

ANALYSIS OF ALTERNATIVE LAND USES IN THE CHARNECA PLIOCÉNICA DO RIBATEJO

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RESUM

En aquest treball es presenten els resultats de la recerca d'usos alternatius del sòl en la regió submediterrània portuguesa. Es consideren tres alternatives: la surera (*Quercus suber*) associada a un sistema de pastures, la surera no associada a pastures i el pi marítim (*Pinus pinaster*) utilitzat per a la producció de fusta i resina.

ABSTRACT

Some results of the research on alternative land uses in the portuguese submediterranean ecological region are presented. Three alternatives are considered: the cork oak (*Quercus suber*) stand with (or without) a system of pasturage under the oak canopy and the maritime pine (*Pinus pinaster*) stand for wood and resin production are compared.

Key words: agroforestry management, cork oak, *Pinus pinaster*, *Quercus suber*.

INTRODUCTION

The analysis of some production systems presented in this paper is based in the research being carried away on productive activities and on the management of the agroforestry firm in the Charneca Pliocénica do Ribatejo. The lack of firm's organized accounting does not allow the precise definition of production and cost functions when multiple use management is considered. The joint cost allocation to individual activities is arbitrary (Hof and Field, 1987) and even the accounting - based separable costs have been shown to be different from the true separable costs in multiple-use forestry (Hof and Field, 1989) leading to a problematic modelling process. The inexistence of input-output models and the lack of experience on the valuing of non-market services or of externalities contribute also to the difficulties facing the economic or the cost-benefit analysis of agroforestry projects in the region.

Present technical and economical knowledge advises the analysis of systems which integrate only productive activities whose technical relations are sufficiently known (Borges *et al.*, 1990). Accordingly, only three production systems are considered in this paper: 1) System maritime pine (SMP). The plantation of a Maritime Pine (*Pinus Pinaster*) stand with two goals: wood and resin production. 2) System cork oak (SCO). The plantation of a Cork Oak (*Quercus suber*) stand with one major goal: cork production; a secondary product will be firewood. 3) System cork oak with pasturage (SCOP). The plantation of a cork oak (*Quercus suber*) stand with a pasturage

system under the oak canopy has three major goals: the production of cork, sheep meat and wool; a secondary product will be firewood.

In order to guarantee the comparability of the financial rentability criteria for the three systems a common planning period of 121 years was considered. One and two rotations were included in the case of, respectively, the cork oak and the pine stands. The area occupied by the three production systems was considered to be 900 hectares according to the average forest property area in the region and to the possible economies of scale.

ANALYSIS OF THE PRODUCTION SYSTEMS

The analysis that follows has as its purpose the ranking of the three systems according to their financial rentability and to the supply of permanent employment they generate.

Decision criteria such as the net present value (NPV) or the benefit/cost ratio (B/C) are used to evaluate the profitability of the investments. The calculations were performed using constant prices to avoid an uncertain price forecasting. The long planning period considered, and the probable changes of the rate of return, advise both a sensitivity analysis of the NPV and B/C to interest changes and the use of complementary decision criteria such as the internal rate of return (IRR) or the payback period (PP).

These parameters provide information concerning the capacity of the agroforestry sector to attract private investment in the region. Simultaneously the analysis of the chronological distribution of the agroforestry firm financial availabilities allows the definition of adequate public funding programs.

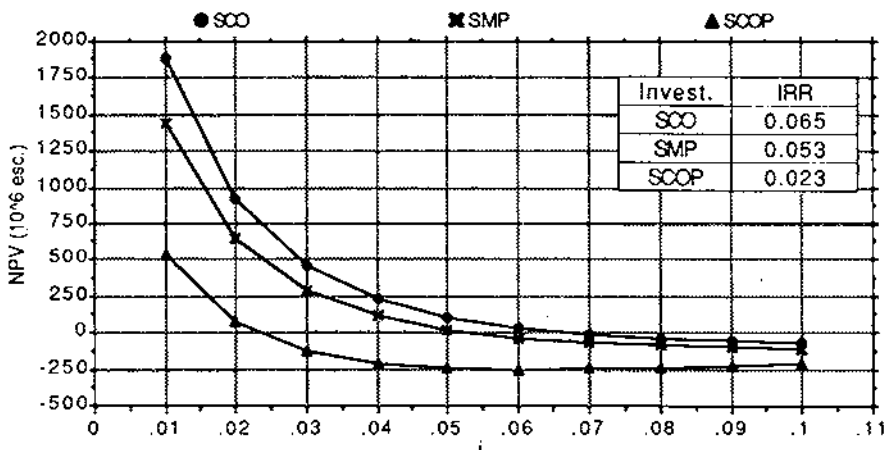


Figure 1 - Sensitivity analysis of the NPV of the three investments to changes of the rate of return (i)

Some results of the financial analysis of the three systems are presented in the figures 1 to 3.

The reading of the curves in Fig. 1 leads to the following inferences:

Cork production is financially superior to the joint production of wood and resin. The NPV of the SCO is higher than the NPV of the SMP for all rates of return

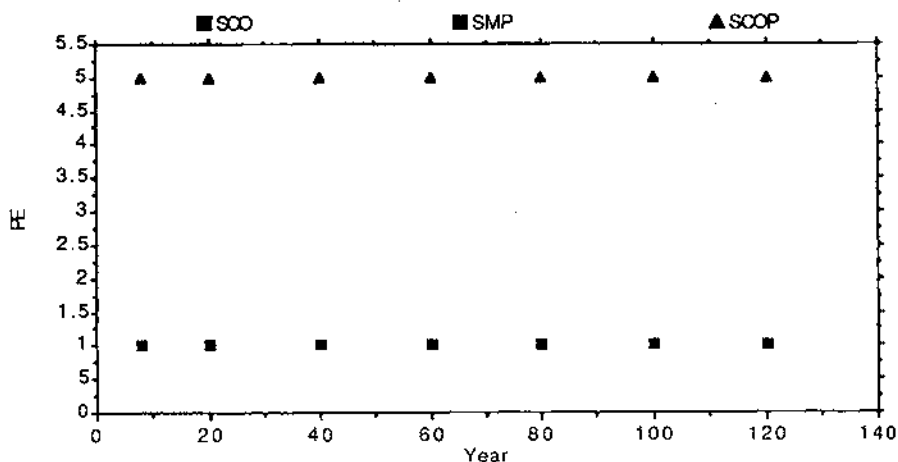


Figure 2 - Sensitivity analysis of the B/C ratio of the three investments to changes of the rate of return (i).

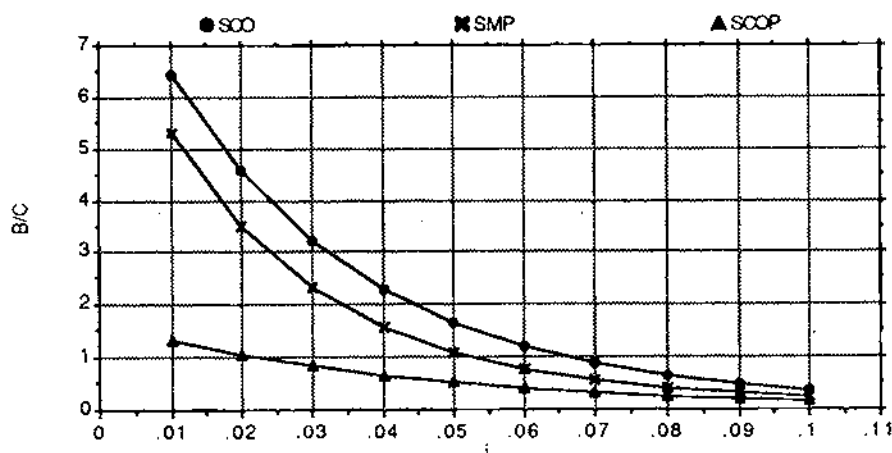


Figure 3 - Sensitivity analysis of the PP of investments with positive rentability to changes of the rate of return (i).

considered, although the disparities are more important in the case of lower rates. Nevertheless the difference between the IRR of the two systems is still significant (.01). This inequality is justified by the concentration of revenues proceeding from the clear cut, years 60 and 121, in the case of the SMP, which contrasts with a more uniform income distribution in the SCO. Higher initial investment in the former contribute also to it. The Maritime Pine regional productivity of about $6 \text{ m}^3/\text{ha}/\text{year}$ (Hidrotécnica Portuguesa, 1965) and the revenues from the extraction of resin from trees, the last four years before its cut, don't permit a NPV of the SMP higher than the one of the SCO, with an average cork productivity of $2.7 \times 10^3 \text{ Kg}/\text{ha}$, (Costa, 1990).

The option for an extensive pasturage system under the cork oak canopy proves to be financially inferior to the other two alternatives. Its rentability is positive only to very low rates of return: the IRR is close to .023. The weight of the initial investment, the delay of the introduction of the pasturage system in order to guarantee the success of the cork oak regeneration, the lower cork production, consequence of the wider spacing considered, and the low productivity of pasture allowing only 3.2 raising units per hectare, all contribute to it. The consequences of the portuguese economic integration in the european communities upon the sheep meat price may lead to an even lower rentability of this system (Borges *et al.*, 1990).

The ranking of the three investments according to the B/C ratio is similar to the one evidenciated before. The SCO proves to be superior for all rates of return considered: the revenues obtained from each monetary unit invested are higher.

Risk and uncertainty considerations recommend the determination of the PP of the three investments. This criteria evidenciates again the financial infeasibility of the pasturage system. This investment is recuperated only for rates of return lower than .02; its PP for this last rate is close to 90 years. The superiority of the SCO is confirmed: for all rates of return considered, with the exception of the low significant

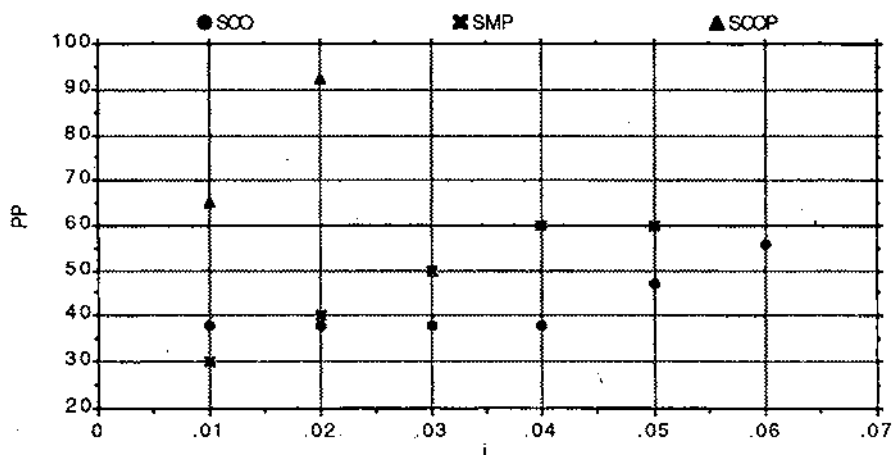


Figure 4 - Chronological distribution of permanent employment generated by the three investments during their planning .

$i=.01$, the PP of this system is inferior to the one registered in the case of the SMP. The calculation of the PP shows also that the firm financial availability is very low during the first 40 years of the planning period both for the SCO and the SMP, when a rate of return close to $.02$ is considered. Higher rates, closer to the equilibrium values in the financial market worsen significantly this deficit. This information may contribute to the definition of public funding programs in order to promote the investment in the agroforestry sector on the region.

The socioeconomic analysis of agroforestry projects comprises the evaluation of project impacts on other productive sectors, on the environment and particularly on social practices and stability. This paper complements the financial analysis just completed with the examination of the employment generated by the three investments.

The reading of the curves in Fig. 4 evidenciate the difference between the SCOP, which generates a significant permanent employment, and both the SCO and SMP with an impact of lower importance on the labour market. The management of the pasturage system justify it.

As for the supply of temporary labour, the superiority of the SCOP is also evident. In the ranking of the three investments the SCO seems to occupy a higher position than the SMP due to the uniformity of its temporary employment supply.

CONCLUSIONS

The evaluation of the three systems leads to the conclusion that in the Charneca Pliocénica do Ribatejo cork production alone is superior to the other forestry or agroforestry activities considered.

If product's prices ratio remains unchanged, the Maritime Pine wood and resin productions with lower financial rentability may find justification only as a means to diversify the firm's objectives and to prevent its dependency on just one market.

As for the introduction of a pasturage system under the cork oak canopy its financial infeasibility is mainly due to the productivity of pastures in the region. Cash-flows are positive only when cork extraction takes place leaving the system in a position clearly inferior to the SCO.

The impact on the labour market seems to favour, at first sight, the SCOP. Nevertheless if indirect or induced impacts are considered the ranking between the SCO and the SCOP may be altered because cork industry is an important economical activity in the region and in the country.

The lack of the inexistence of technical and economical studies on the relations between different productive activities don't allow the definition of production functions for more complex systems, the reason why only these three alternatives were considered. Research on the modelling of multiple use systems depends on the availability of firm's organized accounting which is presently lacking.

The identification of external effects of the agroforestry investment is important when public decision-making is considered. The impacts on other economical activities, on the environment and on society contribute to the socioeconomic significance of the investments. In order to analyse them, research on input-output models which integrate the agroforestry activity in the regional economy should be considered.

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