Society for Ecological Restoration International

Cork Oak Woodlands on the Edge

ECOLOGY, ADAPTIVE MANAGEMENT, AND RESTORATION

Edited by
James Aronson, João S. Pereira, and
Juli G. Pausas

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CONTENTS

Chapter 13

Mixed Cork Oak–Stone Pine Woodlands in the Alentejo Region of Portugal

Inocêncio S. Coelho and Pablo Campos

One of the most unusual Mediterranean landscapes dealt with in this book is the mixed cork oak and stone pine woodland, found primarily in southern Portugal and scattered parts of northease, west, and southwestern Spain. Given that stone pine is widespread in all the warmer parts of the Mediterranean region and that it occurs on the same kind of soils as cork oak, it is surprising that this particular type of mixed woodland occurs in only a small portion of the Iberian Peninsula. It is not impossible that its origin is anthropogenic.

In this chapter we present an economic study of a mixed cork oak–stone pine woodland maintained on a private estate in the Alentejo region of southern Portugal. We analyze costs and benefits to the owner and private income distribution for the woodland owner and his employees. The goal is to determine whether total profitability for landowners is competitive, as compared with alternative nonland investments of similar risk and time horizon frames, given the prevailing management practices of nonmechanical harvesting of cork and pine nuts and chronic overgrazing by domestic livestock, which prevent regeneration of cork oak. In addition, we ask whether the conservation of the mixed woodland is important enough for society and government to underwrite their conservation. The last section of the chapter is devoted to this question and addresses issues that will also be raised in the next two chapters and are central to the book as a whole.

Mixed Cork Oak and Stone Pine Woodland Areas

In 2004 mixed stands of cork oak and stone pine occupied 22,380 hectares in Portugal, which represents a huge increase in stone pine, particularly, since 1985. This is the result of the afforestation programs supported by the

Portuguese application of Common Agriculture Policy (EU 2080/92 regulation) set-aside measures. In the planted stands of mixed woodland, cork oak is dominant, but the primary goal of stone pine management traditionally was timber production, with a final harvest at about forty years, after which time the mixed plantations were generally transformed to pure stands of cork oak. In the second half of the twentieth century, however, the increasing use of roasted pine nuts as human food stimulated the interest of landowners so that harvesting pine nuts gradually became subject to a private property rights regime. (Formerly, pine nut gathering in Portugal was a free-access resource for local people.) There is also growing demand for *private amenities* from woodlands, which economists define as the private exclusive use of environmental goods and services, such as the landowner pleasure of spending weekends and holidays far from the city, surrounded by cork oak woodlands. Today, private amenities are the most important nonindustrial source of private landowner capital income—after cork itself—that owners derive from open cork oak woodlands in Portugal and Spain (Campos and Caparrós 2006; Campos et al. 2007a).

The traditional mixed woodland system in Portugal is practiced mostly on large private estates (100 hectares or more), which occupy about 60,000 hectares in all. The landowner usually manages most forest operations with paid workers (employees) and privately owned machinery. Cork and pine nuts can be sold on the tree as stumpage or at the farm gate after being harvested. Cork and pine nuts are manually harvested. Livestock rearing is often managed by livestock keepers who lease the use of the grazing resources from the woodland owner.

Cork stripping continues to be the primary cork oak management goal. Therefore, the nearly total lack of natural regeneration indicates that in the long term, mixed cork oak and stone pine stands in Portugal, as well as pure cork oak stands (see Chapters 10 and 15), are at risk. To shed light on this precarious situation, in the next two sections we develop a private economic analysis of the current lack of facilitated natural regeneration practices in mixed woodland. For lack of data, we will not attempt to measure the loss of natural capital caused by the death of mature cork oak trees, but this factor should ultimately be taken into account. Furthermore, we disregard livestock activity, for which detailed studies have been published elsewhere (Coelho 2005b; Campos et al. 2007a, 2008b, 2008c; Rodríguez et al. 2005). For lack of data, we also could not directly include the economic value of environmental services to society from mixed woodlands, although this issue is discussed at length at the end of the chapter and in Chapters 14 and 15. Government expenditures on woodland are not also taken into account in our analysis.

Private Economic Benefits and Cost Valuation Methods

The relevance of applying an accounting system that considers the mixed woodland ecosystem, *Hicksian income*, is recognized in the European System of Accounts regulation (Eurostat 1996), and it is only partially applied to European Union woodland and forest "farms" via the Economic Accounts for Agriculture and Forestry (EAA/EAF) (Eurostat 2000). The latter accounting system does not incorporate the value of private owner amenity consumption and the public benefits and costs that accrue to society from the mixed woodland ecosystem. As a consequence, the official statistics on woodland and forest total incomes are incomplete. The shortcomings of the EAA/EAF accounting system have led us to seek a more comprehensive approach (Campos et al. 2008c). In Table 13.1 we explain the specific character of the different market and nonmarket types of economic values included in a total economic value (TEV) of forest total income measurement (Campos 1994; Campos et al. 2005; cf. Pearce 1993).

Because private cost does not include the Portuguese government's direct expenditures on woodland fire control and natural resource depletion mitigation, the private total costs only partially reflect the economic effort needed to manage woodland activities. Thus, public expenditure increases the amount of the private total income because in the absence of such government support, the owner must expend labor and capital on fire prevention and control to mitigate natural and manufactured capital loss by wildfire.

The complete accounting and valuation methods applied in this chapter, and also in Chapters 14 and 15, are available in Rodríguez et al. (2005) and Campos et al. (2008b) and will be explained briefly here. Note that we calculate mixed woodland private total income, taking into account market

TABLE 13.1.

Potential sources of total economic value of cork oak woodlands.

Active uses			Passive uses
Actual uses		Future uses	
Direct	Indirect	Option	Existence values
Often exclusivity or competition in use; either private or public goods.	Environmental services considered as an intermediate output or input for the production of final ecosystem goods and services.	Users' willingness to pay for goods and services for one's own or other people's future benefit.	Collective and individual users' willingness to pay for the future existence of a good or service in danger of extinction, independently of its current or future active use.

Source: Based on Campos et al. (2005:325).

benefits and costs, and extend mixed woodland outputs to include the monetary measurement of private amenities.

Private Benefits and Costs

Private amenities include an owner's exclusive current active access to and enjoyment of his or her land and a number of landowner *option values* and *passive use values*, such as legacy and *existence values* (Campos et al. 2005, 2007a). This "self-consumption" of private amenities is commonly internalized as capitalized market value in the setting of woodland market prices (Eurostat 2002; Campos and Caparrós 2006; Campos et al. 2007a). To measure private amenity income value, we asked owners of pure and mixed woodlands along the Alentejo coast how much income they were willing to forgo in order to maintain their landownership and not sell the property to invest in alternative enterprises. We calculated an average private amenity value of €197/ha (Coelho 2005b; Campos et al. 2007a, 2007b). We shall now present results from an analysis of current private incomes and profitability rates at the Vale Estate, situated in the Alentejo coastal region, on the banks of the Sado River.

Case Study: Vale Estate Woodland

The Vale Estate has a total of 1,793.5 hectares of productive woodland. Most of this (78.7 percent) consists of mixed stands of cork oak and stone pine. In addition, there are 2.6 percent of pure stands of stone pine and 18.2 percent of pure stands of cork oak. Sandy soils prevail, and with less than 500 millimeters mean annual precipitation, stone pine regenerates easily and spontaneously, but not cork oak, for which natural regeneration is often deficient for reasons described in Chapters 6 and 10.

Private Economic Incomes and Profitability Rates

Although we assume that cork production will decline in the future if current cork oak management practices continue unchanged, this is ignored in our economic analysis, whose results reflect an average year. In other words, for the purposes of this study we assumed that outputs and costs are stable, and we calculated total income for Vale Estate in 2003 prices and omitted rates of inflation and capital gains related to land revaluation. Assuming that both these rates are constant, our results are given in real terms. As noted earlier, owners' profits are considered to be commercial outputs derived from sales

TABLE 13.2.

Mixed woodland Vale Estate total private benefits, 2003.

Class	Quantity/ha	Price (€/unit)	Value (€/ha)[a]
1. Sales			411.3
1.1 Cork (kg)	167.300	2.000	334.600
1.2 Pine nut (kg)	61.500	0.475	29.200
1.3 Firewood (kg)	1,000.000	0.025	25.000
1.4 Grazing rent (forage units)	150.0	0.1	15.0
1.5 Hunting rent (ha)[a]	1	7.5	7.5
2. Private amenity (ha)[a]	1	197.0	197.0
3. Subsidies net of taxes			0.93
4. Total benefits (1 + 2 + 3)			609.23

[a]"ha" refers to woodland hectares.

of cork, pine nuts, firewood, charcoal, grazing rights, and hunting rights, as well as subsidies net of taxes on the aforementioned outputs and the self-consumption of private amenities.

Table 13.2 summarizes the total private benefits of Vale Estate in the "average" year of 2003. Cork stripping, private amenities, and pine nut harvesting contribute 54.9 percent, 32.3 percent, and 4.8 percent, respectively, of total woodland benefits (sales, private amenities, and subsidies). The remaining benefits—firewood, *grazing rent*, hunting rent, and subsidies net of taxes—represent only 8 percent of total benefits. Notably, cork accounts for 81 percent of sales.

As for total costs (Table 13.3), more than half (54.8 percent) consists of silvicultural treatments for cork oak and stone pine, including maintenance of footpaths and firebreaks, understory shrub cutting and pruning of young pines, and administration of the farm. The *labor cost* is the greatest portion (81.6 percent) of total cost, with intermediate consumption (raw materials and services) accounting for 4.2 percent and machinery depreciation for 14.2 percent of Vale Estate's total costs. Wage rates for cork stripping (€10.6 per hour) and pine nut harvesting (€2.9 per hour) are, respectively, 2.5 and 0.67 times the average Vale wage rate (€4.31 per hour) paid to temporary and permanent employees on the estate (see Table 13.3).

The total benefit should be the Vale Estate source for paying the costs of intermediate consumption (raw materials and services) and capital consumption (machinery depreciation; 3 percent of total benefits) and labor costs (12 percent of total benefits). The remaining 85 percent of total benefit belongs to the private landowner as business capital income. The Vale Estate owner benefits amount to €519.27/ha and represent 87.67 percent of total income (Table 13.4).

TABLE 13.3.

Mixed woodland Vale Estate total private cost, 2003.

Class	Quantity/ha	Price (€/unit)	Value (€/ha)
1. Raw materials			1.25
1.1 Forestry work			1.25
2. Services			2.51
2.1 Forestry work			1.04
2.2 Cork stripping			0.16
2.3 Pine nut harvesting			1.31
3. Labor costs[a]	17.03	4.31	73.4
3.1 Forestry work	8.9	3.84	34.25
3.2 Cork stripping	1.98	10.63	21.06
3.3 Pine nut harvesting	6.15	2.94	18.09
4. Machinery depreciation[b]			12.8
5. Total cost (1 + 2 + 3 + 4)			89.96
5.1 Forestry work			49.34
5.2 Cork stripping			21.22
5.3 Pine nut harvesting			19.4

[a]Per hour of work.
[b]Includes machinery depreciation for forestry work and cork and pine nut transport to farm gate.

TABLE 13.4.

Mixed woodland Vale Estate private labor, capital, and total incomes, 2003.

Class	Labor income (€/ha)[a]	Capital income (€/ha)	Total income (€/ha)
1. Cork stripping	21.06	313.38	334.44
2. Private amenity		197.00	197.00
3. Pine nut harvesting	18.09	9.80	27.89
4. Firewood		25.00	25.00
5. Grazing rent		15.00	15.00
6. Hunting rent		7.50	7.50
7. Forestry work	34.25	–48.41	–14.16
8. Total (1 + 2 + 3 + 4 + 5 + 6 + 7)	73.40	519.27	592.67

[a]"ha" refers to woodland hectares.

Sales of cork contribute 60.3 percent of total *capital income*, 32 times the income from pine nut harvesting, and the cork stripping wage rate is 3.7 times the pine nut harvesting rate (see Table 13.3). Vale cork is of high quality for natural stoppers, and its price is as high as €2/kg at the farm gate, whereas cork prices in southern Spain often are less than €1/kg.

The mature Vale mixed woodland implies an annual average private investment of €6,620/ha. (The woodland market price is €6,575/ha, and the operating capital is €45/ha.) These figures show that this mixed estate is a human-created woodland resource-based investment, with a low durable

human-made operating capital investment. We find that Vale Estate commercial profitability rate (4.8 percent) is competitive, and adding the 3.0 percent private amenity profitability rate, we estimate the Vale total profitability rate to be 7.8 percent. This high short- to medium-term private profitability rate is possible without replacing the mature cork oak's natural mortality. It is shown in Campos et al. (2007b) and Chapter 15 that given the lack of private owner profitability from facilitating natural cork oak regeneration through silvicultural practices, including the planting of cork oak saplings, woodland owners cannot be expected to undertake such practices without subsidies. Therefore, in the final section we develop an appeal in favor of investing public money in mixed woodland conservation, with the aim of contributing to the potential needs of future human generations for cork and pine nut raw material and for *public amenities*, such as public recreation, climate change mitigation, and biodiversity conservation (Campos et al. 2007a, 2008b).

Sustainability and Stewardship of Total Economic Value

Stone pines naturally dominate cork oak in mixed associations and thereby endanger the equilibrium and the sustainability of the mixed woodland ecosystem. Because cork oaks regenerate poorly (see Chapter 10), some intervention is needed to counter the immediate temptation of landowners to allow exclusive renewal of stone pine. Yet the economic incentive of landowners to actively promote balanced regeneration of the two species, or to invest in replanting of cork oak, depends entirely on government subsidies (Campos 1998; Campos et al. 2007b, 2008c). Indeed, recent public policy incentives offered for planting and maintaining mixed woodland stands have contributed to the maintenance and conservation of the mixed woodland ecosystem (see also Chapter 15).

Although the mixed woodland ecosystem, such as the one at Vale, when studied in the context of private benefits has certain peculiarities, woodland management and the apparent tradeoffs between grazing and cork oak regeneration can provide useful insight for those concerned with all cork oak woodlands, both in southern Europe and in northwestern Africa (see Chapters 14 and 15). Livestock grazing plays a major role in the biodiversity and cultural components of all open woodland systems (Díaz et al. 1997; see Chapter 3 and Box 3.2; see also Color Plate 6), and both overgrazing (intensification of use) and undergrazing (extensification of use) can provoke an unstable situation (see Chapter 10). On one hand, unrestricted animal grazing by livestock and wild herbivores inhibits or prevents cork tree seedling recruitment and in the long term can lead to total disappearance of open cork

oak and mixed woodlands as a reservoir for carbon storage and sanctuary of heritage and biodiversity values. On the other hand, maintaining livestock in the woodlands helps to combat shrub encroachment (see Chapters 14 and 15). If managed properly, the livestock help maintain high plant biodiversity and increase the value of the mixed and other cork oak woodlands as working cultural landscapes. In this light, sustainable grazing of livestock in open cork oak woodlands is an agroforestry bio-tool that increases the provision of public goods, including mitigation of global warming and biodiversity loss at a local or regional scale, and also helps maintain the economic supply of natural cork for future generations (see Chapters 17 and 18). Both carbon credits and biodiversity credits are beyond the scope of this chapter, but they merit attention for their possible economic value in a mixed woodland setting in the future (cf. Campos et al. 2005).

The mixed woodland ecosystem has great social relevance, yet the private and public benefits it provides are in danger of declining or even disappearing. All those joint private and public economic benefits and nature conservation tradeoffs motivate society as a whole in favor of government incentives and regulations to preserve the mixed woodland ecosystem area, on the basis of compatibility between traditional and new uses (i.e., commercial uses and environmental services).

Forest fires are an ever-present factor in the dynamics of woody vegetation in all Mediterranean climate regions, including southern Portugal. Wild and human-set fires are dissimilar in the mixed woodland and the pure conifer forest, with the incidence of forest fires being smaller in open mixed *montados* than in closed coniferous forests. In woodland ecosystems with open tree stands and shrubs controlled by grazing and by periodic clearing, the risk of catastrophic fires is reduced.

Finally, the mixed woodland case study presented here confirms what we know about the short- to medium-term competitive private profitability of mature Mediterranean pure and mixed cork oak woodlands. But we also know that landowners incur capital losses by renewing cork oak or stone pine (see Chapter 15; Campos 1998; Campos et al. 2007b) through facilitated natural regeneration or actual replanting. Current market failures to anticipate the future scarcity of private mixed woodland ecosystem services could lead to an undervaluation of those commercial and environmental economic benefits. These facts could help explain why market land prices—which should reflect the discounted owner capital income by market long-term private profitability rates—and government direct expenditures and subsidies both fail to anticipate true actual asset value (market and social values) of the mixed woodland with a sustainable tree management scheme. Therefore, if

we accept that private owners do not renew their mixed woodlands under actual and future expected market trends, preservation of the rare mixed woodland of southern Portugal becomes a public concern for present and especially future human generations. Chapter 14 describes the householder's subsistence economy in a state-owned cork oak woodland situated in northern Tunisia.

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THE SCIENCE AND PRACTICE OF ECOLOGICAL RESTORATION

Advance praise for *Cork Oak Woodlands on the Edge*

"This book brings together the best of the ecological and social sciences to assess the condition of an iconic ecosystem of the western Mediterranean world, with results as useful and beautiful as the cork oak itself."

—J. R. McNeill, Georgetown University, author of *Something New Under the Sun*

"Cork oak forests have coevolved with human societies for thousands of years; they support the livelihoods of millions of people and are a key component of treasured Mediterranean landscapes, but the pressures on these forests have never been greater. This scholarly work offers a wealth of knowledge on the management and restoration of a critical forest system and contains much of significance to those concerned with our relationship to all forests worldwide."

—Jeff Sayer, science advisor, IUCN

"*Cork Oak Woodlands on the Edge* provides a broad introduction to a vanishing cultural landscape. Cork oak woodlands are rich in species and also in traditional knowledge and lessons for understanding and coping with global change."

—Fernando Valladares, Instituto de Recursos Naturales, CSIC, and
Rey Juan Carlos University, Madrid

"This comprehensive account of Mediterranean cork oak trees and the cultural landscapes they have dominated for millennia reveals much about ecology, management, history, and culture. The contributors represent an international group of researchers and managers engaged in exploring and restoring these emblematic ecosystems."

—Francis E. Putz, Department of Biology, University of Florida

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