
ACTION 20.2 – RRN – Intervention Area 3

ECOPOL

**Internalization of the cork oak forest
“Montado” functional narrative in the
formulation, monitoring and evaluation
of Rural Development Policies**

Technical File

The ECOPOL Project aims to contribute to the formulation, monitoring, and evaluation of a Common Agricultural Policy (CAP) more suitable to the reality of Mediterranean agroforestry systems, promoting collaboration and knowledge transfer between rural development agents, with a methodology based on the concepts of multifunctionality, ecosystem services (ES) and compensation for externalities.

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The ECOPOL Project aimed at:

- Identifying and prioritizing the ecosystem services (ES) produced by the cork oak forest “Montado” as a multifunctional agroforestry system;
- Systematizing technical and scientific information related to the biophysical quantification and the economic value of the priority ES provided by cork and holm oak Montado ecosystems, in contrast with two alternative scenarios – Montado abandonment or grazing intensification;
- Identifying a key set of management measures that enhance the supply of ES identified as priorities and which are directly related to the factors that guarantee the multifunctionality of the system;
- Proposing payments for ES mechanisms that are adequate to the ES provided by the multifunctional cork and holm oak Montado ecosystems

→ What are Ecosystem Services (ES)?

Ecosystem Services (ES) are the benefits humans derive from well-functioning ecosystems.

- **Provisioning** services — goods that we obtain from nature, such as drinking water, agricultural production, livestock, fishing, fibres, cork...;
- **Regulating** services — services that ensure the maintenance of ecosystems, such as carbon sequestration, soil protection, nutrients retention, water balance, pollination...;
- **Cultural** services — services associated with the cultural value of nature, such as recreational and tourism potential, genetic resources, landscape aesthetics, inspiration for arts....



The provision of nine ecosystem services was analysed: water balance, nutrients retention, soil protection, carbon sequestration, functional biodiversity, reduction of fire risk, pollination, Landscape aesthetics and emblematic biodiversity – and two scenarios were evaluated: abandonment of the extensive Montado system (scenario A) and grazing intensification above 0.5 LU/ ha (scenario C).

Results suggested a potential supply reduction for almost all nine priority ES in both scenarios (abandonment and grazing intensification). Based on the economic valuation exercise carried out for three ES (soil protection, nutrient retention and carbon sequestration), a maximum annual monetary compensation to avoid environmental costs associated with either abandonment or grazing intensification in the Montado was estimated at approximately 194€/ha and 338 €/ha, respectively.

Ecosystem Services	Brief Definition in the context of sustainable management in the Montado system	Relevance to society
Regulating Services		
Water Balance Regulation	Regulation of water flows due to specific plant characteristics in the Montado, under specific conditions, contributing to the management of water availability	Water availability
Nutrients Retention	Nutrient retention capacity due to the presence of herbaceous and tree cover characteristics of the Montado, contributing to the reduction of nitrogen and phosphorus leaching and consequent improvement in the infiltrated water quality.	Water quality
Soil protection	Soil stabilization and consequent erosion control and prevention due to the presence of vegetation cover in the Montado.	Erosion control
Climate regulation through carbon sequestration	Regulation of the concentration of greenhouse gases in the atmosphere through carbon sequestration in the soils and vegetation cover of the Montado.	CO ₂ sequestration increase
Functional biodiversity	Presence of specific biodiversity in the Montado with an essential role in the habitat's regulation, contribution to the ecosystem functioning and for the provision of other services. In particular: <ul style="list-style-type: none"> • Phytodiversity – species that contribute to the high ecological value of the understory vegetation; • Diversity of ectomycorrhizal and saprobic macrofungi – species that contribute to nitrogen and phosphorus fixation and soil quality; • Soil macrofauna diversity – species of arthropods and other invertebrates that regulate habitat and soil quality; • Bird diversity – as habitat regulating agents; • Diversity of habitats – multifunctional mosaic. 	Biodiversity that plays relevant ecological functions
Reduction of fire risk	Reduction of the incidence, intensity or capacity of propagation of fire episodes due to the Montado social, biophysical and landscape characteristics.	Reduction of CO ₂ emissions
Pollination	Maintenance of habitats that support the presence and distribution of pollinating agents in the Montado, contributing to the pollination of agricultural fields and consequent productivity.	Safeguarding presence and distribution of pollinating agents
Cultural Ecosystem Services		
Landscape aesthetics	Landscape fragmentation prevention, ensuring ecological continuity and maintaining the scenic and cultural value of this national landscape.	Landscape aesthetic enjoyment
Emblematic biodiversity	Presence of emblematic biodiversity, with high cultural value and legacy, from the Montado, in particular the Iberian Lynx (<i>Lynx pardinus</i>)	Biodiversity with special conservation interest

Complementarily, a set of management measures was determined to ensure the supply of the nine ES analysed.

Figure 2 → Maximum payment to avoid loss of benefits due to land use changes in the Montado (* for the Carbon Sequestration service, the variations relate to scenario B)

	Variations in relation to scenario B2 * Benefit loss, €.ha ⁻¹ .year ⁻¹			
	A		B2	C
Carbon sequestration				
Cork oak	189	←		→ 236
Holm oak	107	←		→ 154
Soil Protection	5	←		→ 65
Nutrient Retention	n.a.	←		→ 37
Total (€.ha⁻¹.year⁻¹)				
Cork oak	194	←		→ 338
Holm oak	112	←		→ 256

Maximum Payment to avoid loss of benefits considered due to Montado abandonment

Maximum Payment to avoid loss of benefits considered due to grazing intensification

Table 1 → Management measures impact for each ES provided by the Montado

Ecosystem Services	Carbon sequestration	Nutrient Retention	Water Balance	Soil Protection	Functional biodiversity					Pollination	Fire risk	Emblematic biodiversity	Scenic Value
					Phytodiversity	Macrofungi	Soil Macrofauna	Birds	Habitats				
Management measures													
Livestock limits (0.1-0.5LU / ha)	X	X		X		X	X	X	X		X	X	
Natural regeneration protection (individual protection)	X				X	X		X	X			X	X
Promote multi-age stands	X							X					
Shrub control without mobilization	X		X	X	X	X	X				X		X
Maintenance of non-productive natural zones scattered in the mosaic at the landscape level.					X	X	X	X	X	X		X	X
Rotational grazing	X				X	X		X	X		X	X	

The proposed eco-scheme for cork and holm oak Montado aims to:

- a) Safeguard the multi-functionality of Montado
- b) Promote and reward good management practices
- c) Promote the adoption of management models compatible with climate and environmental priorities

Scenarios B1 and B2 present the most suitable production models to address decarbonization while promoting various Ecosystem Services, including biodiversity, as extensively shown in this study (see final report of the ECOPOL project available at www.unac.pt).

Table 2 → Eco-scheme model – Ecosystem services remuneration for the Montado

Eco-scheme – Montado ecosystem services remuneration	
General commitments	General commitments assumed to the parcel for 1 year
Eligible areas	Eligible areas of cork or holm oak with a minimum area of 0.5 ha and minimum width of 20 m, with trees with a minimum height of 5 m and a minimum coverage level of 10% (or with a capacity for achieve these thresholds in situ) (NFI6 – Terms and definitions).
Technical support	Mandatory technical support, carried out by technicians accredited within producer’s organizations or associations
Registration	In field book
Mandatory compliance management measures	
Montado without grazing	Montado with grazing
Shrub control without soil mobilization (rotary cutters and/ or brush cutters)	Shrub control without soil mobilization (rotary cutters and/ or brush cutters) Grazing intensification less than 0.5 LU / ha

Table 3 → Proposed environmental and climate commitment – Montado in extensive grazing

Agri-Environmental Measure – Montado in extensive grazing	
General commitments	General commitments assumed to the parcel for a minimum period of 5 years
Eligible areas	Eligible areas of cork and holm oak with a minimum area of 0.5 ha and width minimum of 20 m, with trees with a minimum height of 5 m and a minimum coverage of 10% (or with the capacity to achieve these thresholds in situ) (NFI6 - Terms and definitions) and extensive grazing with livestock density between 0.1 LU / ha and 0.5 LU / ha
Technical support	Mandatory technical support, carried out by technicians accredited within producer’s organizations or associations
Registration	Registration in field book
Mandatory compliance of the management measures	
Protection of natural regeneration for the maintenance of unequal stands	Installation of individual protectors Rotational grazing
Reserve of dispersed non-productive natural areas (3 to 10% of the eligible area)	Patches of shrubs different in height, composition and age Water lines and wetlands

The results of the quantitative and qualitative assessment obtained in the ECOPOL project show the high potential of the Montado, as a multifunctional agroforestry systems, to provide Ecosystem Services (ES), particularly when comparing to contrasting trends of abandonment and grazing intensification.

Furthermore, it is evident that the supply of the priority ES analysed is strongly dependent not only on biophysical factors, but also on the management adopted.

The proposed management measures aim to ensure multifunctionality and environmental sustainability of the Montado, maximizing its potential for supplying priority ES, without prejudice to its socio-economic viability and applicability to the Portuguese reality.

Since this study focused on the cork and holm oak Montado systems, we understand that the Mediterranean agroforestry systems also include other species – oaks, chestnut trees and pine cone forests – that in pure or mixed stands with the species studied here, provide the same type of ES.

Mediterranean agroforestry territories in which cork and holm oak are the more representative species ensure an economic activity of multiple use, unique in national and even European terms. They also ensure a lower level of risk, owing to low production intensity and a moderate to high supply rate of various ecosystem services: carbon sequestration, water cycle and nutrients, soil protection and guarantee of biodiversity.

Confirming the economic value of the ES provided is a first step in consolidating the payment model that ensures the internalization of these important benefits provided to society.

This document is the non-technical summary of the project. Additional information can be consulted in Marta-Pedroso, C., Laporta L., Santos Silva C. (2020) ECOPOL: Internalization of the Montado functional narrative in the formulation, monitoring and evaluation of Rural Development policies. Study financed by PDR2020 (announcement no. 1 / operation 20.2.3 / 2018). Coordinators: Domingos, T., Gonçalves Ferreira, A., Silveira, P., Tenreiro, P. .. Edition: Instituto Superior Técnico & UNAC, Lisbon and Coruche.

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