

Regeneration patterns of *Quercus suber* according to *montado* management systems

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Abstract Traditional management of *montado* (*dehesa*) is an example of integration of sustainable land-use and biodiversity conservation. The whole system sustainability is currently threatened by the intensification of soil tilling to control shrub invasion and promote pastureland, the absence of tree natural regeneration being one of the most outstanding threats. A study to assess effects of management on tree regeneration at early stages was developed in a cork oak *montado* grazed by cattle, in southern Portugal. We specifically compared the effects of harrowing every 3–4 years with those of shrub clearing with a shredder every 5–7 years. We hypothesized that extending shrub maintenance may facilitate cork oak regeneration at early stages in grazed *montado*. Fenced

cork oak paddocks under the same management system for at least the last 40 years were surveyed for cork oak seedling, juvenile and sapling density; shrub cover percentage was also estimated. Recruitment bottleneck was observed after the seedling stage under harrowing, while in shredded areas all stages were well represented and often associated with shrub patches. Overall, the highest cork oak recruitment occurred at intermediate shrub cover (40–60 %). By maintaining shrub patches and their protective effect against direct radiation and grazing impact, while preventing shrub encroachment, shredding every 7 years seems to create an important temporal window for effective oak regeneration. This management practice might thus be suitable to favour successful tree regeneration in grazed cork oak *montado*, assuring the persistence of this system.

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Introduction

Mediterranean cork oak (*Quercus suber* L.) savanna (called *montado* in Portugal and *dehesa* in Spain) is found only in southwestern Europe and northwestern Africa. Cork oak *montado* presents a tree density ranging 20–100 adult trees ha⁻¹ (DGRF 2007) and is distinguished by a systematic combination of agricultural, pastoral, and forestry uses. The traditional land-