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Operational Group (OG)

SILVPAST

Review assesses the state of the art regarding the use of livestock for ecosystem management in Mediterranean landscapes.

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Technical sheet

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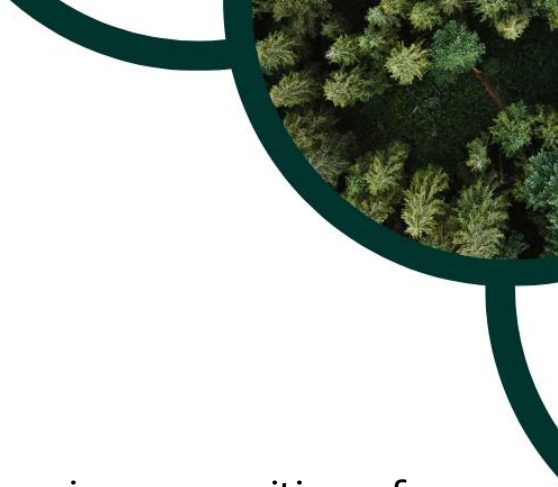


1. Summary

In the Mediterranean basin, the structure and species composition of traditional landscapes have historically been shaped and maintained by human-driven disturbances, such as extensive live- stock grazing. The cessation of these activities, which have partially replaced the role of natural disturbances, may lead to vegetation overgrowth and biomass accumulation, with potential adverse impacts on biodiversity, ecosystem functions and services.

Recently, the use of livestock for ecosystem management, with the purpose of maintaining grazing disturbance and the associated ecosystem processes, has been gaining traction. Nevertheless, there is still limited evidence on the performance of such grazing interventions. This review assesses the state of the art regarding the use of livestock for ecosystem management in Mediterranean landscapes as well as installed study plots for the same purpose. It examines the association between the regime and duration of grazing interventions and their reported effects on ecosystems. Wildfire prevention and biomass control, biodiversity and habitat conservation and the regulation of soil quality are the main reasons for the use of grazing interventions.

Overall, the retrieved data revealed heterogenous findings on the use of domestic herbivores for ecosystem management in Mediterranean landscapes. The results of this review suggest that the use of domestic herbivores in ecosystem management can contribute to wildfire prevention and biomass control, with these positive effects fading away in long-term grazing interventions. Goats seem to perform better than cattle for biomass control. Regarding the effects in biodiversity and habitat conservation, they were generally positive for extensive and moderate grazing regimes and significantly negative for intensive grazing regimes. The effect in regulation of soil quality were always negative, increasing the impact with the intensity of the grazing regime practiced.

As a result from this project, was created the document “Implementação custo-eficiente de mosaicos silvopastoris de carvalho negral” which compiles

all the information obtained from the review of the state of art and the results observed in the study plots.

2. Introduction

This technical report is a summary of the project SILVPAST.

The responsible entity for this project was Terraprima Sociedade Agrícola, Lda.

The operational group responsible for the innovations here summarized is made up by the following entities:

Terraprima Sociedade Agrícola, Lda.

Multinatura, Lda.

APIS, Companhia Agrícola e Pecuária, S.A.

Quinta do Colmeal, Lda.

ATNatureza – Associação Transumância e Natureza

UNAC – União da Floresta Mediterrânica

FCUL – Faculdade de Ciências da Universidade de Lisboa

This work group had as objectives the development of a method of implementing silvo-pastoral mosaics, in areas occupied by pyrenean oak, promoting forestry and livestock production making the exploration of these areas economically viable. To achieve this objective, firstly it was done an extensive review of the state of art and later installed two study plots in which an intensive work was carried out on forest and floristic inventory, monitorization of the livestock, processing satellite image data and analysis of the genetics of the specie population.

In total there was 2 study areas, made by pyrenean oak forest stands, adding up to an area higher than 300ha. The studied areas are made by two types of plots. The control plots (plots without any changes) and plots where grazing of low intensity was introduced, <0,3 livestock units per hectare (stock rate). In one of the studied areas an area of pasture was also analysed. Afterwards the effects of grazing activity was assessed for the following variables: vegetation structure, biomass regulation, biodiversity, natural regeneration success, productivity and phenology of the vegetation.

FIGURE 1. STUDIED AREAS

3. Framework

3.1 Pyrenean oak woods

The pyrenean oak (*Quercus pyrenaica* Willd.) forests are an ecosystem native to Portugal, Spain, France and Morroccos, that occupies the transition zones between temperate oceanic climates (Cfb) and cold semi-arid climates (BSk). These ecosystems have a high landscape and ecological value, due to this they were classified by NATURA 2000 has a habitat of community importance.

Nowadays these systems are in danger of disappearing because of anthropic activities and successive recurrence forest fires. This have led to the current distribution of the specie being quite small and fragmented. Because these systems have low economical return and are often affected by fire, the property owners don't have incentive to actively manage these areas, which increase the biomass accumulation and susceptibility to wildfires. This project aims to reinvigorate these systems through the introduction of grazing, allowing the reduction of costs associated with spontaneous vegetation control and a shorter period of regular economic returns to the property owner, in this way ensuring the restoration of the native woods in the long term.

Because of the spatial distribution of this specie, as already mentioned, is quite small and fragmented there was a need to understand if the genetic variability in the studied areas was enough to ensure the perpetuity of the forest stands.

3.2 Natural Regeneration

The natural regeneration of pyrenean oak can occur by seminal or vegetative routes (shoots from stumps or superficial roots). These two methods of natural regeneration exhibit different advantages. Regarding the seminal route, it allows a bigger genetic diversity, regarding the vegetative route, it allows a higher growth rate at initial phases and higher resistance to water deficit conditions since it uses an already establish root system.

The natural regeneration when compared to plantations show some advantages and disadvantages. Regarding the positive factors, of the natural regeneration, it is less expensive and more environmental, since it doesn't cause disturbances in the ecosystem, and it is based in the ecological succession processes. However, this process is slower, is unpredictable regarding the future composition, spatial and age distribution, and can lead to the accumulation of spontaneous vegetation in this way increasing fire susceptibility.

4. Grazing

The herbivory done by large animals is a factor that widely influences the development of a forest stand. We can say that such animals are

“environmental engineers”, because of their behaviour, such has the diet and the trampling of the vegetation, leads to changes in vegetation structure, composition, and ecosystems functions. Be aware, that even though plenty of the changes in the ecosystem can be classified as beneficial, such as spontaneous vegetation biomass reduction and the dispersal of seeds, the excessive grazing can lead to negative changes in the ecosystem, such as the reduction of the natural regeneration success rate and the reduction of soil quality.

In the cases of few or non-existent wild large herbivore animals, grazing made by domestic cattle may promote the ecosystem functions.

5. Conclusion

From the different studied variables and factors that influence the success of reestablishing native forests of pyrenean oak and the management of silvo-pastoral mosaics we can take the following conclusions:

1 – In regard to the genetic composition of the pyrenean oak stands, 5 sites were analysed (the two studied areas and three other stands) that were spatially isolated from each other, in three different scales, inter-populational, populational and intra-populational. From this study its was concluded that there is low differentiation between the different stands, this means that pollen dispersal can happen at long distances. It was found an equilibrium between seminal and vegetative natural regeneration, whereas clone trees were found together in small spots.

2 – From the state of art review, when classifying the impacts of the different grazing regimes in “Biomass regulation and fire prevention”, “Biodiversity and habitat conservation” and “Soil quality regulation”, we can take the following conclusions: all the grazing regimes contribute positively to the “Biomass regulation and fire prevention”, only when the grazing regime is intensive does it have a negative impact in “Biodiversity and habitat conservation” otherwise the impacts are positive, and for all the grazing regimes the impact was negative for “Soil quality regulation”

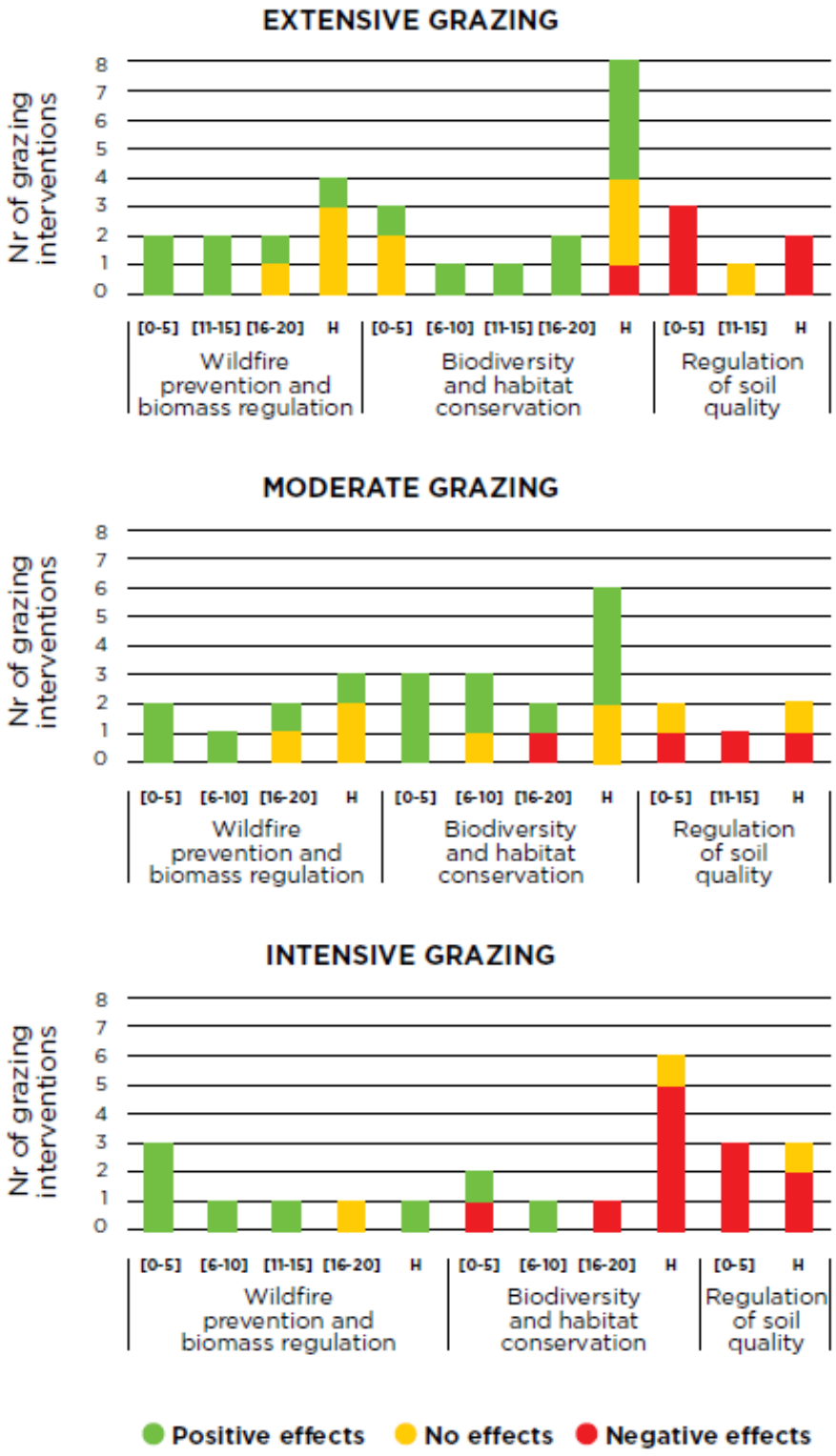


FIGURE 2. IMPACTS OF GRAZING REGIMES IN ECOSYSTEMS

3 – Regarding the effects in vegetation structure, in the control plots the vegetation develop continuously, increasing the cover of the different vegetation layers maintaining fuel vertical continuity. In the plots grazed there was a simplification of the vegetation structure, with the consumption of branches and plants that were in lower layers, this way allowing the interruption of vertical fuel continuity, and there was also an increase in area without any plant cover.

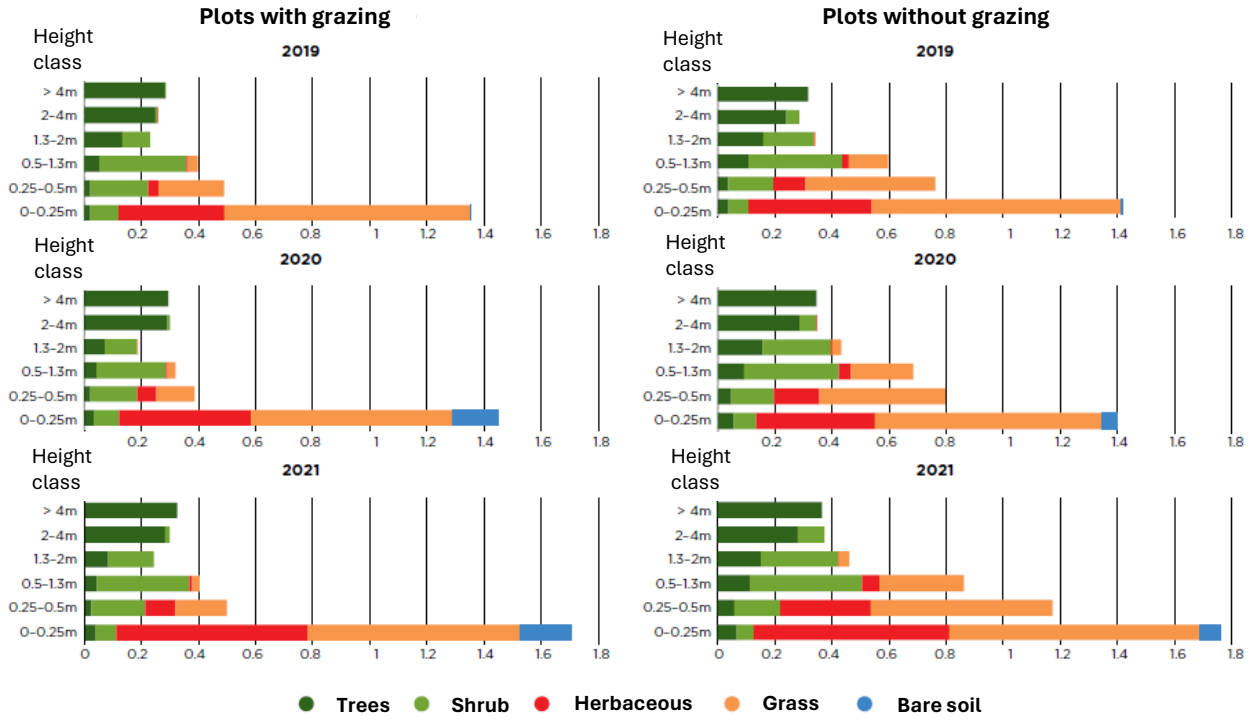


FIGURE 3. VEGETATION STRUCTURE WITH OR WITHOUT GRAZING

4 – The effects in biomass regulation in the control plots were the continuous increase in biomass on the different layers. In the grazed plots there was a decrease in biomass accumulation, mainly in herbaceous plants and shrubs.

5 – The biodiversity showed similar results in both studied areas, with only a small difference. In one of the studied areas no significant difference was found in the number of species identified in the grazed plot when compared to the control plot. In the other studied area, the results were similar, however when comparing the forest plots (grazed and control) with the pasture field, the later exhibited a higher number of species. This result

should be analysed with a critical thinking since the ecosystems are not the same, the results are not comparable between them.

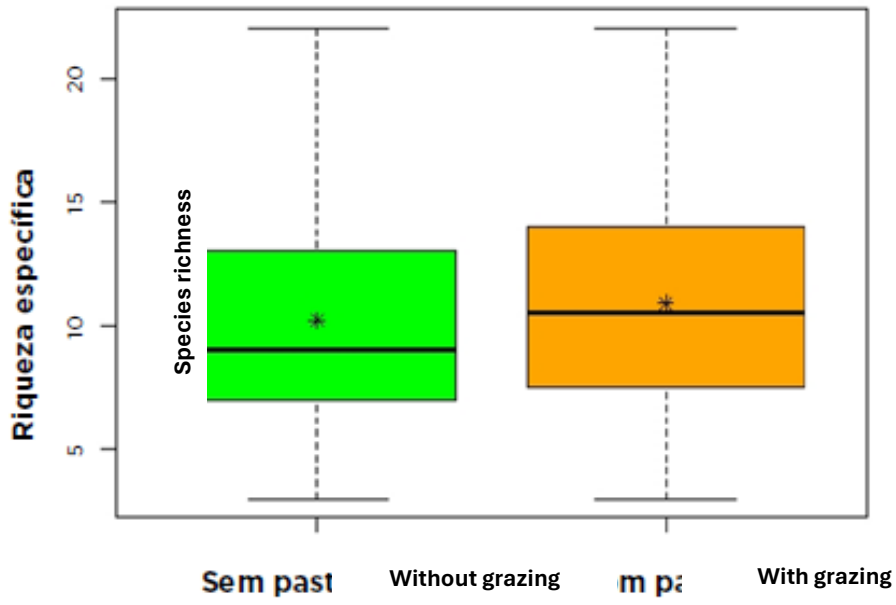


FIGURE 4. NUMBER OF PLANT SPECIES IDENTIFIED IN AN AREA OF 1M^2

6 – The effect of grazing in the natural regeneration success rate showed as result a higher mortality in the grazed plots in comparison to the control plots, due to the consumption and stomping of the small plants. The difference between the two studied areas, higher or lower mortality of natural regeneration, was correlated to the stock rate, higher stoke rates lead to higher mortality.

7 – Regarding the phenology and productivity of the vegetation, adopting the classification of plants in herbaceous (a), shrubs (b) and trees (c), the herbaceous vegetation was the one that gone through greater changes after the introduction of grazing, which happened in the middle of 2018. The herbaceous plants showed higher productivity and the anticipation of the growth period. The bushes and tress had a decrease in productivity.

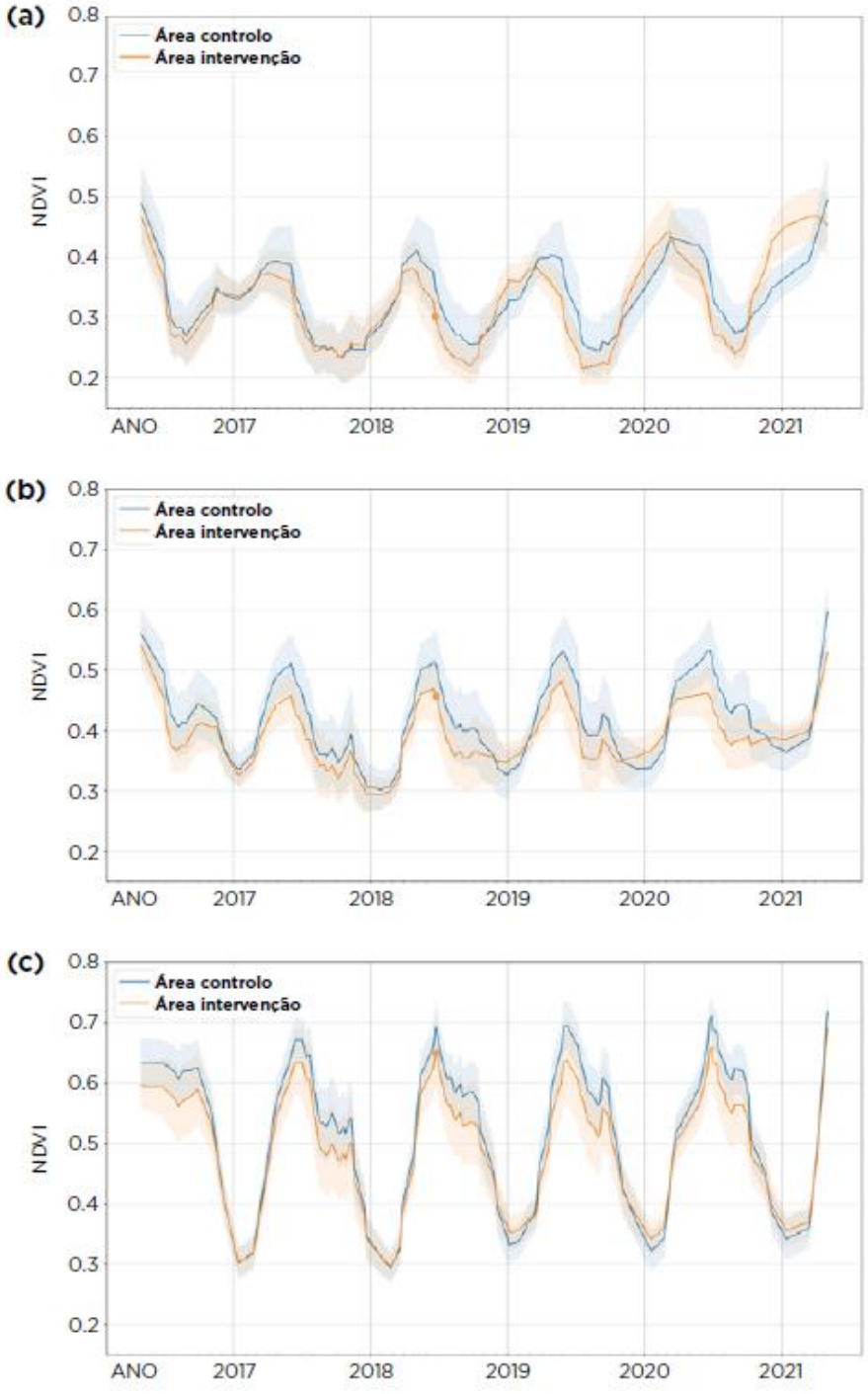


FIGURE 5. NDVI CURVES FOR THE DIFFERENT CLASSES OF PLANTS

6. Good practices for the silvo-pastoral management

To ensure the recovery and perpetuity of pyrenean oak forest stands, the implementation of silvo-pastoral mosaics may be a management method to consider.

This management method allows the reduction of financial burden, an increase of profits and the reduction of time between monetary returns to the property owner. In this way its created an incentive for the active management of this ecosystems, helping in reestablish native woods.

Bellow follows a list of good practices when implementing silvo-pastoral mosaics in pyrenean oak stands.

- In the areas intervened three types of plots should be created, spatially distributed heterogeneously. Pasture plots, areas of little to no tree and bush cover with pasture that supplement the cattle feed, forest plots with grazing, the use of these areas by the cattle allows for the control of spontaneous vegetation, and forest plots without grazing, in this way ensuring the success of natural regeneration.

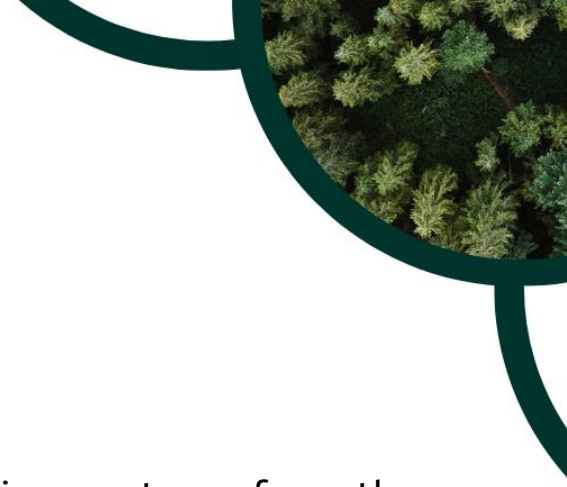
- If a genetic bottleneck was detected, in principle such will not happen since pollen is able to be dispersed at great distances, it will be necessary to introduce genetically different individuals.

- A rotation should be done between the forest plots with and whitout grazing, ensuring in this way the perpetuity of the whole forest stand.

- The stoke rate should be small, in this way grazing the positive effects are maximized and the negative effects are minimised. As an approximation, the stock rate should be between 0,3 and 1 head of livestock per hectare, if lower the changes in biomass reduction will not be significant and if higher the negative effects will be promoted on a large scale.

- It still necessary to do spontaneous vegetation control operations whenever its necessary. However, in principal this will be done with bigger periodicity.

- After the introduction of cattle in an area, all the natural regeneration should be protected, in this way allowing their survival.



References

All the information and images contained in this report are from the authorship of the Operational Silvpast.

This report had as base:

Rodrigues, N. (2023). Implementação Custo-Eficiente de Mosaicos Silvopastoris de Carvalho Negral. UNAC – União da Floresta Mediterrânica. Benfica, Portugal.

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