Management of cork oak forest landscapes in the Algarve (Serra do Caldeirão):

fire hazards mitigation, socio-economic development and biodiversity conservation

CEABN

The context

- There is a urgent need to guarantee the sustainability of forest resources management and exploitation
- There is a need to safeguard the multiple products and services provide by forests, including soil, water and biodiversity.
- There is a need to protect the forest from the growing fire risks, though this should not compromise negatively the other objectives sought in forest management.
- Recognition that there is a need to improve forest management techniques, particularly the management of undergrowth to reduce fire hazards, as these are often inefficient and damaging of forest ecosystems.

So how to manage cork oak forest landscapes, particularly the woody undergrowth, so as to reduce fire hazards, promote the exploitation of secondary forest resources and conserving biodiversity?

Objectives

1. To understand the short and long-term effects of vegetation management (scrub clearing) in cork oak forests, at the stand scale, in reducing fire hazards, conserving biodiversity, availability of secondary forest products and scenic quality of forest landscapes.

2. To understand the scaling up of management options taken at the stand level by forest landowners and managers.

3. To develop vegetation management schemes, which can lead to optimal landscape composition and structure, minimizing fire hazards, and maximizing biodiversity, the exploitation of secondary forest products and scenic quality.

4. Using the information gained in the study to improve the strategies and techniques for the management of cork oak landscapes, thus favouring their sustainable use and the conservation of biodiversity.

The approach

Beggining 2004

Phase I

Selection and mapping of permanent forest plots

Analysis and selection of methodological approaches

Phase II

Characterization of forest plots

Collection and analysis of socio-economic and ecological data

Phase III

Landscape scale analysis of stand scale management options

Landscape scale modelling of ecological processes

Phase IV

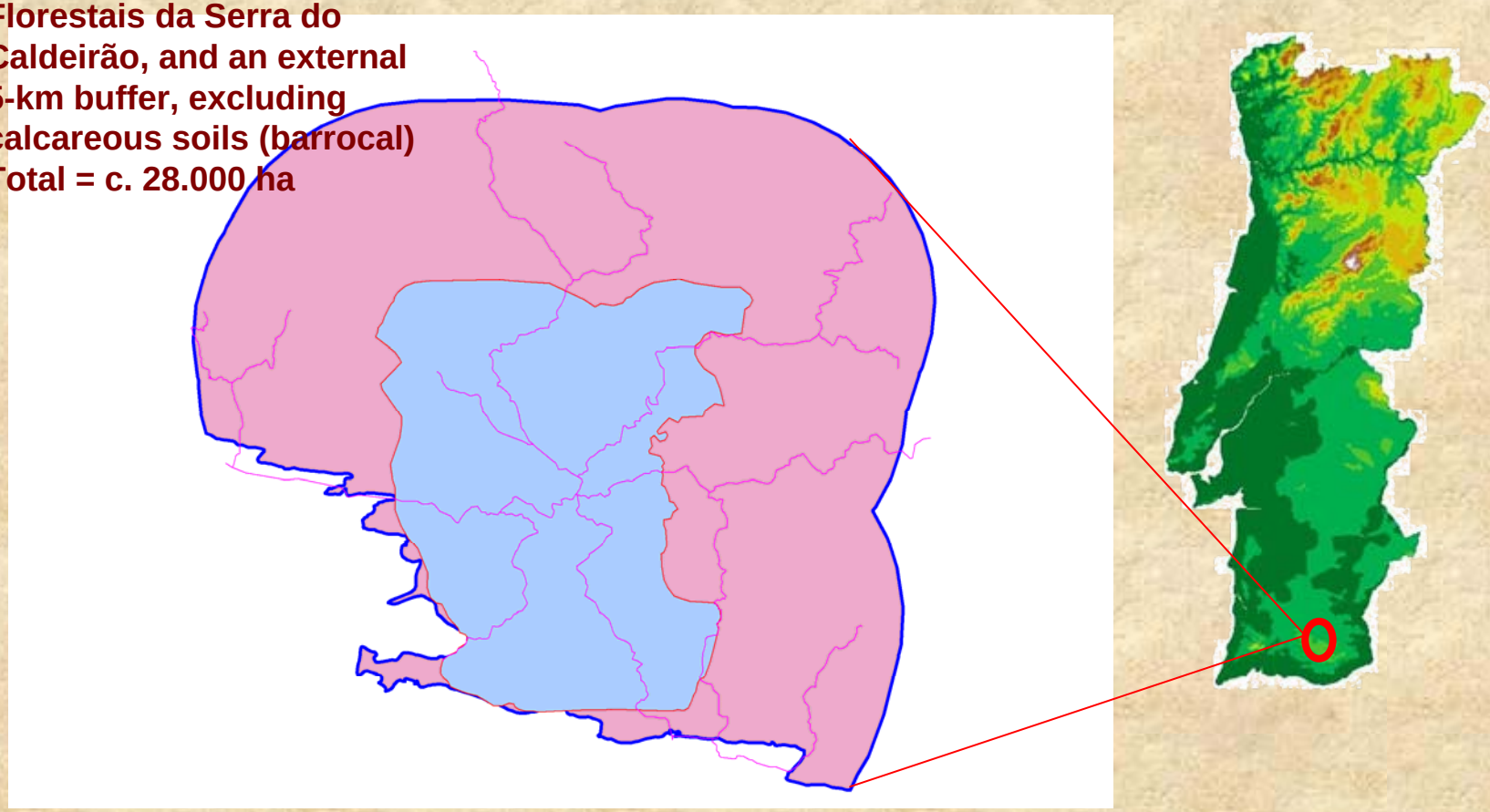
Preparation of reports, papers and participation in workshops and seminars

End 2006

Phase I

Selection and mapping of permanent forest plots

Area managed by the Associação de Produtores Florestais da Serra do Caldeirão, and an external 5-km buffer, excluding calcareous soils (barrocal)
Total = c. 28.000 ha



Study Area

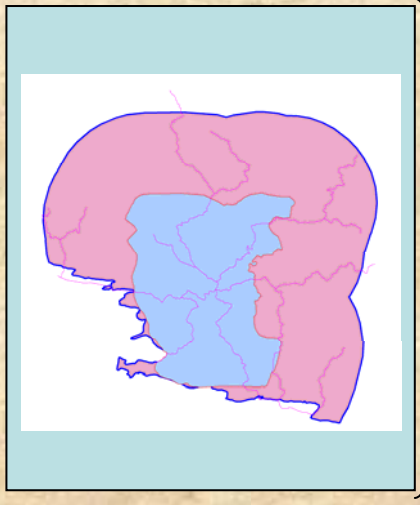
A largely forested mountain range, with low human occupation and a forest production primarily related with the cork oak.

Natura 2000 Site, including threatened species and habitats which are highly influenced by forest management.

Phase I

Sampling scheme – Stand Level

Area	Treatments	Plots	Components
1	6 Age classes since the last scrub clearing	8 plots (1ha) per age class = 48 plots	5 groups of indicators per parcel



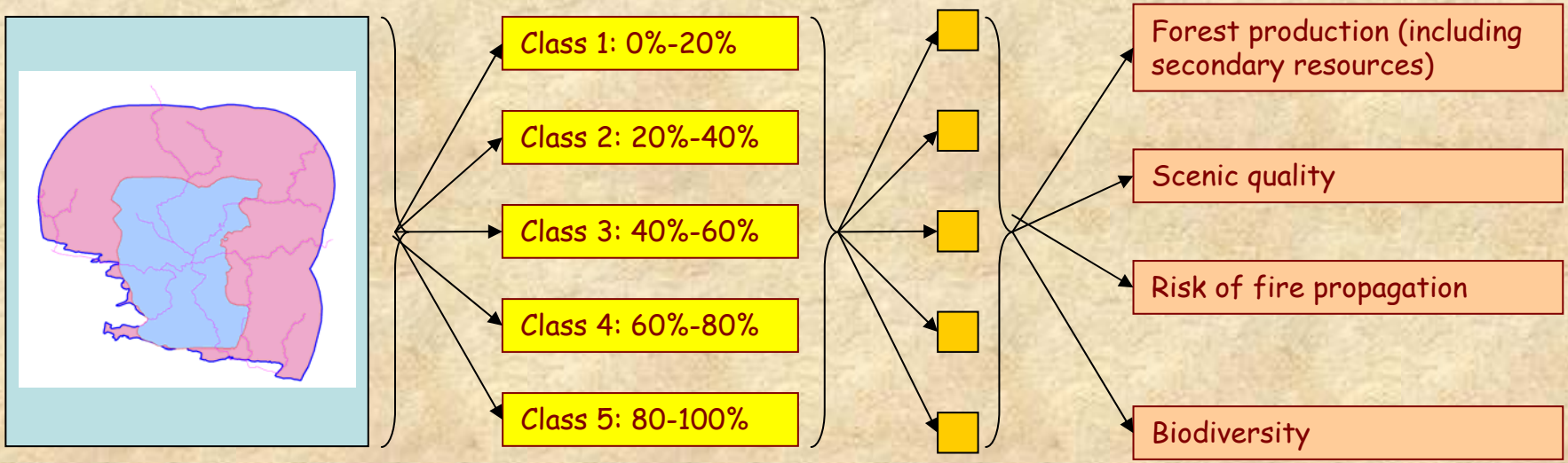
- Age 1: < 1 year
- Age 2: 1-2 years
- Age 3: 2-5 years
- Age 4: 5-10 years
- Age 5: 10-25 years
- Age 6: > 25 years

- Plot value and management (socio-economic enquiries)
- Forest inventory and structural complexity
- Secondary forest resources (game, wild berrys, mushrooms)
- Fire risk (biomass, fuel accumulation, water content)
- Biodiversity indicators (Mushrooms, plants, butterflies, birds)

Phase I

Sampling scheme – Landscape Level

Area	Treatments	Landscapes	Components
1	Proportion of area affected by scrub clearing over the past 10 years	1 Landscape Unit (about 1,000 ha) per treatment	4 groups of indicators per landscape



Phase I

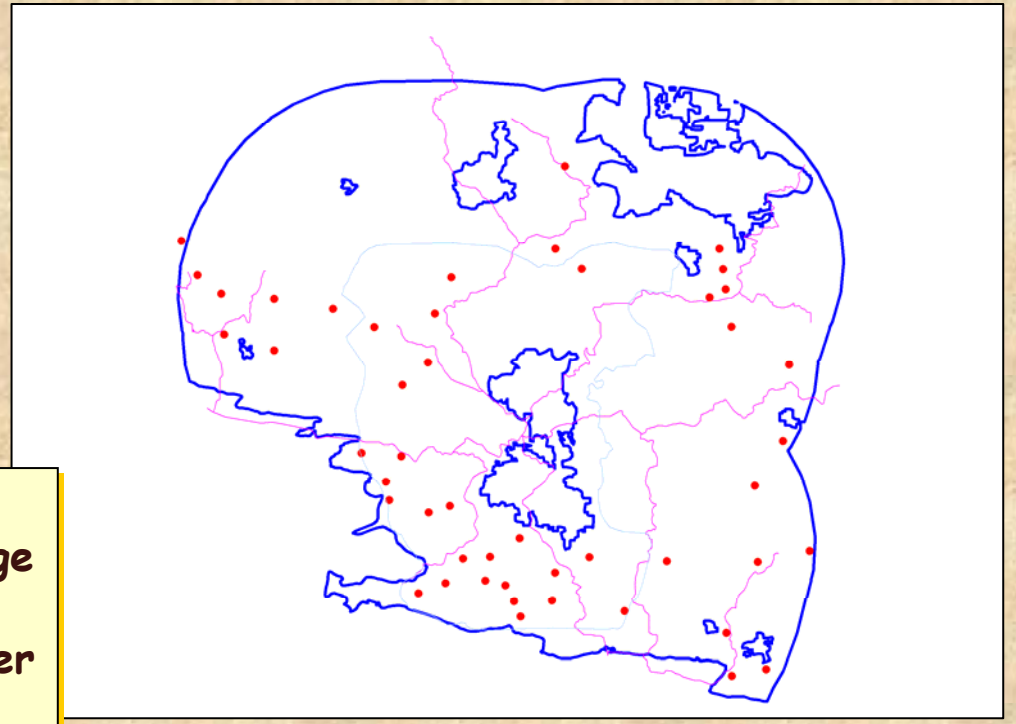
Plot selection

- Random distribution of points in areas not burnt
- Visit to 1 homogeneous plot (1ha) per random point and estimation of a likely age since the last scrub clearing
- Confirmation of the likely age through aerial photographs and enquiries to forest managers
- Repetition of the process until obtaining 8 plots per age class

Phase I

Problems in plot selection

- Shortage and spatial aggregation of plots in classes 5 and 6
- Frequent scrub clearing actions, resulting in changes in the age classes after the plots had been selected
- Large forest fires in July 2004, resulting in the destruction of several plots previously selected and reduction in the area occupied by age 5 and 6 forests



Despite these problems, it was possible to select 8 plots per age class, which can be used as permanent plots in this and other studies

Phase II

Socio-economic characterization

- Enquiries to landowners, in order to obtain information on:
  - Forest management schemes (including the frequency and techniques of scrub clearing)
  - History of forest and agricultural management of each plot
  - Economic value of the plot

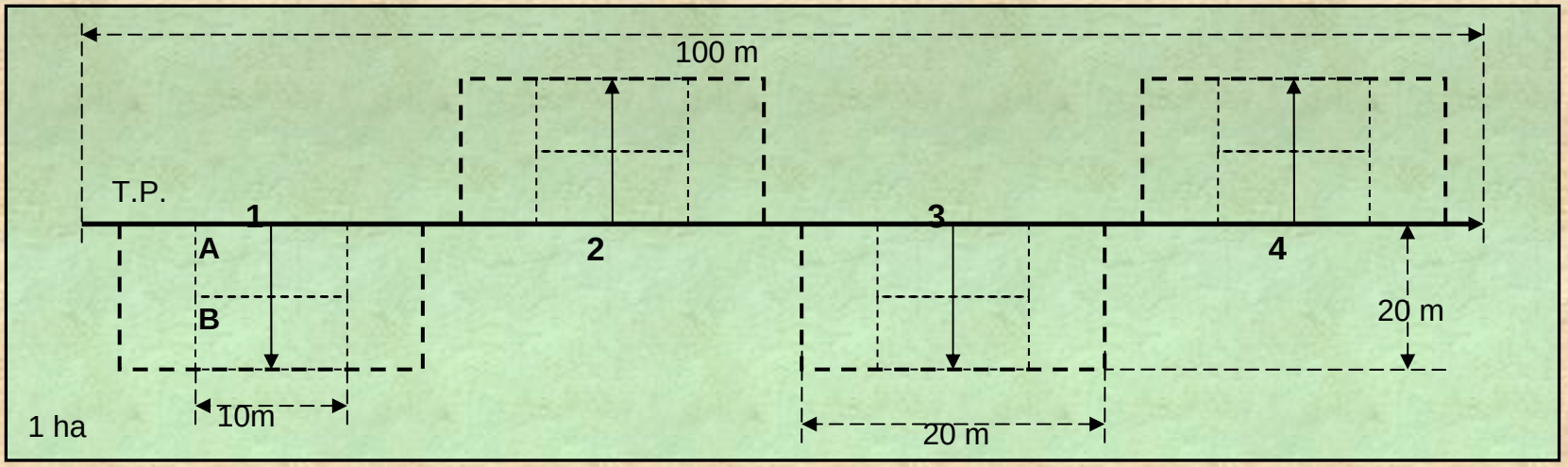
- There have been huge problems in locating the landowners, as there is no public registry of forest estates, the estates are usually very small, and the landowners tend to live outside the region.

- Despite the difficulties, it has been possible to locate and interview most landowners

Phase II

Forest inventory and stand structural complexity

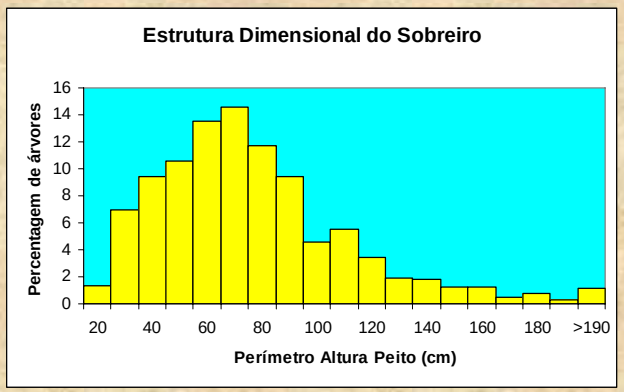
- Sampling along 4 transects (20m) set perpendicularly to the major axis of the plot
- Sampling of the shrub layer by the intersections with the transect lines
- Forest inventory in 4 (20x20m) squares, with the identification and measurement of the Perimeter at Breast Height (PBH; 1,30m) for all plants with PBH > 16 cm.

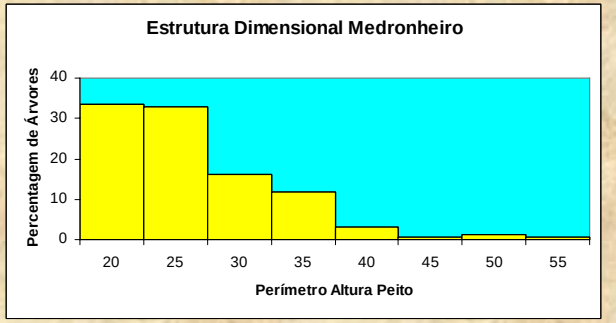


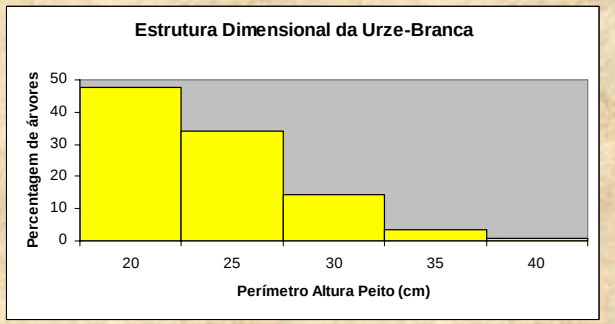
Phase II

Forest inventory and stand structural complexity

- Data was obtained for each plot during field work carried out in Dec. 2004 e Feb. 2005.
- Tree layer largely dominated by the cork oak (74,0%), frequently joined by the strawberry tree (10,7%) and the tree heather (10,7%)
- Size structure of the cork oak reflecting a process of progressive ageing, with very little natural regeneration
- J-shape size structure of the strawberry tree and the tree heather, reflecting the occurrence of natural regeneration
- Highly variable vertical and horizontal development of the shrub layer, reflecting forest management and local ecological conditions.



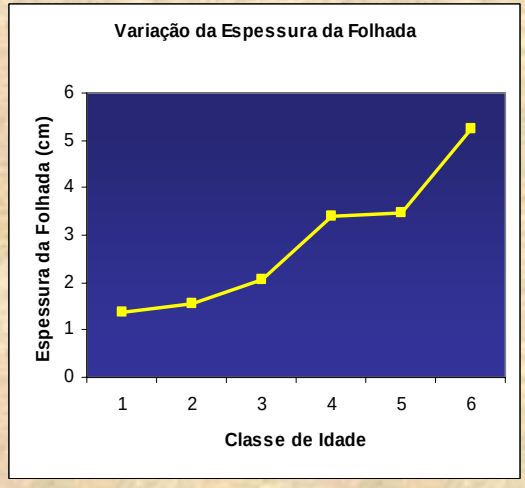


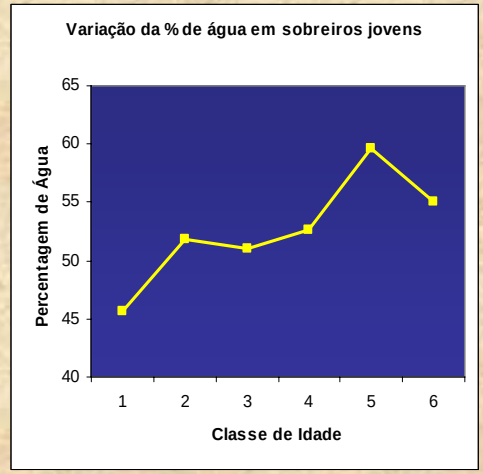


Phase II

Fire Risk

- Data from the forest inventory and the structural complexity study have been used to estimate the biomass of fuel accumulation within each plot
- Estimates of water content for the dominant plant species within each plot (collection of samples for estimation of dry weights in the laboratory).
- The data collected are still being analysed. The preliminary results underline the role of time since shrub clearing on fire hazards.





Phase II

Biodiversity indicators - Methods

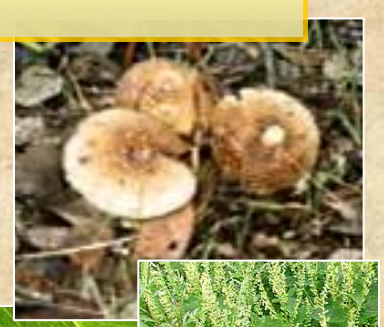
- Quantification of ectomycorrhizal sporocarps, including edible mushrooms, along the major axis (100m) of plots.

- Woody vegetation sampled along the transects used in the forest inventory (Dec. 2004 – Feb. 2005)

- Herbaceous vegetation sampled in 2m radius circles, located the centre of quadrant of each plot (4x48=192samples)

- Visual census of butterflies in transects walked along the major axis of each plot (1 week per month in June, July and September 2005 and April and May 2006)

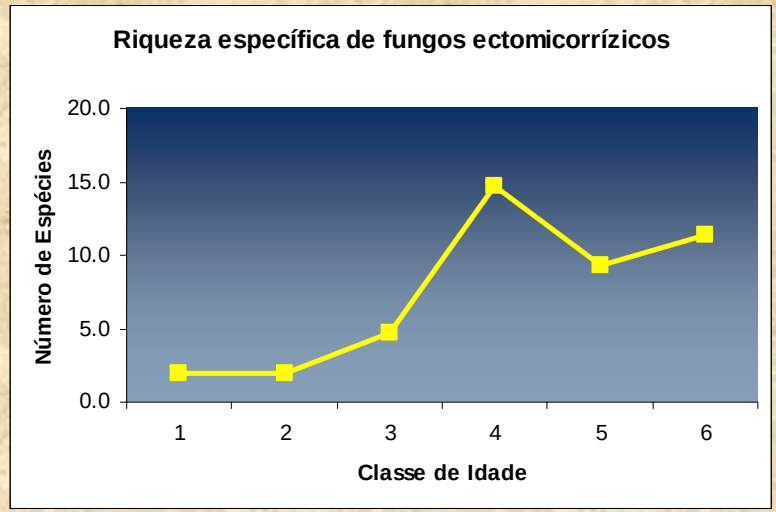
- Census of breeding birds in each plot; two point counts in May and June 2005)



Phase II

Biodiversity Indicators – Preliminary Results

- Fungi: Inventory of 55 species and morphospecies; sampling halted due to the lack of sporocarps caused by the drought conditions; preliminary results suggest a maximum diversity in plots with intermediate disturbance.

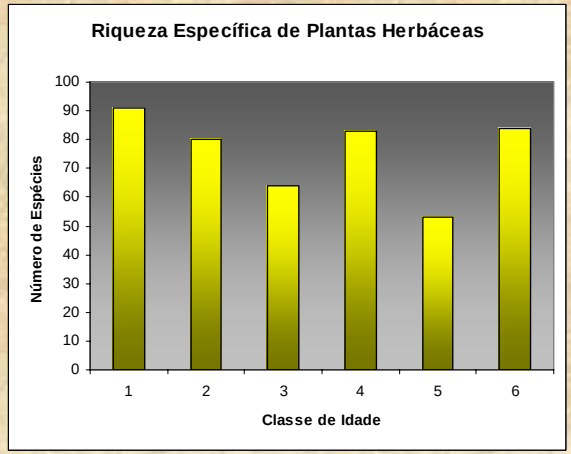


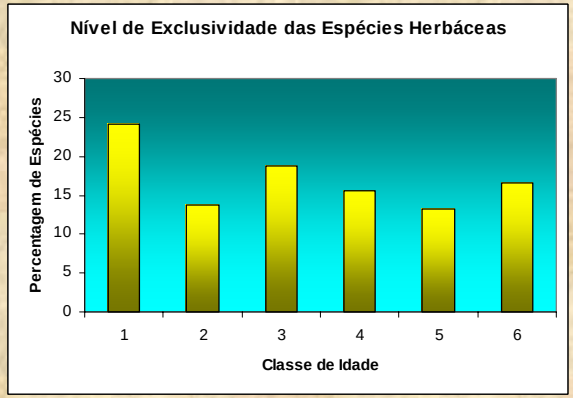
- Scrub vegetation : Sampling completed; Data analysis in progress. Composition and structure of woody communities highly variable, resulting from local ecological conditions and management actions. Dominant species: *Arbutus unedo*, *Calluna vulgaris*, *Cistus ladanifer*, *Cistus populifolius*, *Erica arborea*, *Genista triacanthos*, *Helichrysum stoechas*, *Lavandula stoechas*, *Lavandula viridis*, *Lithodora prostata*, *Quercus suber*, *Ulex eriocladus*.

Phase II

Biodiversity Indicators – Preliminary Results

- Herbaceous plants: Identified 176 species of herbaceous plants. Higher richness in recently cleared plots, but many species occurring exclusively in older plots.
- The overall biodiversity of the system seems to be related with the complementarities among plots with contrasting management regimes.
- Butterflies: ongoing sampling.
- Birds: Sampling in spring 2005 but data not yet analysed





Phase II

Secondary forest resources

- Mushrooms: Quantification of edible mushrooms during the transects for estimating the diversity of ectomycorhizal fungi: estimates of density, collection and weighting of edible species. Autumn 2005-Spring 2006. (*If there are funds available!!)*

- Game species: Sampling of rabbit pellets in quadrats set for the herbaceous vegetation (Spring 2005), estimates of red-legged partridge abundance during bird counts (Spring 2005) and survey of wild boar signs along the major axis of each parcel (wild boar; Autumn 2005 and Spring 2006).

- Wild berries: Use of the forest inventory to estimate the density of strawberry trees; berry counts in trees of different size for estimating fruit production per size class (Autumn 2005).

- Ongoing data analysis. Preliminary results suggest that rabbits are virtually absent, while wild boars are extremely abundant.

Phase III

Methods

- Selection of landscape mosaics representing different proportions of area affected by the clearing of understory.
- Evaluation of the scenic value based on enquiries and photographs of each landscape unit. Selection of two target audiences: rural and urban population of the Algarve
- Modelling of biodiversity, fire hazards, and secondary forest resources at the landscape scale
- Identification of management scenarios representing different amounts and spatial distribution of areas affected by different scrub clearing regimes (e.g. rotational clearing *vs.* maintenance of old-growth conditions).
- Optimization of management scenarios that might contribute for reducing fire hazards while increasing biodiversity and the production of secondary forest resources.

Phase IV

Approach

- Workshops with landowners and forest managers about the implications of the project results
- Preparation of scientific papers.
- Participation in Congresses, Seminars and Workshops.

- Discussion of techniques for scrub removal carried out with forest landowners and managers in collaboration with local forest producers association

Concluding Remarks

- This project allowed the establishment of 48 forest plots (1 ha), which may be used in future studies to assess the short and long-term effects of cork oak forest management.

- An ecological and socio-economic baseline for each forest plot has been created, which might nevertheless be complemented with additional descriptors.

The study is underlining the importance of maintaining mosaic cork oak landscapes, with patches representing stands with different management regimes, thereby providing conditions for species requiring contrasting ecological conditions.

Mosaic landscapes are also required for reducing fire hazards and increasing the potential for the exploitation of secondary forest resources.