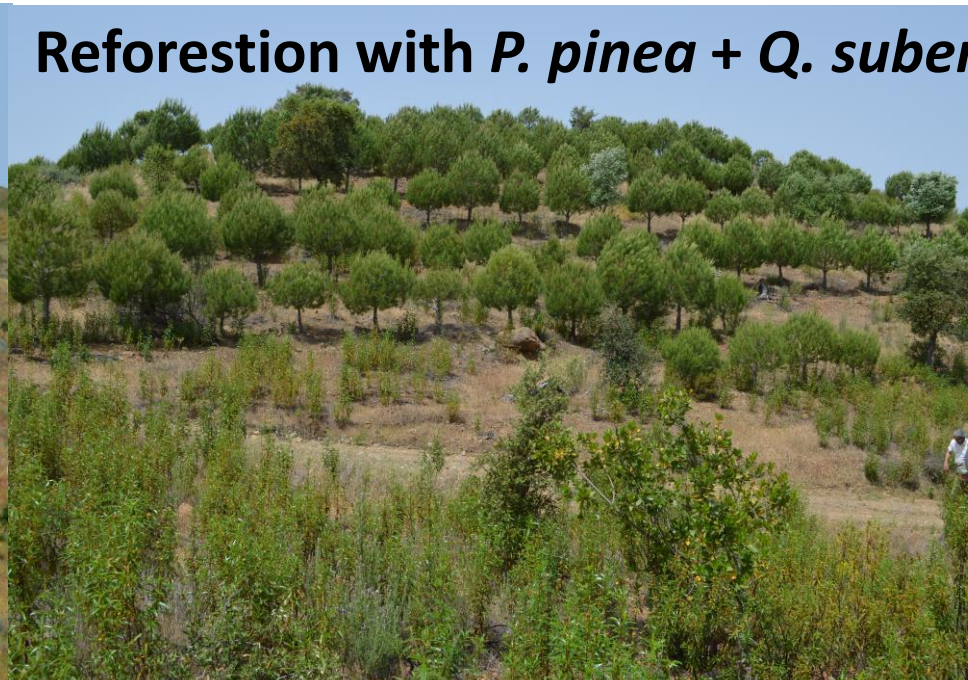





Reforestion with *P. halepensis*
+ *Q. suber*

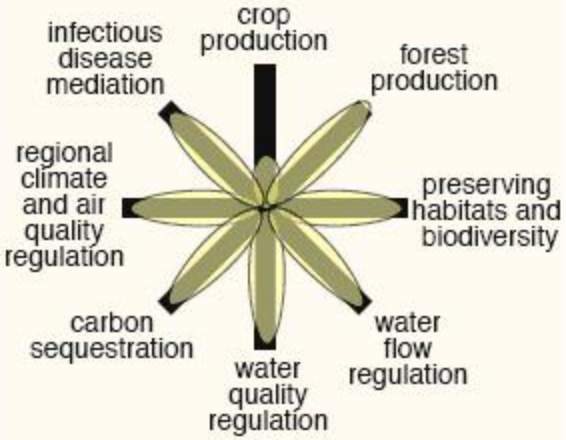

Reforestion with *A. unedo* + *Q. suber*


Reforestation with *Q. suber*

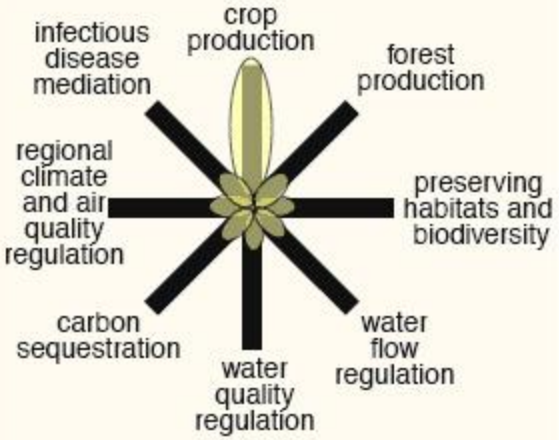

Reforestion with *P. pinea* + *Q. suber*

Ecosystem services

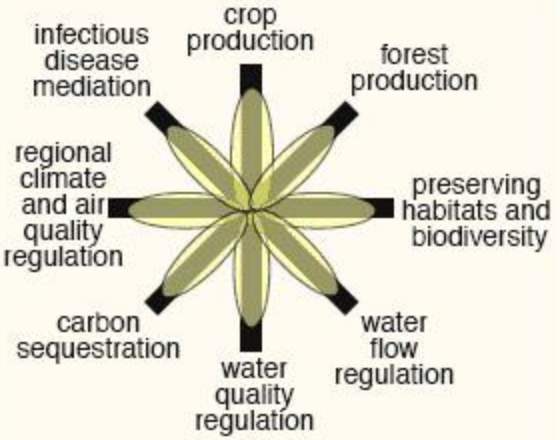
Ecosystem Services Evaluation
Reforested sites



natural ecosystem



intensive cropland



cropland with restored ecosystem services

Reflorestation sucess indicators

Type	Restoration success indicator	Method
Diversity	Woody plant species (species number and cover)	Field sampling
	Herbaceous plant species	Seed bank collection to germinate in greenhouse; field sampling in Spring?
	Lichen	Field sampling
	Other organisms under consideration	
Structural	Total plant cover	Field sampling
	Woody plant density, dimensions (height, DAP), biomass	Field sampling
	Total biomass and separated by perennial/annual components	Remote sensing (NDVI) and groundtruthing with sample collection in the field (g/m2)
	Rabbit latrines	Field sampling
Functional	Plant func diversity	Plant field sampling and database values
	Soil quality (physical, chemical and biological)	soil sampling for SOM, C, fungal biomass, decomposition potential; soil depth; indicators for infiltration rate and erosion
Economic and social (ES)	Economic income	Interview owners (pinion, cones, cork, wood, livestock, etc.)
	Social perception	Interviews
General characterization	Nearer water source, etc.	remote sensing

Combining: Reference + Ecosystem functioning + Ecosystem services provision

WP4 – Best practices for water and soil conservation in the semiarid: improving sustainability and resilience

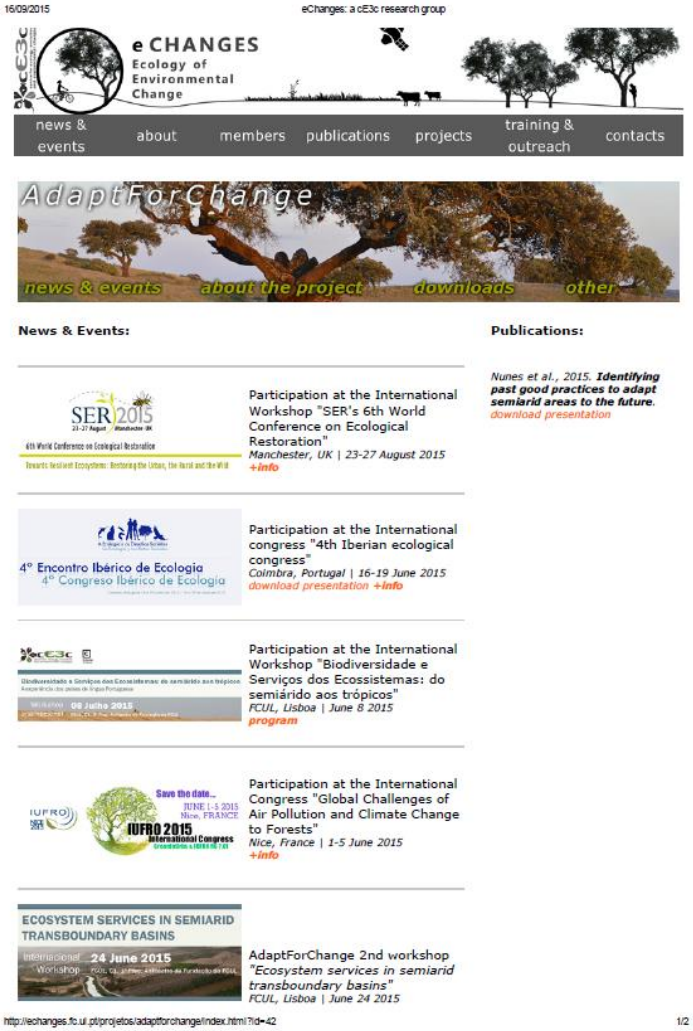
We will make a collection of the most sustainable and efficient methods of soil and water conservation in the semiarid. We will demonstrate these methods in the homesteaders of Monte do Vento and Vale Formoso, where for the past years many of these techniques are being implemented successfully.

FCSH UNL

Erosion plot with oaks plantation - Herdade Vale Formoso - Municipality of Mértola

WP 6-management, integration and dissemination

http://echanges.fc.ul.pt/projetos/adaptforchange



C.1 Produtos do Projeto
Deliverable products of the Project

Nome do produto *Name of the Deliverable* (max. 50 caracteres)	
1.	Base de dados SIG modelo WP1
2.	E-book manual de actividades alternativas wp2
3.	Base de dados reflorestações WP3
4.	E-book boas práticas de solo e água wp4
5.	Criação de um site de internet WP6
6.	E-book boas práticas de reflorestação wp3
7.	Relatórios dos dois workshops WP5
8.	Modelo de Regeneração websig WP1
9.	Artigos científicos WP1 e WP3
10.	Relatório do impacto das ações do projeto WP6
11.	Videos dos seminários inicial e final WP6

1-International conventions:
This project covers the 3 main United Nations (UN) conventions.

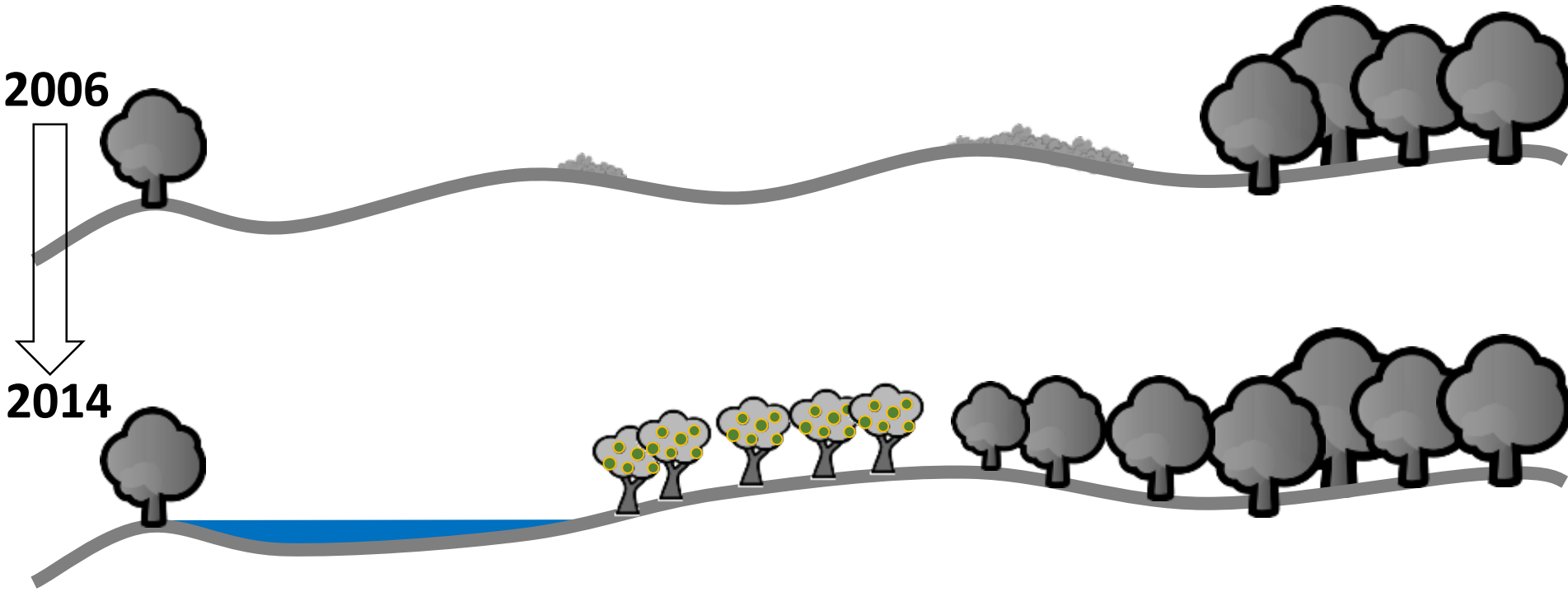
2-EEA Grants and European Union
These institutions promote adaptation at a local level with the involvement of many levels of stakeholders as a way to generate wealth and overcome the effects of climate change.

3-National and Regional Public Administration may benefit from this project through:
- APA, sequester and improving the quality of the soil
- ICNF
- The protected areas of the region, such as the Natural Guadiana Valley Park,
- The regional institutes of environment and agriculture

4-Public local administration.
5-Municipal technicians.
6-Forest owners and companies.
7-Scientific Community.

landcover in a local area

landcover change in a local area



landcover change in a local area

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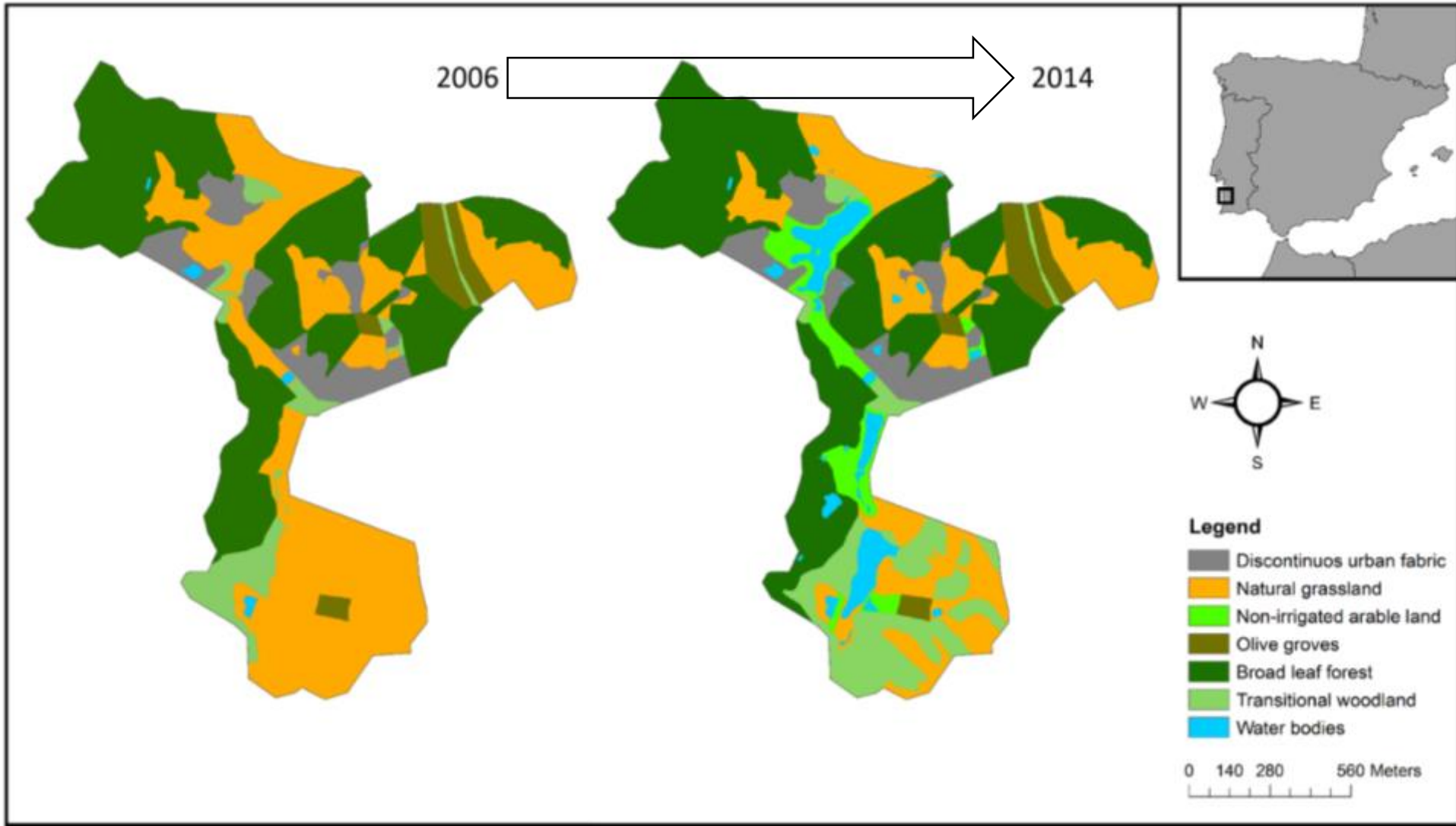
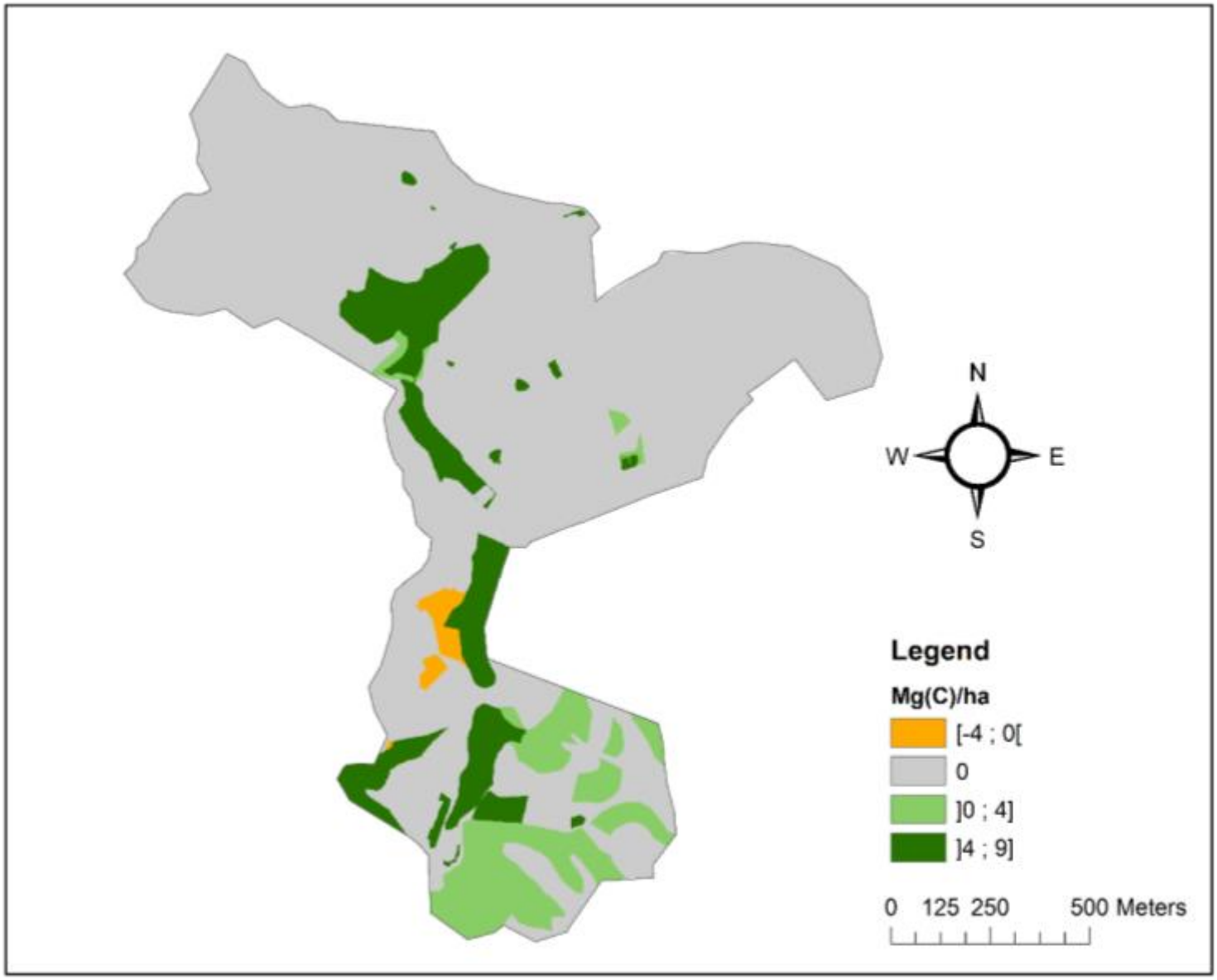
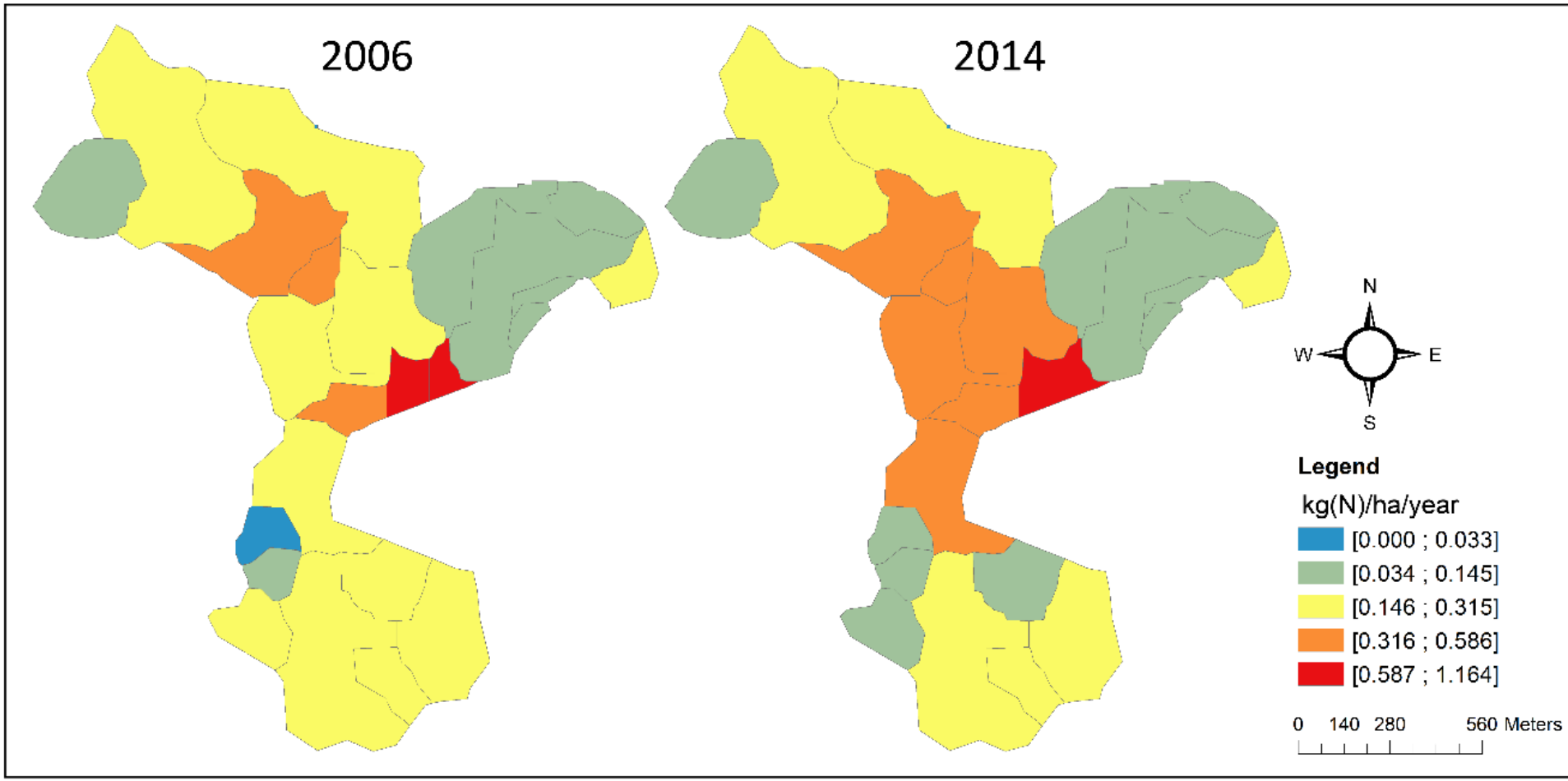


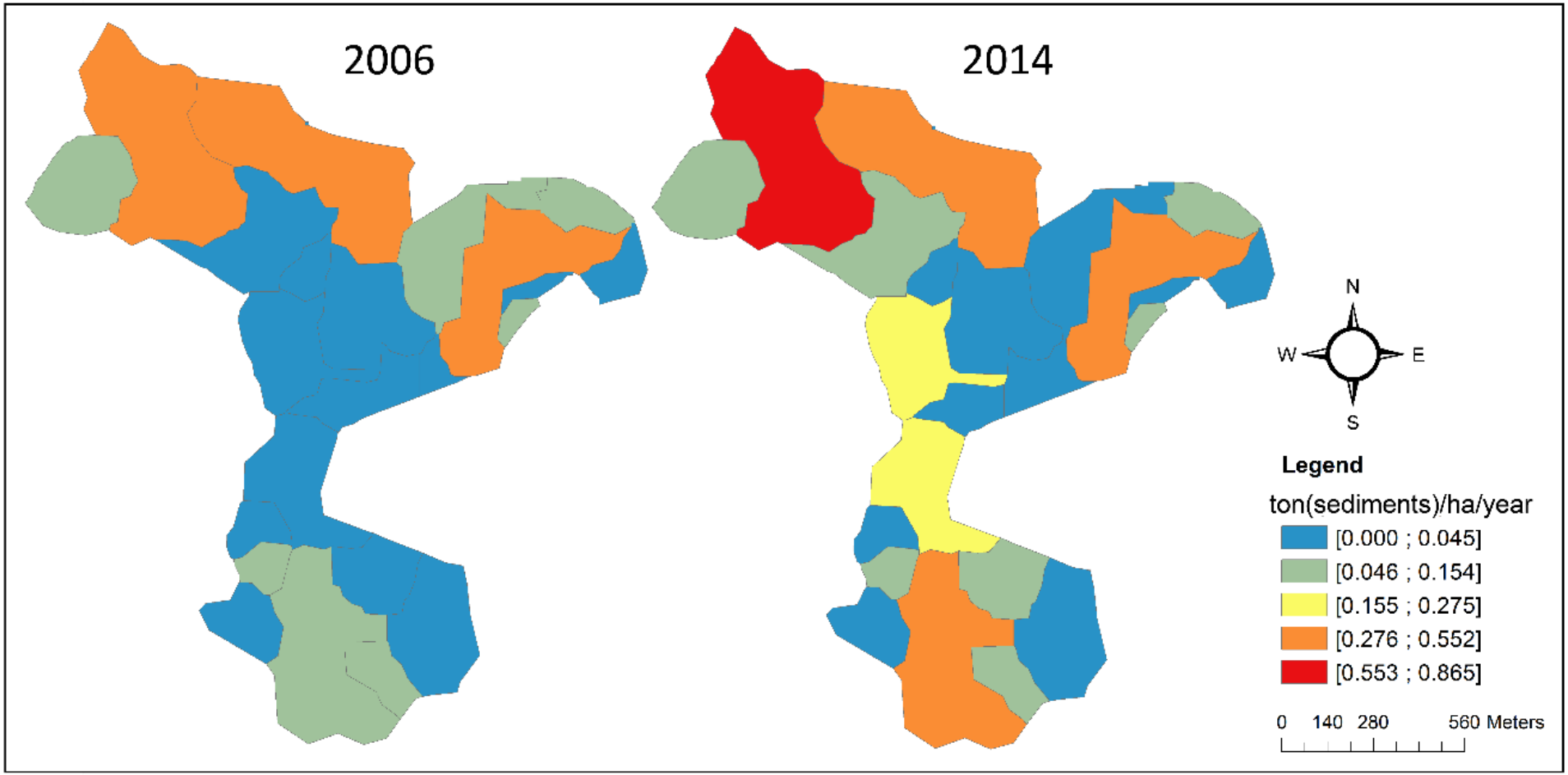
carbon storage change in a local area



nitrogen leaching change in a local area

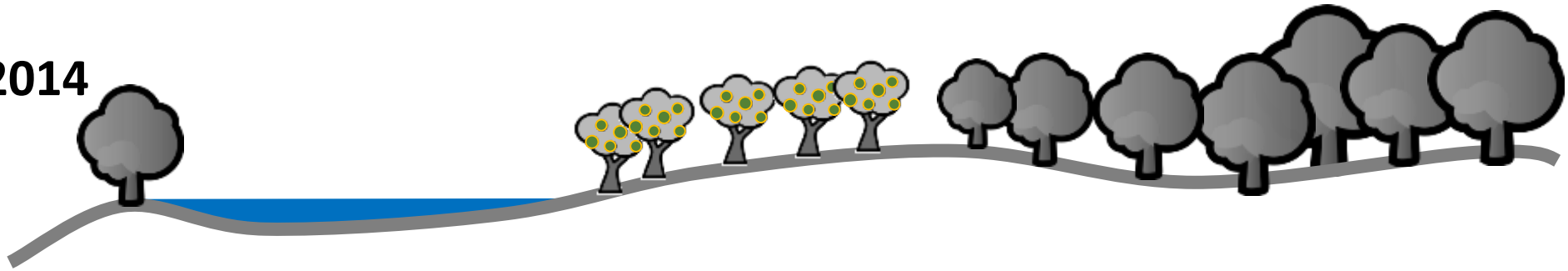


sediments discharge change in a local area



non-target ESs tradeoffs

2014



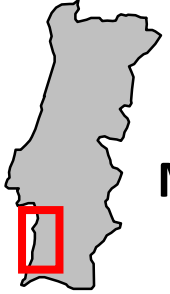
	carbon	water purification	sediment retention
year	*Carbon storage (Mg ha^{-1})*	*Nitrogen leaching (Kg ha^{-1} year^{-1})*	*sediments discharge (ton ha^{-1} year^{-1})*
2006	75.22	0.23	0.034
2014	82.27	0.23	0.080
Δ 2006-2004	**7.05**	**0.001**	**0.046**
	+9.4%	**+0.4%**	**+135.3%**

Trinta anos de biomonitorização ambiental no Alentejo Litoral: o que aprendemos

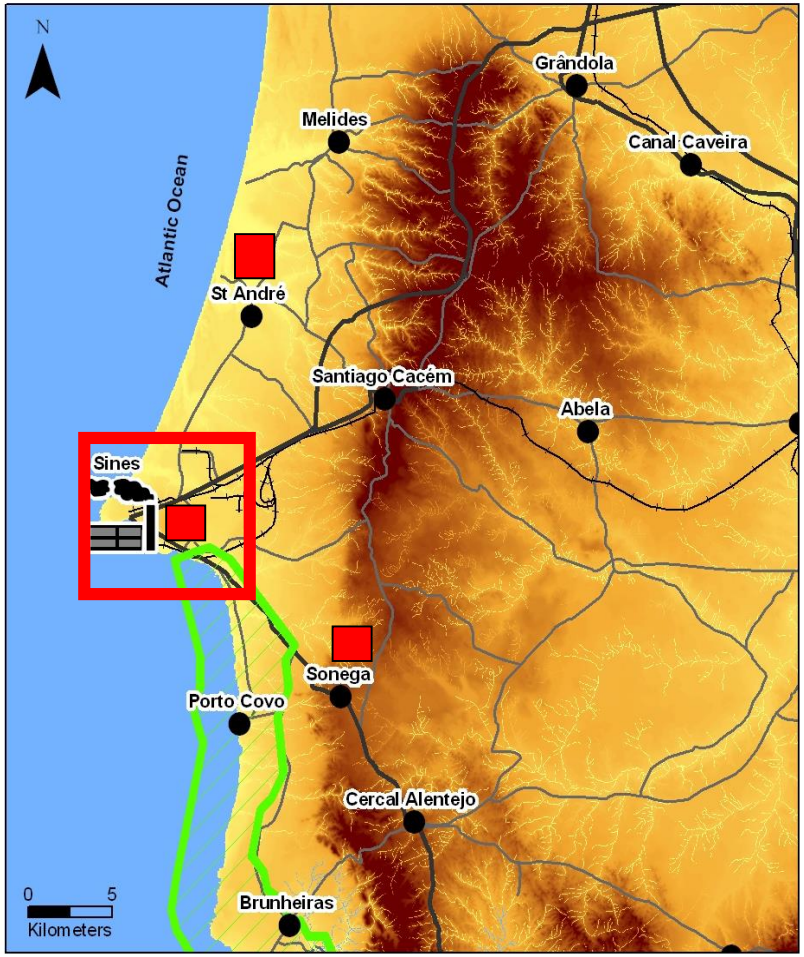
Cristina Branquinho,

Universidade de Lisboa, Faculdade de Ciências, cE3c

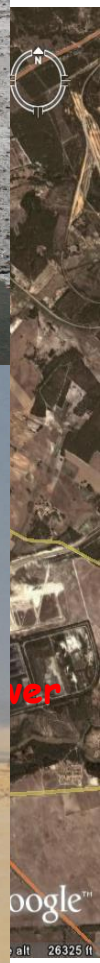
cmbranquinho@fc.ul.pt

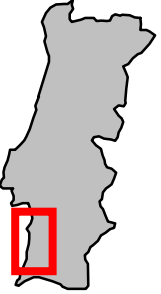


MULTIPLOS Usos do solo



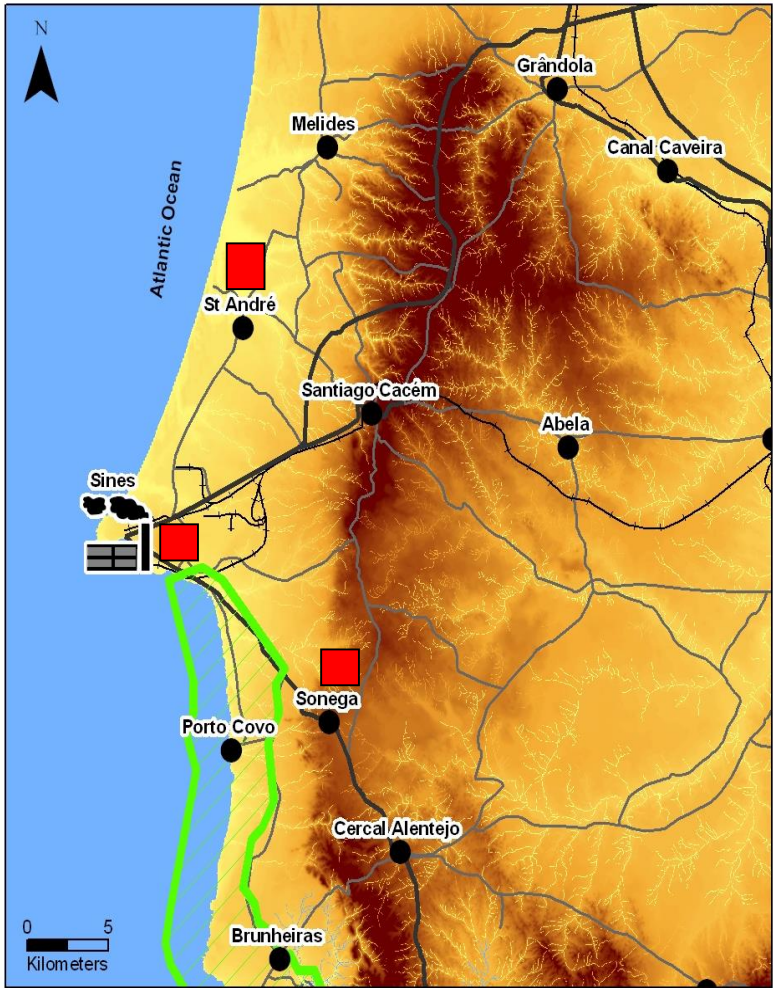
ais

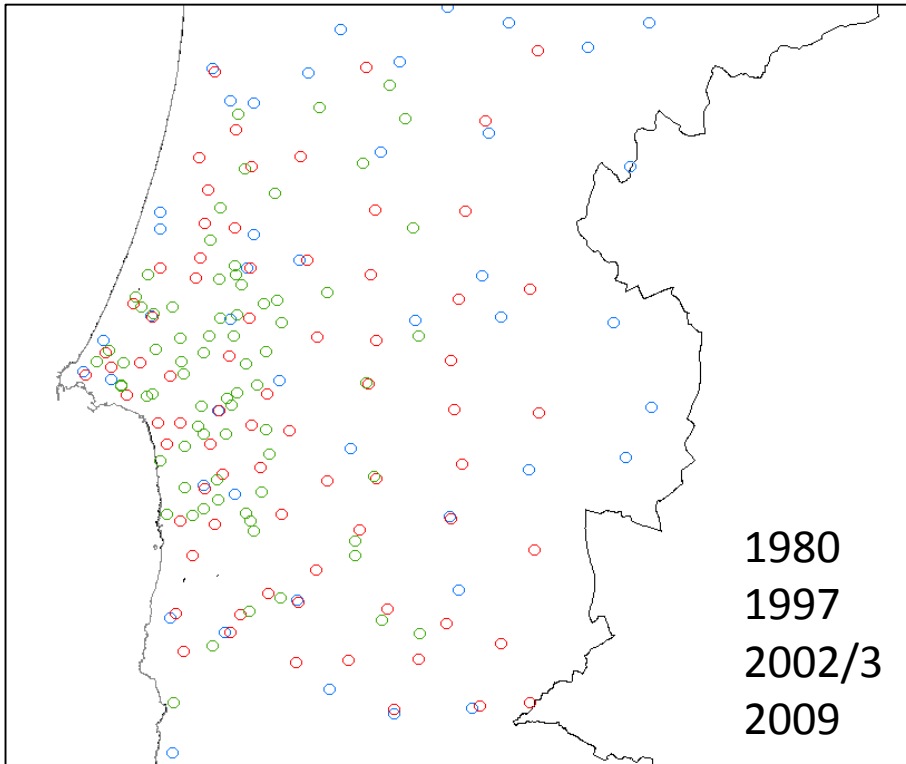




Lichen Diversity Sampling along time

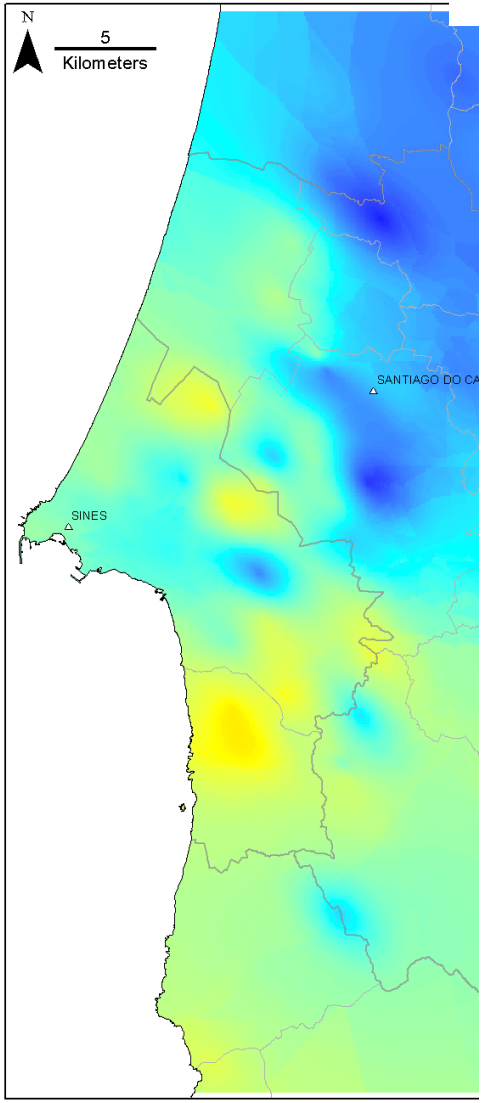
The sampling method was not the same;
but we could look to total number of lichen species present



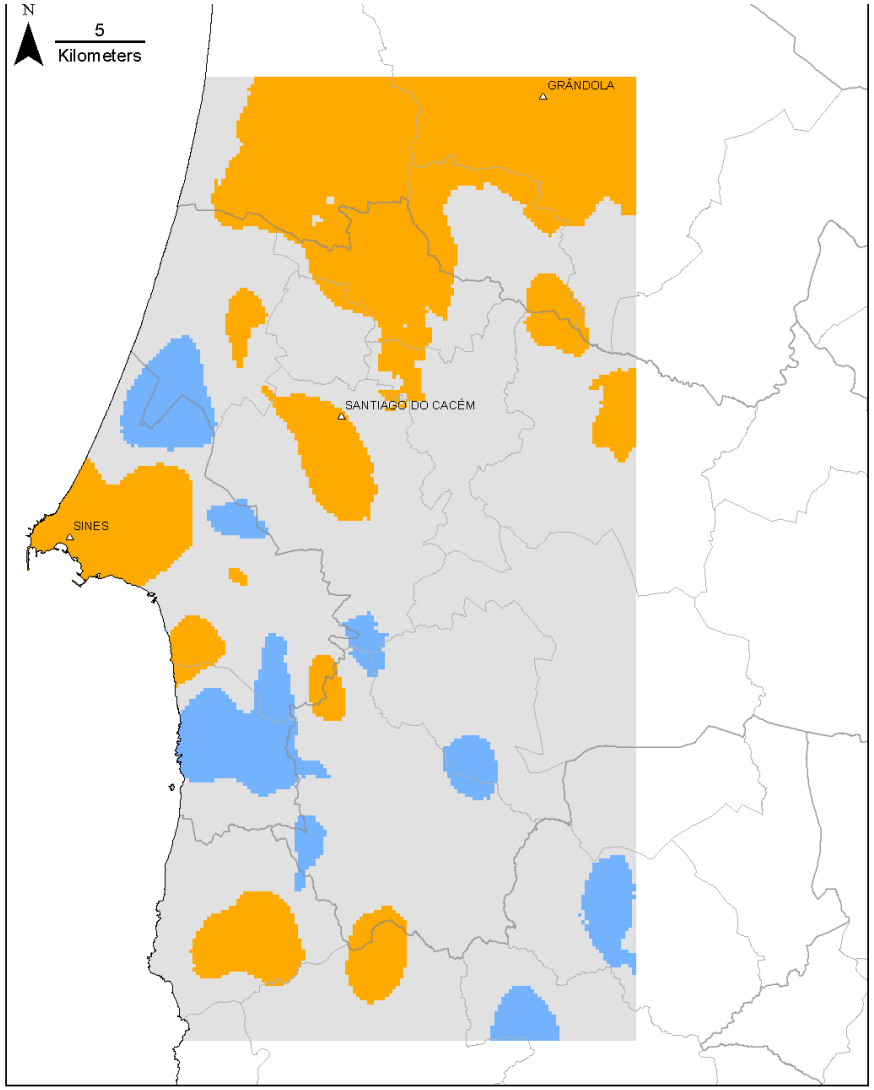


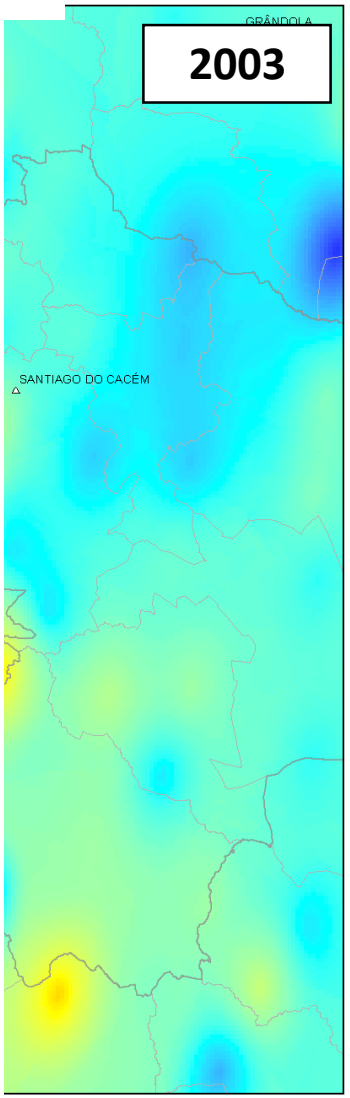
1980
1997
2002/3
2009

Difference in the Nº of Lichen Species 1980-2003



Jon

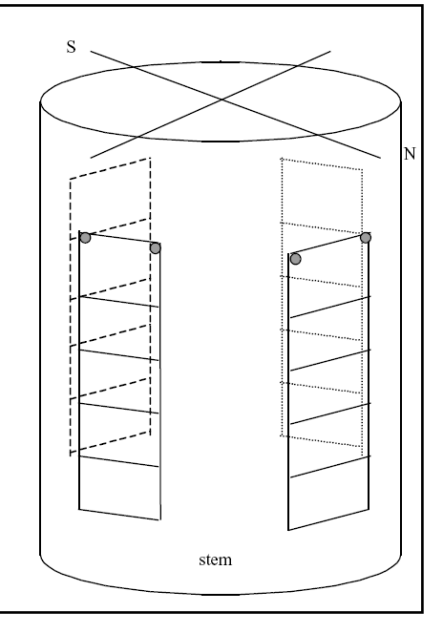


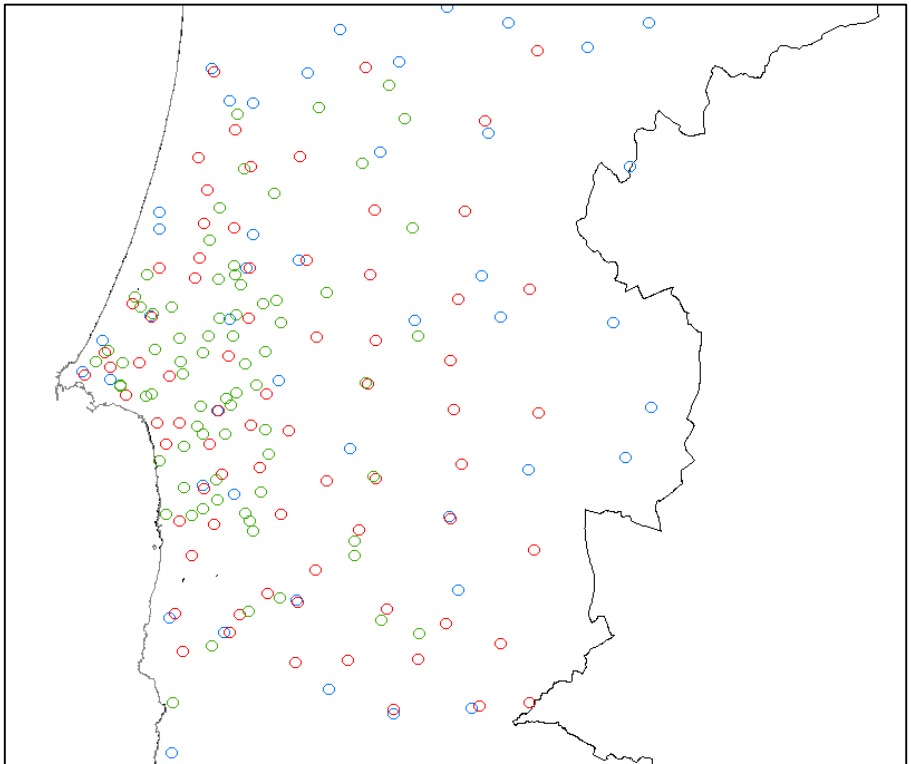


Pinho et al., 2004

METHODS

Lichen diversity

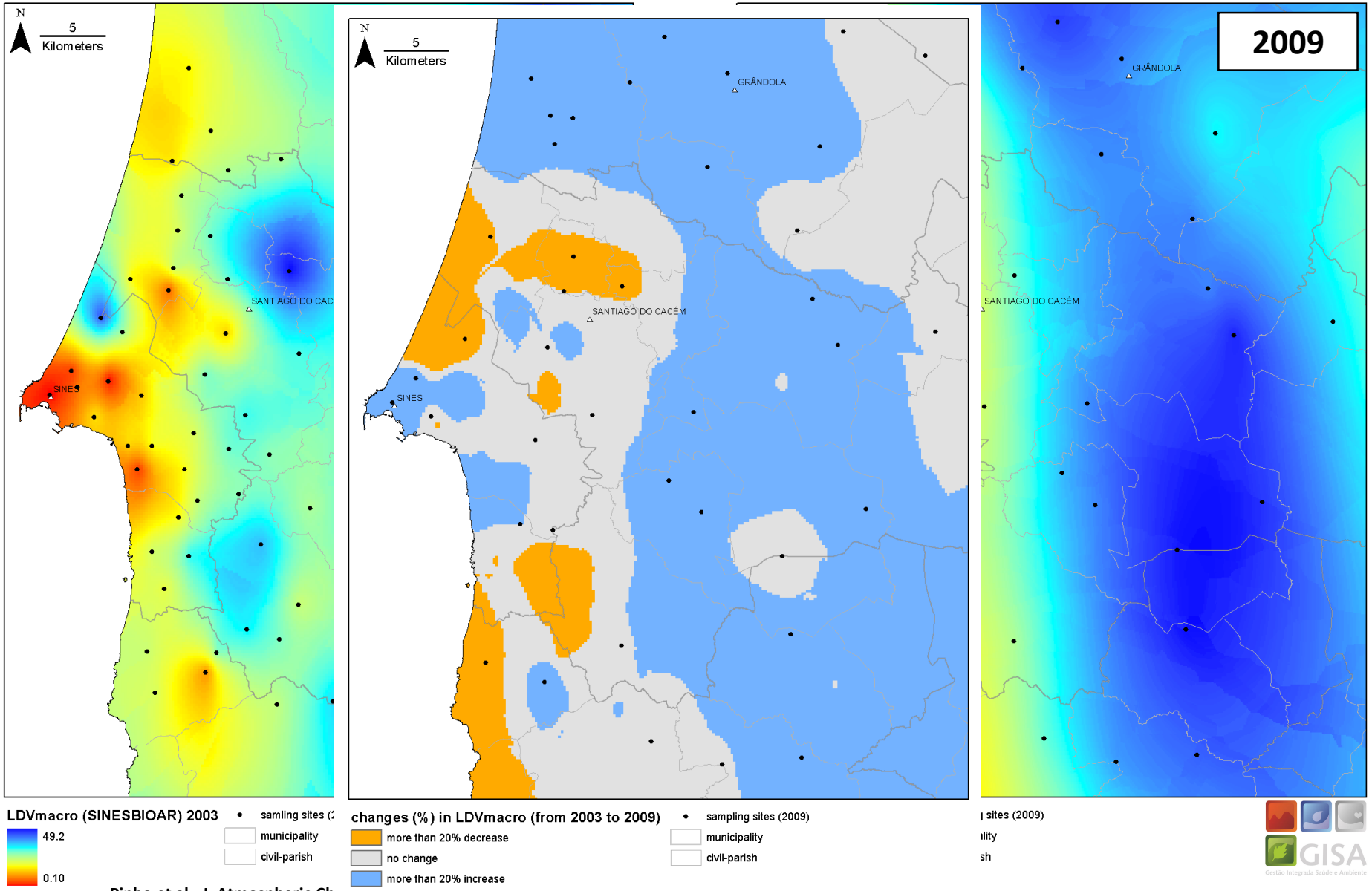




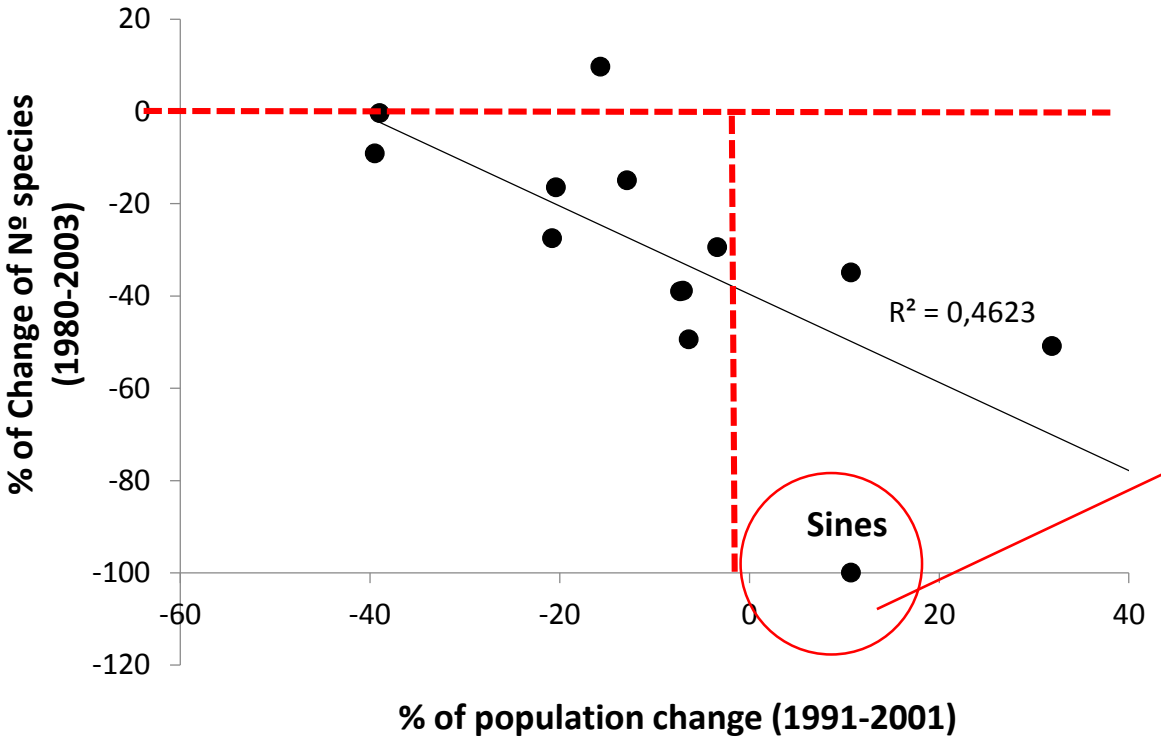
Lichen diversity accordingly to Asta et al. (2002) and Scheidegger et al. (2002)

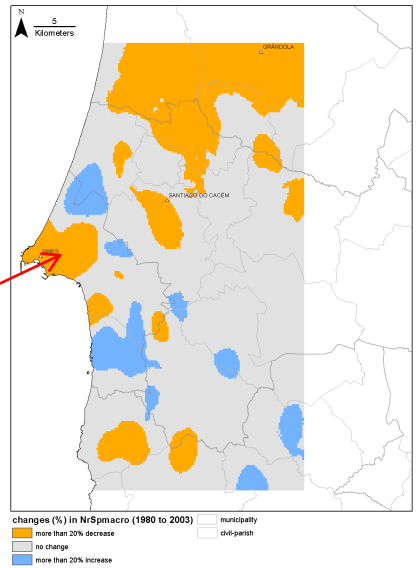
Calculated LDV (species number and frequency)

LDV differences 2003-2009



Does the changes in population explains the changes in LDV?

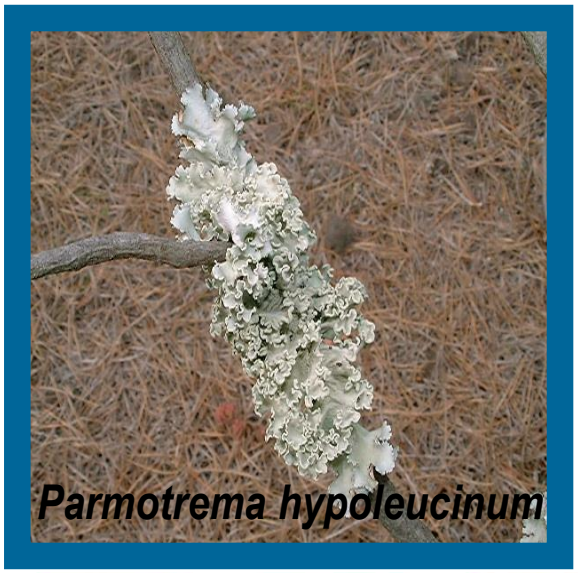


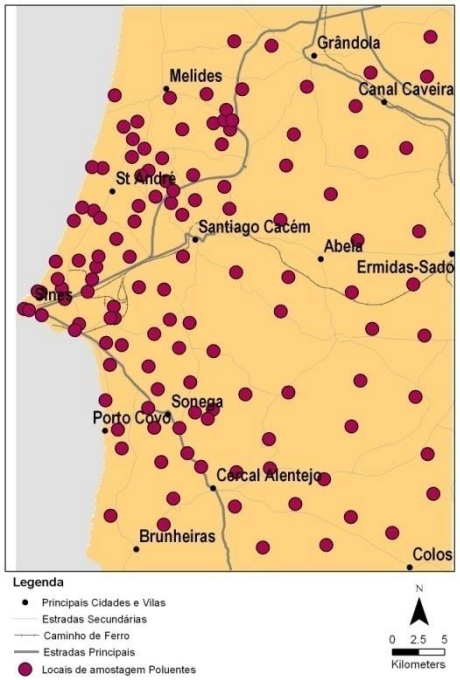


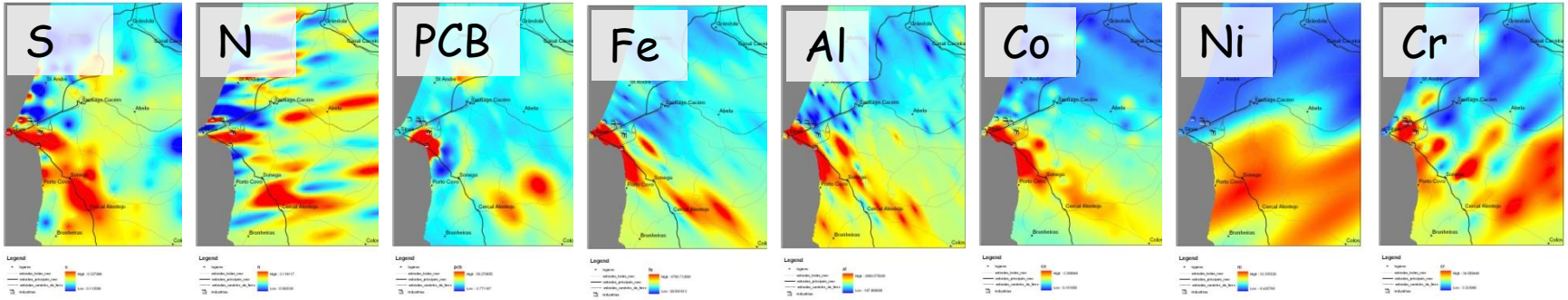
Energy consumption in Industry

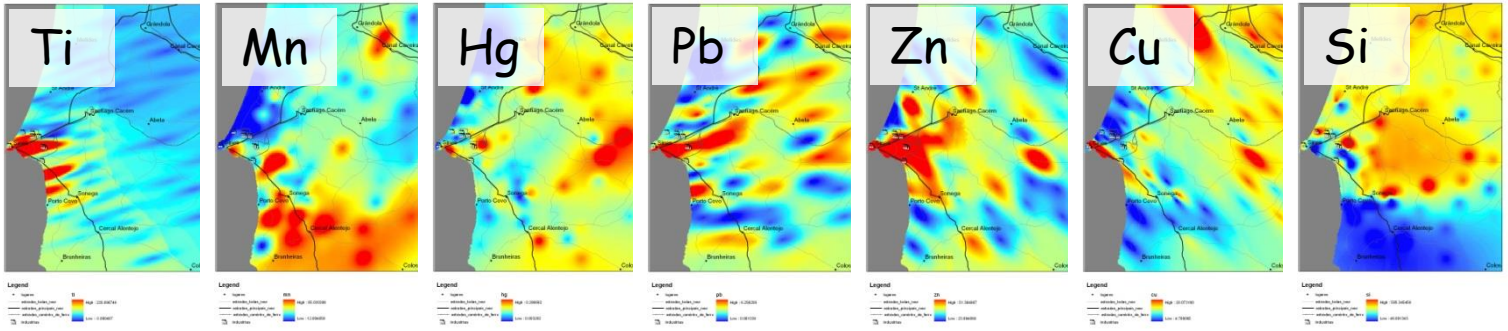
Geographic Location	2004
	kWh/ consumer
Alcácer do Sal	40227,50
Grândola	18032,70
Odemira	9557,60
Santiago do Cacém	28343,90
Sines	3029830,60

Lichen Pollutants



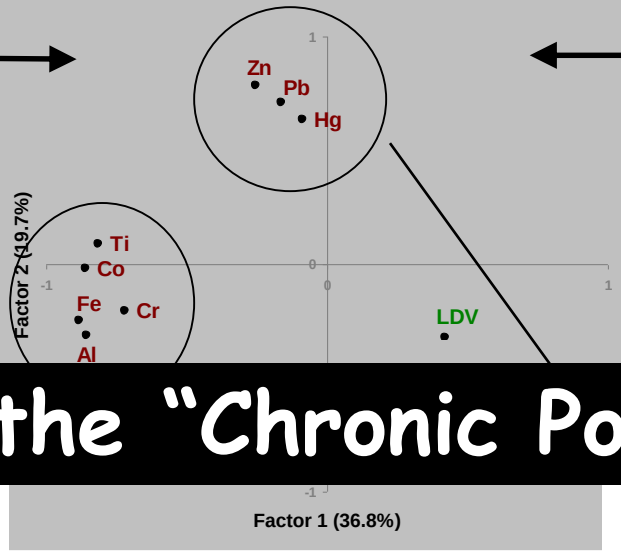




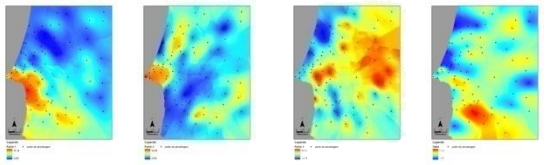


Data from the model of lichen diversity in the region

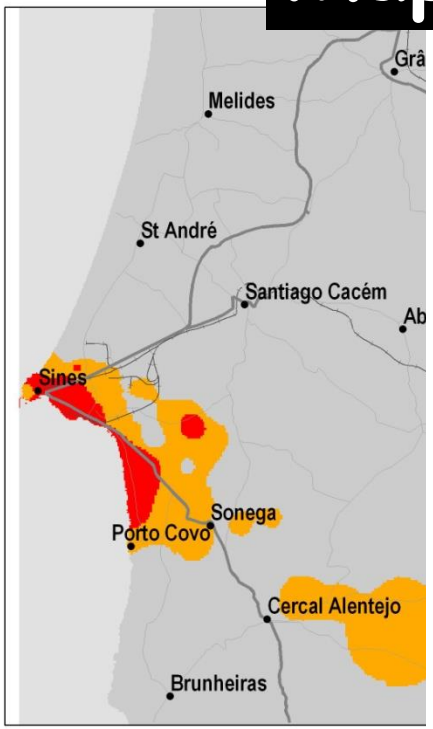
Factor 1 e 2 da ACP



Data from the model of all pollutants in the region



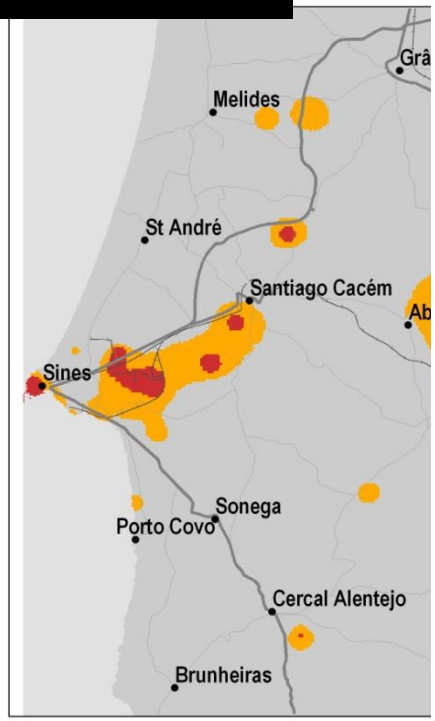
Map of the "Chronic Pollution"



Legenda
- Principais Cidades e Vilas
- Estradas Secundárias
- Caminho de Ferro
- Estradas Principais

Factor 1 (biodiversidade & poluentes)
- muito degradado
- degradado
- não degradado

N
0 2.5 5
Kilometers



Legenda
- Principais Cidades e Vilas
- Estradas Secundárias
- Caminho de Ferro
- Estradas Principais

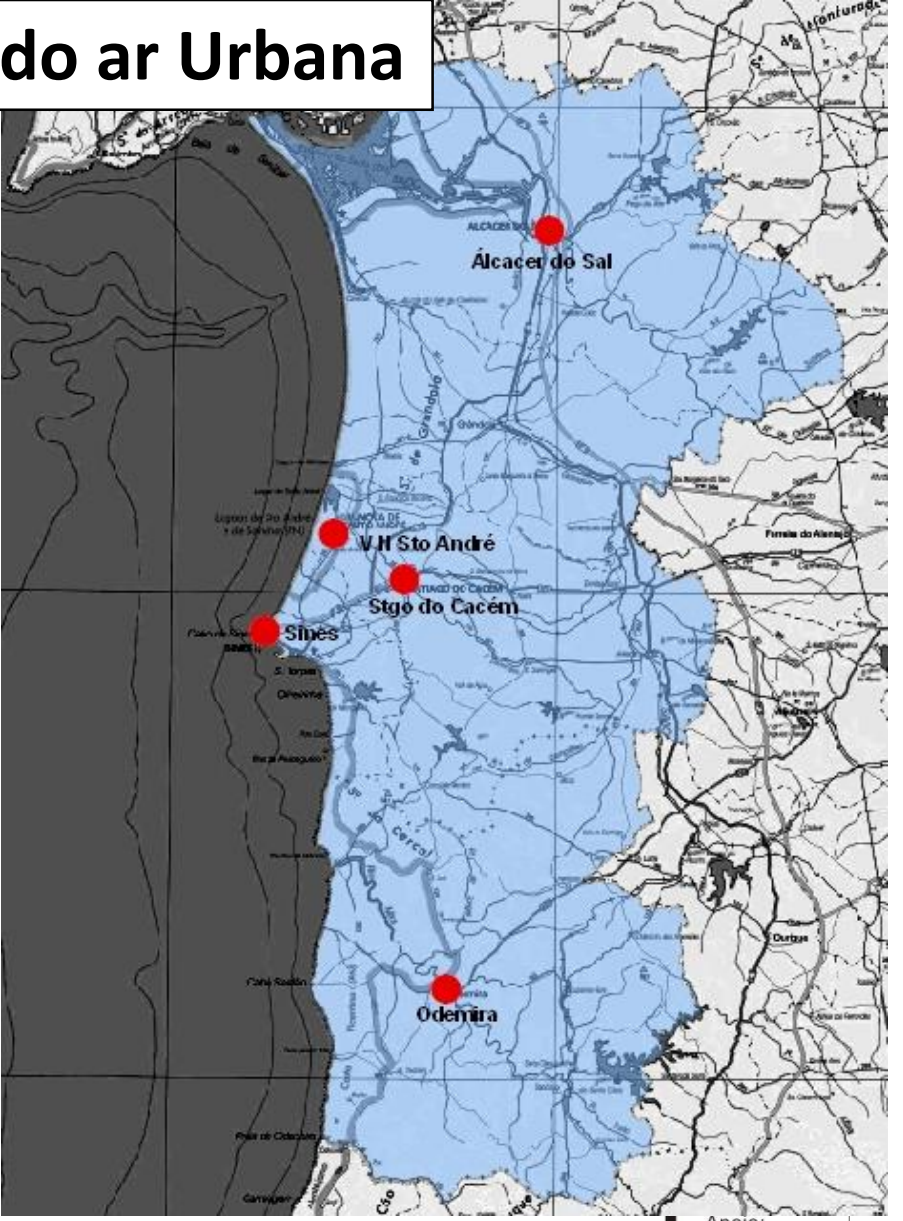
Factor 2 (biodiversidade & poluentes)
- não degradado
- degradado
- muito degradado

N
0 2.5 5
Kilometers

Qualidade do ar Urbana

GISA

Gestão Integrada Saúde e Ambiente



Dez 2007 a Dez 2011

5 municípios
Saúde: ARSLVT
Ambiente: CCDR-A
FCUL; IST; ISCTE
Ricardo Jorge
12 empresas

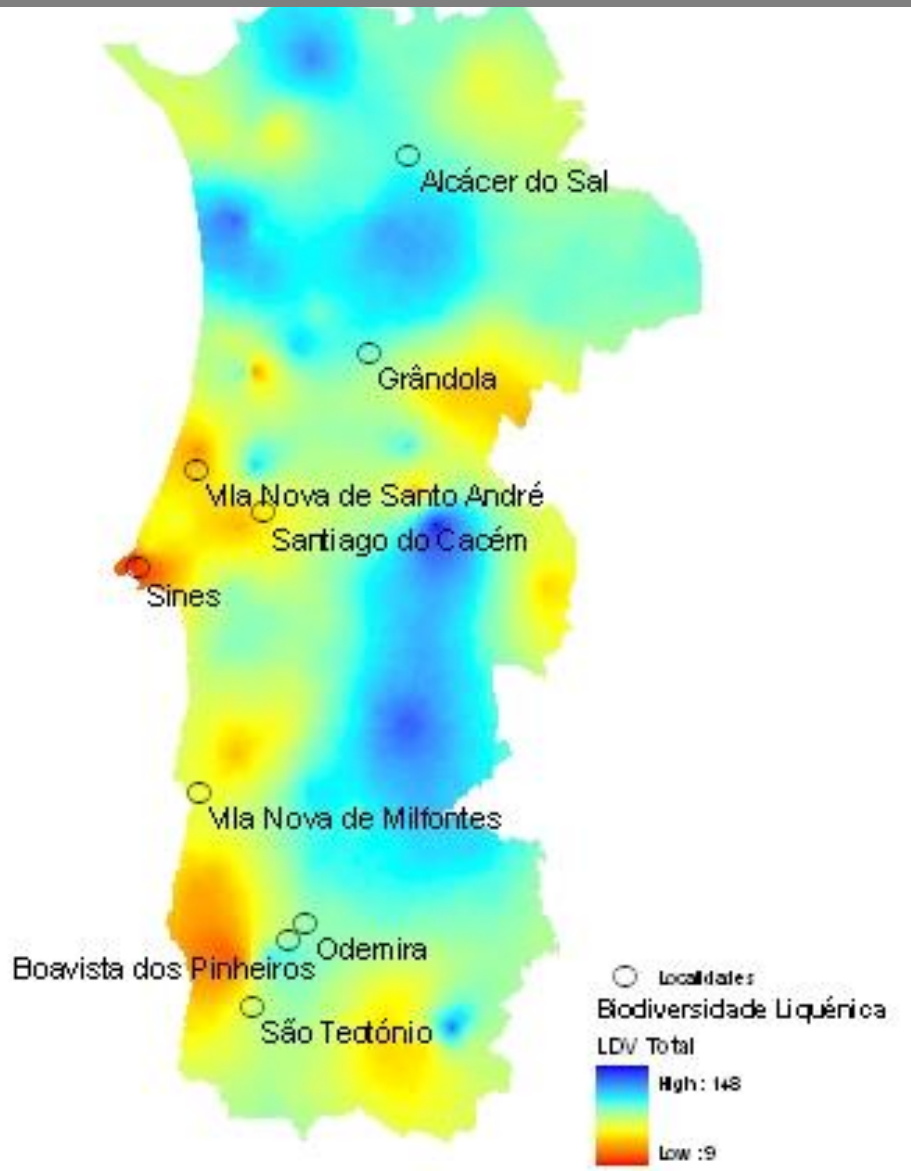
Organização:

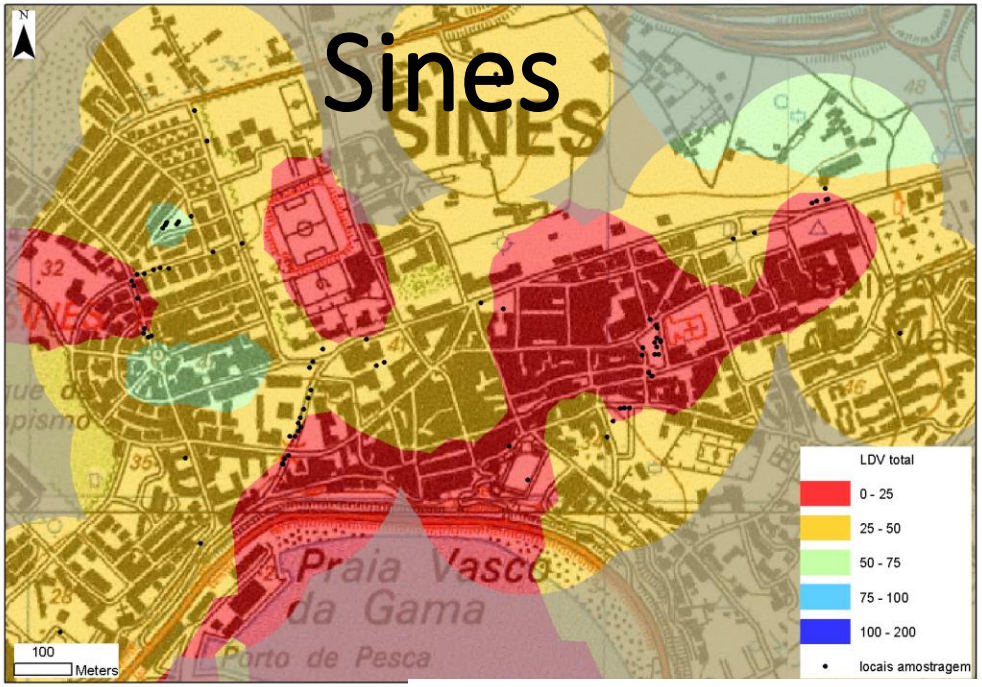
Câmara Municipal de Sines

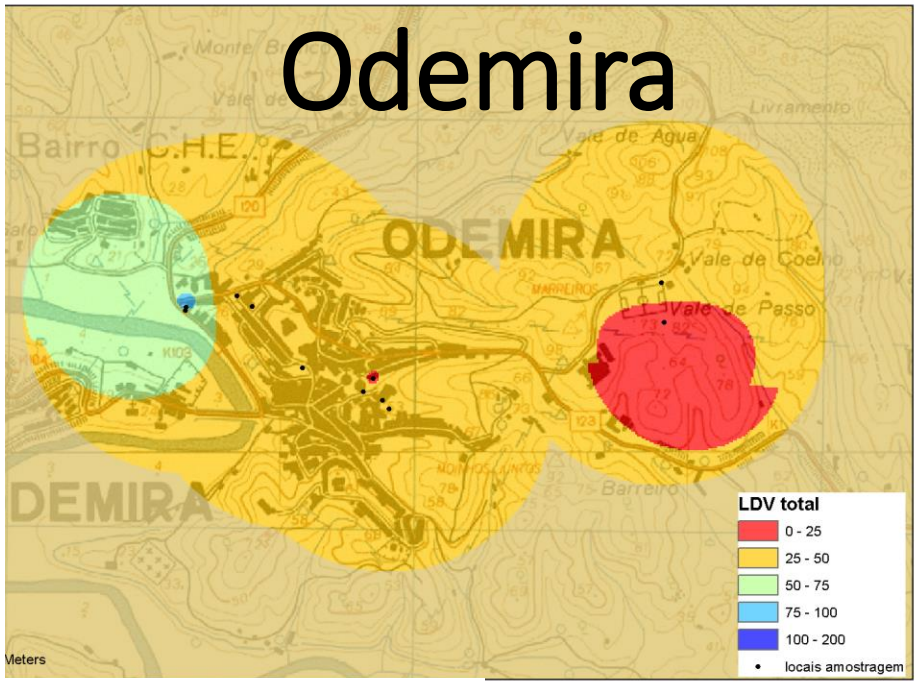
Parceiros:

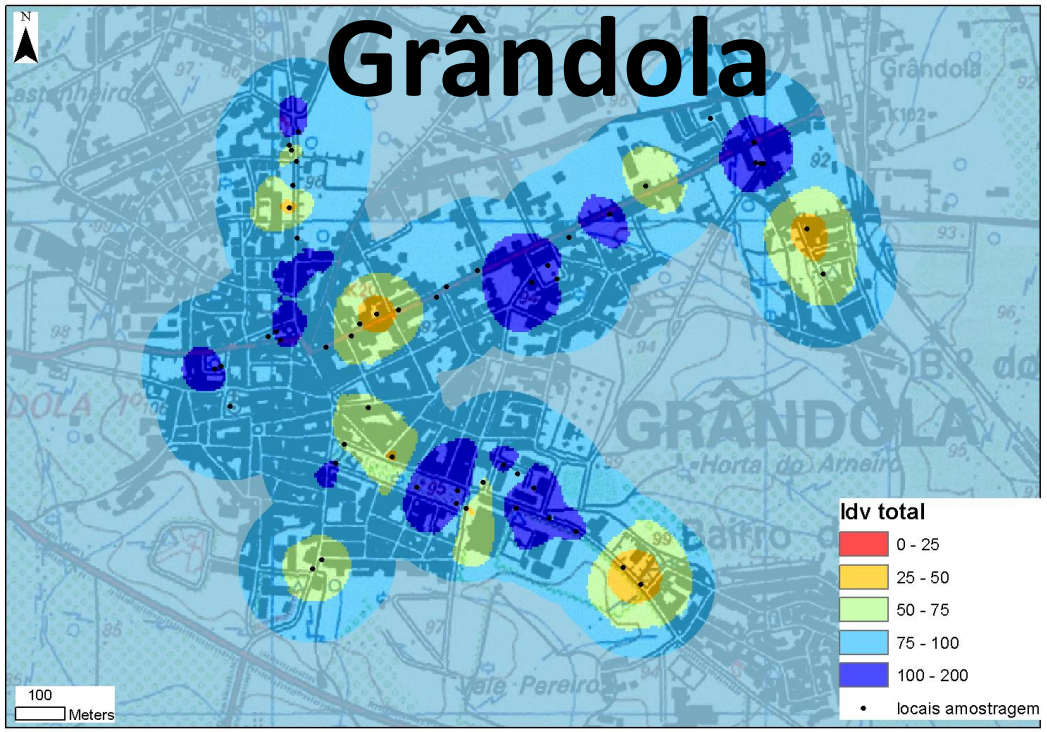
Apoio:

Líquenes e como indicadores da qualidade do ar: o caso de estudo do Alentejo Litoral




Sines
SINES
Praia Vasco da Gama
Porto de Pesca
LDV total
0 - 25
25 - 50
50 - 75
75 - 100
100 - 200
locais amostragem
100
Meters


Odemira
ODEMIRA
Bairro C.H.E.
Vale de Água
Vale de Coelho
Vale de Passo
LDV total
0 - 25
25 - 50
50 - 75
75 - 100
100 - 200
locais amostragem
Meters


Grândola
GRÂNDOLA
Horta do Arneiro
Vale Pereiro
ldv total
0 - 25
25 - 50
50 - 75
75 - 100
100 - 200
locais amostragem
100
Meters

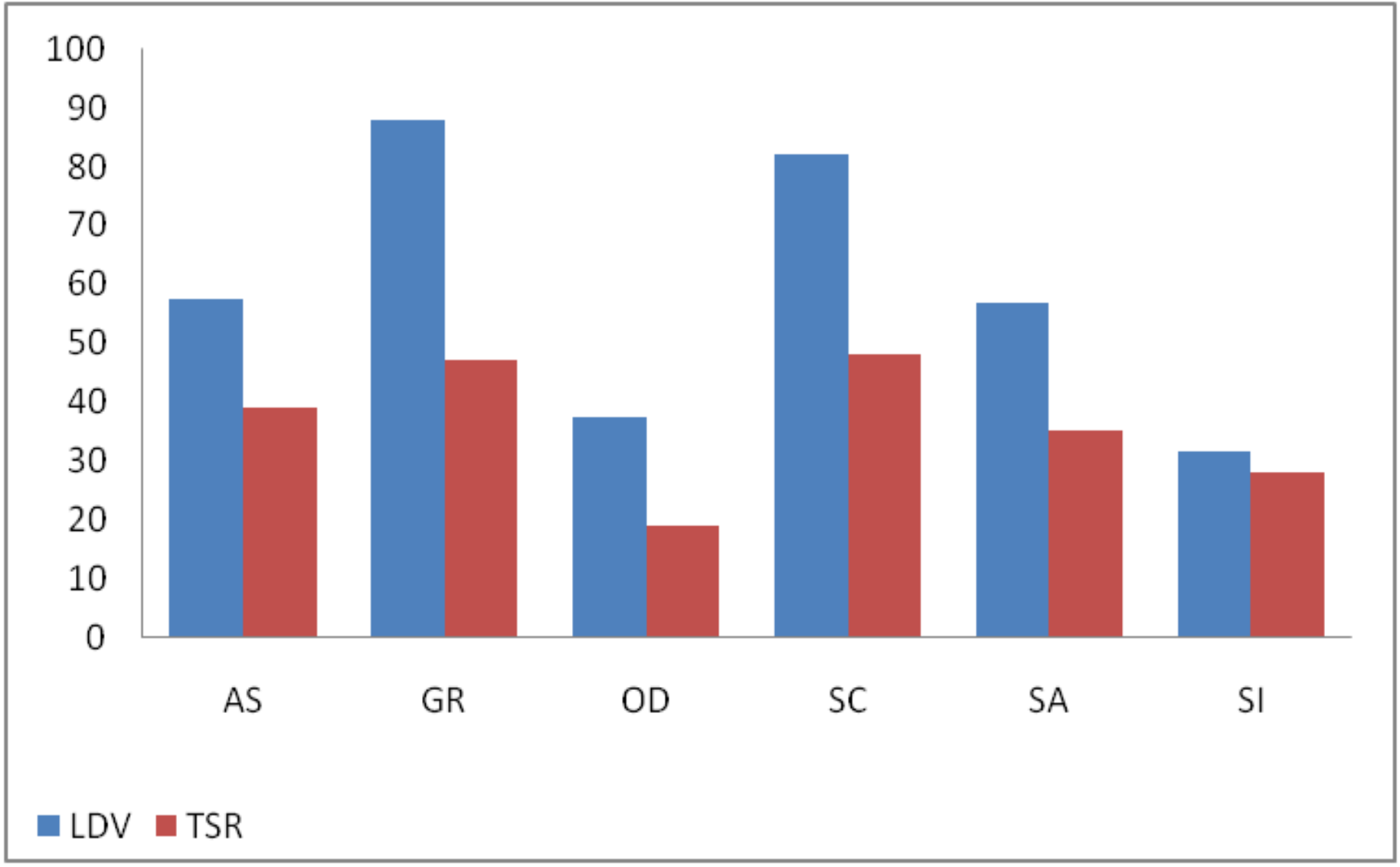


Figure 1. Values of LDV and species richness (TSR) for the sampled towns. AS: Alcácer do Sal, GR: Grândola, OD: Odemira, SC: Santiago do Cacém, SA: Santo André, SI: Sines.

Líquenes e como indicadores da qualidade do ar: o caso de estudo das zonas urbanas do Alentejo Litoral

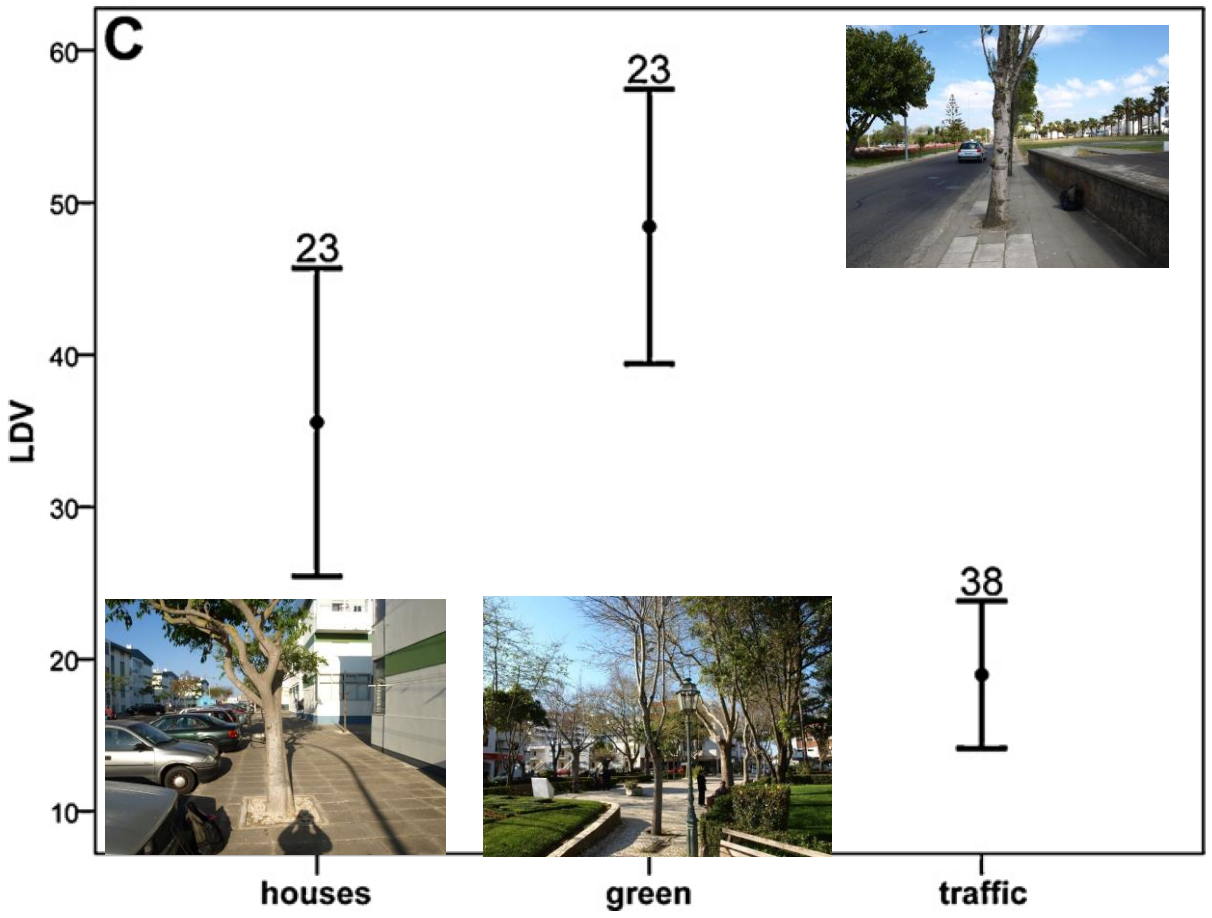


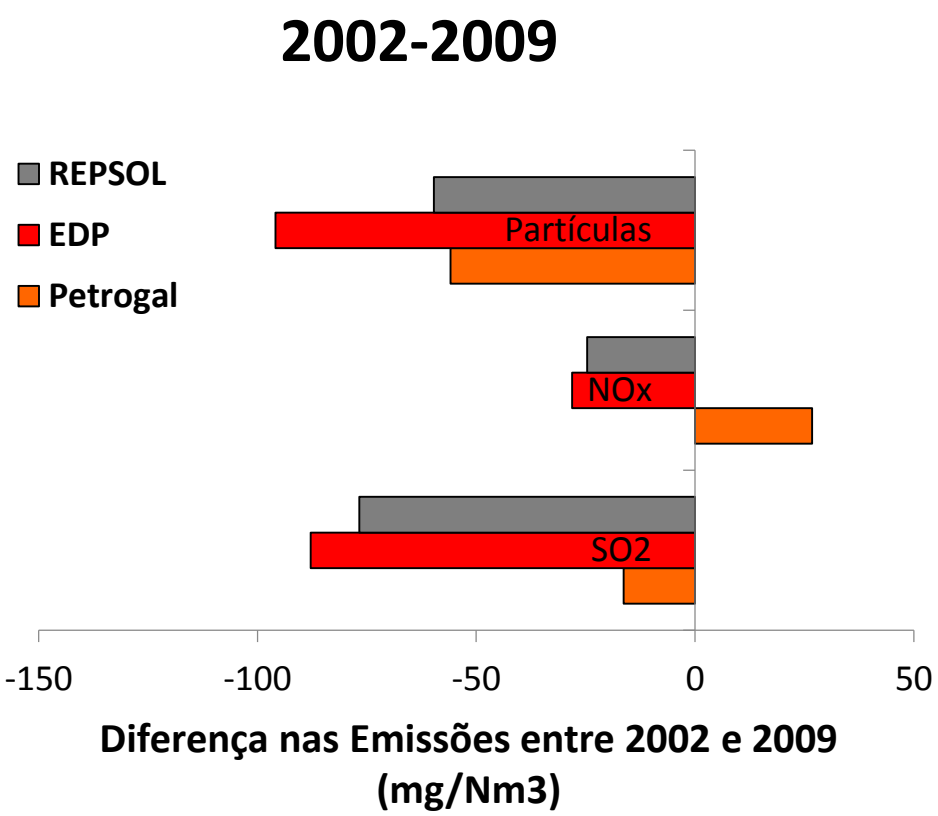
Fig. 2. Range plots for pH (A), separated by bark of trees (B) and LDV (C) for the considered land uses. The bars represent the 95% confidence interval. The number on top of bar indicates the amount of trees included in each plot.

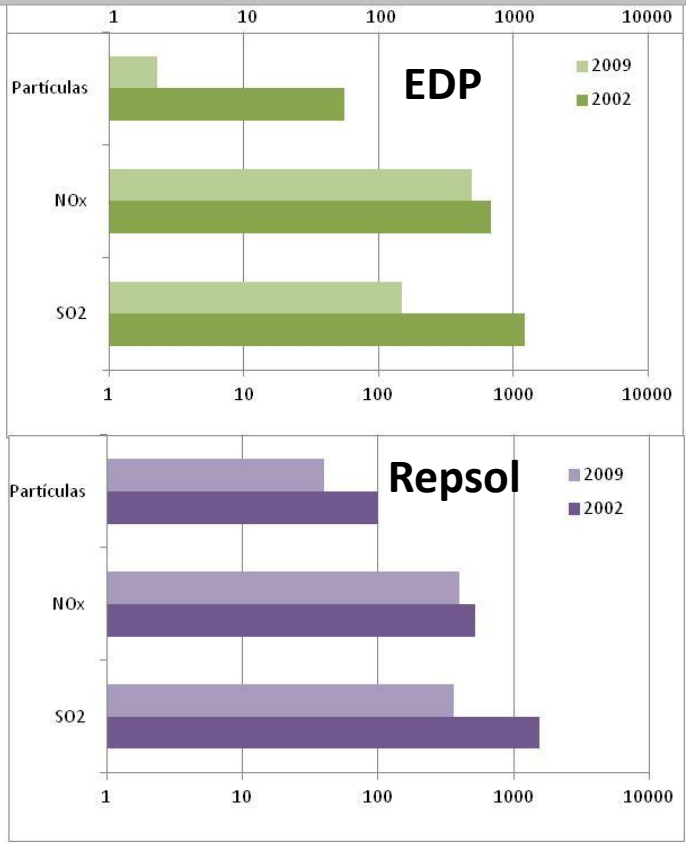
Llop E, Pinho P, Matos P, Pereira MJ, Branquinho C. 2012. The use of lichen functional groups as indicators of air quality in a Mediterranean urban environment. Ecological Indicators

Emissões das principais empresas

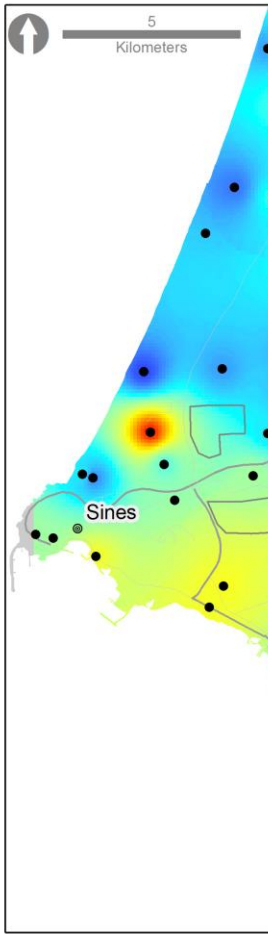
De acordo com o cenário adoptado na Estratégia Temática, prevê-se que **a redução de emissões (entre 2000 e 2020) provenientes de fontes fixas, para Portugal, seja de:**

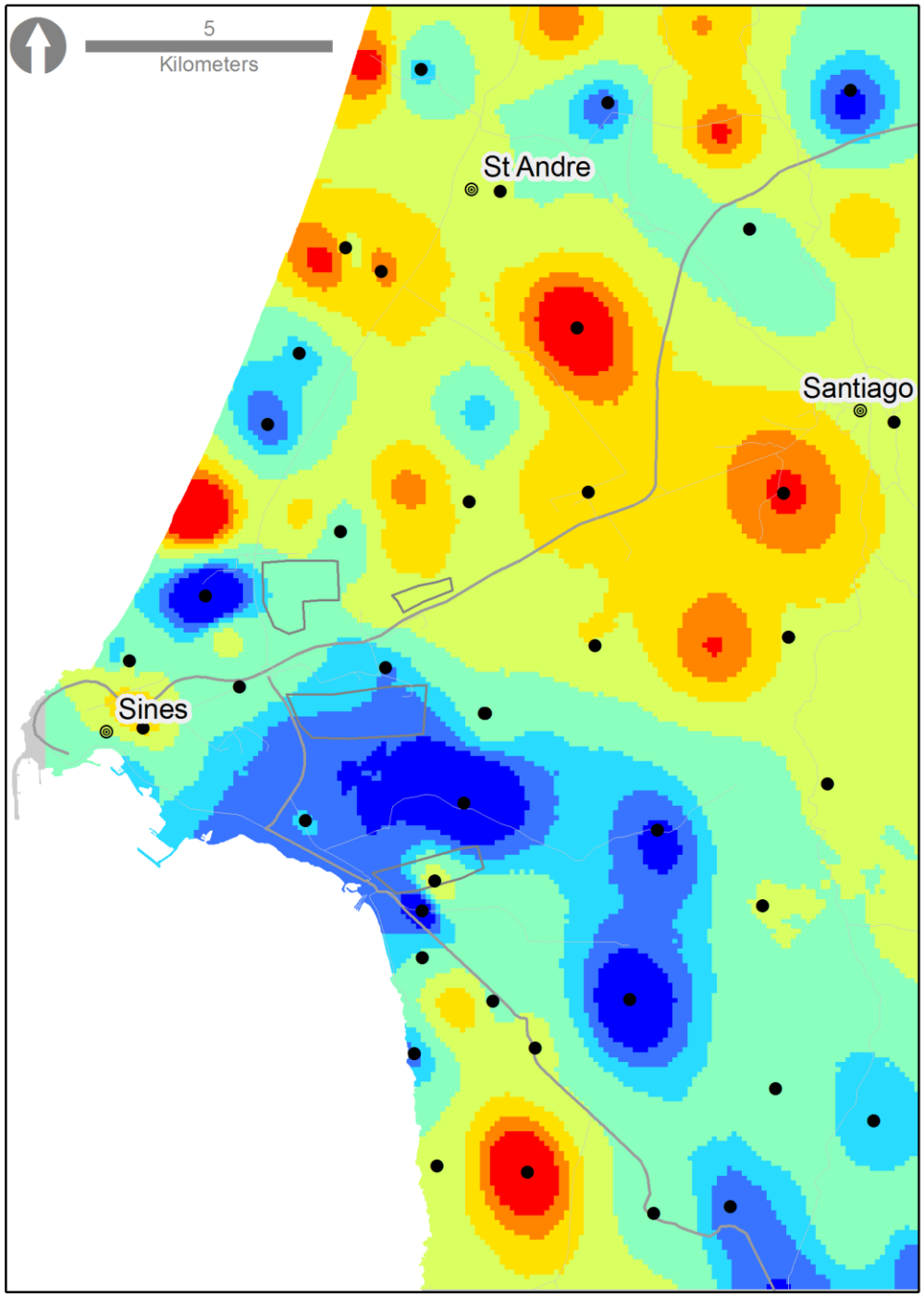
48% para as PM2,5
52% para o NOx,
79% para o SO2,

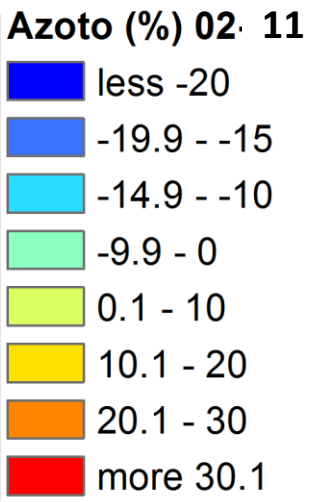


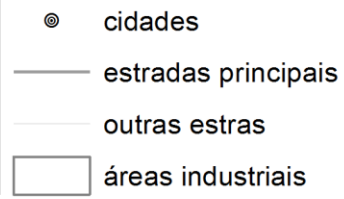


Emissões - Medianas anuais de 2009 e 2002 (mg/Nm3)









empo

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.1

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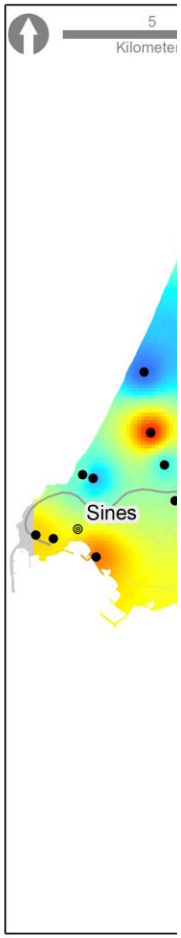
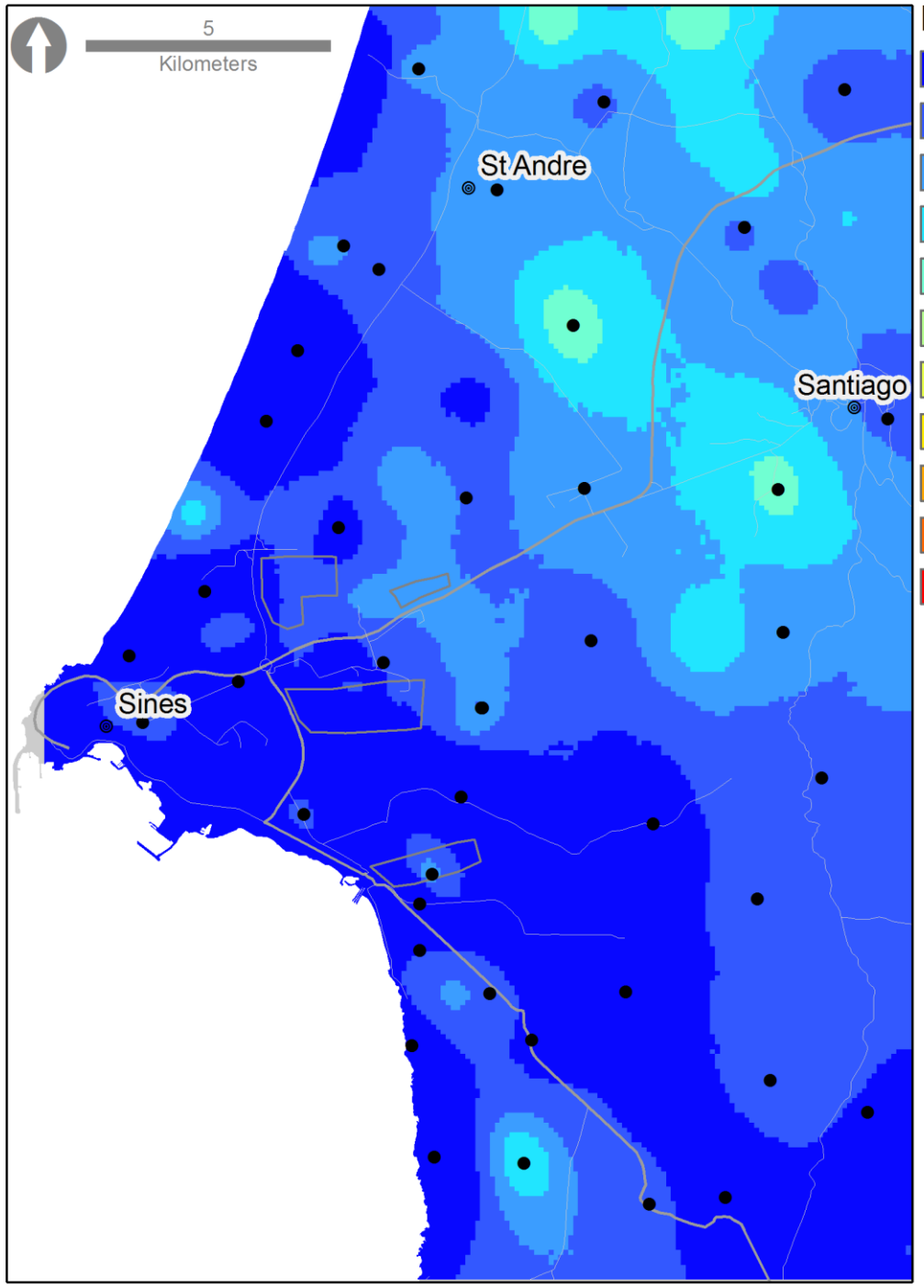
tras estras
eas industriais

tempo

ial de S





Enxofre (%) 02-0 11

- less -50
- -49.9 - -40
- -39.9 - -30
- -29.9 - -20
- -19.9 - -10
- -9.9 - 0
- 0.1 - 10
- 10.1 - 20
- 20.1 - 30
- 30.1 - 40
- more 40.1
- amostragem 11

- cidades
- estradas principais
- outras estras
- áreas industriais

Thanks
Obrigado