

Appendix 3

Table A3.1 The Result-Based Indicators, their expected environmental outcomes and possible management actions leading to desirable outcomes. References that support the construction of each indicator are also stated.

Result-Based Indicators	Environmental outcomes	Possible management actions	References
A1 Degree of soil coverage by <i>Rumex bucephalophorus</i> and <i>Chamaemelum mixtum</i>	A Healthy and functional soil	Application of dolomitic limestone; Soil fertility improvement; Livestock management; Creation of drainage systems.	Bilotta et al. 2007; Marcos et al. 2007; Benavides et al. 2009; Brito et al. 2014; Carvalho et al. 2015; Sales-Baptista et al. 2016; Serrano et al. 2017; Serrano et al. 2020.
A2 Extension of bare soil			
B1 Density of tree cover regeneration with trees in the second stage of development	B Quercus regeneration	Livestock management; Elimination of soil tillage practices; Utilization of tree protectors.	Pulido and Díaz 2005; Acácio et al. 2007; Plieninger et al. 2010; Pinto-Correia et al. 2011; Arosa et al. 2015; Simões et al. 2016; Arosa et al. 2017.
B2 Conservation state of the tree cover regeneration			
C1 Balanced between botanic herbaceous groups	C Mediterranean biodiverse pastures	Livestock management; Pasture seeding; Soil fertility improvement; Shrubs encroachment control.	Pinto-Correia and Mascarenhas 1999; Plieninger et al. 2004; Ferraz-de-Oliveira et al. 2013; Lüscher et al. 2014; Kairis et al. 2015; Ferraz-de-Oliveira et al. 2016; Sales et al. 2016; Simões et al. 2016; Sevov et al. 2017; Waters et al. 2017; Abdalla et al. 2018; Listopad et al. 2018; Hernández-Esteban et al. 2019; Jongen et al. 2019.
C2 Degree of soil coverage by thistles			
C3 Degree of soil coverage by shrubs			
D1 Diversity level	D conservation of singular landscape elements	Isolated landscape elements management; Natural habitat restoration; Livestock management; Fencing; Watering systems establishment	Williams et al. 2004; Arizpe et al. 2008; Pinto-Cruz et al. 2009; Godinho et al. 2011; Rosset et al. 2013; Pereira et al. 2015; Catarino et al. 2016; Lumbreras et al. 2016; Simões et al. 2016; Tulloch et al. 2016; Hunter Jr et al. 2017; Macek et al. 2018; Varela et al. 2018.
D2 Representativeness of each singular element			
D3 State of conservation of elements			

References:

- Abdalla, M.; Hastings, A.; Chadwick, D.R.; Jones, D.L.; Evans, C.D.; Jones, M.B.; Rees, R.M.; Smith, P. 2018. Critical review of the impacts of grazing intensity on soil organic carbon storage and other soil quality indicators in extensively managed grasslands. *Agriculture, Ecosystems and Environment*, 253: 62-81. DOI: <http://dx.doi.org/10.1016/j.agee.2017.10.023>
- Acácio, V.; Holmgren, M.; Jansen, P.A.; Schrotter, O. 2007: Multiple recruitment limitation causes arrested succession in Mediterranean Cork Oak systems. *Ecosystems*, 10: 1220-1230. DOI: <https://doi.org/10.1007/s10021-007-9089-9>
- Adham, A.; Riksen, M.; Ouessar, M.; Ritsema, C. 2016. Identification of suitable sites for rainwater harvesting structures in arid and semi-arid regions: A review. *International Soil and Water Conservation Research*, 4: 108-120. DOI: <http://dx.doi.org/10.1016/j.iswcr.2016.03.001>
- Arizpe, D.; Mendes, A.; Rabaça, J.E. 2008. Sustainable riparian zones: A management guide. Generalitat Valenciana. ISBN: 978-84-482-4967-0
- Arosa, M.L.; Ceia, R.S.; Costa, S.R.; Freitas, H. 2015. Factors affecting cork oak (*Quercus suber*) regeneration: acorn sowing success and seedling survival under field conditions. *Plant Ecology & Diversity*, 8 (4): 519-528. DOI: <http://dx.doi.org/10.1080/17550874.2015.1051154>
- Arosa, M.L.; Bastos, R.; Cabral, J.A.; Freitas, H.; Costa, S.R.; Santos, M. 2017. Long-term sustainability of cork oak agro-forests in the Iberian Peninsula: A model-based approach aimed at supporting the best management options for the montado conservation. *Ecological Modelling*, 343: 68-79. DOI: <http://dx.doi.org/10.1016/j.ecolmodel.2016.10.008>
- Benavides, R.; Douglas, G.B.; Osoro, K. 2009. Silvopastoralism in New Zealand: review of effects of evergreen and deciduous trees on pasture dynamics. *Agroforestry Systems*, 76: 327. DOI: <https://doi.org/10.1007/s10457-008-9186-6>
- Bilotta, G.S.; Brazier, R.E.; Haygarth, P.M. 2007. The impacts of grazing animals on the quality of soils, vegetation, and surface waters in intensively managed grasslands. *Advances in Agronomy*, 94. DOI: [https://doi.org/10.1016/S0065-2113\(06\)94006-1](https://doi.org/10.1016/S0065-2113(06)94006-1)
- Brito, I.; Carvalho, M.; Alho, L.; Goss, M.J. 2014. Managing arbuscular mycorrhizal fungi for bioprotection Mn toxicity. *Soil Biology & Biochemistry*, 68: 78-84. DOI: <http://dx.doi.org/10.1016/j.soilbio.2013.09.018>
- Carvalho, M.; Goss, M.J.; Teixeira, D. 2015. Manganese toxicity in Portuguese Cambisols derived from granitic rocks: causes, limitations of soil analyses and possible solutions. *Revista de Ciências Agrárias*, 38 (4): 518-527. DOI: <http://dx.doi.org/10.19084/RCA15137>

Catarino, L.; Godinho, C.; Pereira, P.; Luis, A.; Rabaça, J.E., 2016. Can birds play a role as High Nature Value indicators of montado system?. *Agroforest Syst* 90, 45–56. <https://doi.org/10.1007/s10457-014-9761-y>

Ferraz-de-Oliveira, M.I.; Lamy, E.; Bugalho, M.N.; Vaz, M.; Pinheiro, C.; d'Abreu, M.C.; Silva, F.C. Sales-Baptista, E. 2013. Assessing foraging strategies of herbivores in Mediterranean oak woodlands: a review of key issues and selected methodologies. *Agroforest Syst* 87: 1421-1437. DOI: <https://doi.org/10.1007/s10457-013-9648-3>

Ferraz-de-Oliveira, M.I.; Azeda, C.; Pinto-Correira, T. 2016. Management of Montados and Dehesas for High Nature Value: an interdisciplinary pathway. *Agroforest Systems*, 90: 1-6. DOI: <https://doi.org/10.1007/s10457-016-9900-8>

Godinho, C.; Rabaça, J.E., 2011. Birds like it Corky: the influence of habitat features and management of 'montados' in breeding bird communities. *Agroforest Syst* 82: 183–195. <https://doi.org/10.1007/s10457-010-9345-4>

Hernández-Esteban, A.; Rolo, V.; López-Díaz, M.L.; Moreno, G. 2019. Long-term implications of sowing legume-rich mixtures for plant diversity of Mediterranean wood pastures. *Agriculture, Ecosystems and Environment*, 286: 106686. DOI: <https://doi.org/10.1016/j.agee.2019.106686>

Hunter Jr, M.L.; Acuña, V.; Bauer, D.M.; Bell, K.P.; Calhoun, A.J.K.; Felipe-Lucia, M.R.; Fitzsimons, J.A.; González, E.; Kinnison, M.; Lindernmayer, D.; Lundquist, C.J.; Medellín, R.A.; Nelson, E.J.; Poschlod, P. 2017. Conserving small natural features with large ecological roles: A synthetic overview. *Biological Conservation*, 211: 88-95. DOI: <http://dx.doi.org/10.1016/j.biocon.2016.12.020>

Jongen, M.; Förster, A.C.; Unger, S. 2019. Overwhelming effects of autumn-time drought during seedling establishment impair recovery potential in sown and semi-natural pastures in Portugal. *Plant Ecology*, 220: 183-197. DOI: <https://doi.org/10.1007/s11258-018-0869-4>

Kairis, O.; Karavitis, C.; Salvati, L.; Kounalaki, A.; Kosmas, K. 2015. Exploring the impact of overgrazing on soil erosion and land degradation in a dry Mediterranean agro-forest landscape (Crete, Greece). *Arid Land Research and Management*, 29: 360-374. DOI: <https://doi.org/10.1080/15324982.2014.968691>

Listopad, C.M.C.S.; Köbel, M.; Príncipe, A.; Gonçalves, P.; Branquinho, C. 2018. The effect of grazing exclusion over time on structure, biodiversity, and regeneration of high nature value farmland ecosystems in Europe. *Science of the Total Environment*, 610–611: 926-936. DOI: <http://dx.doi.org/10.1016/j.scitotenv.2017.08.018>

Lumbreras, A.; Marques, J.T.; Belo, A. F.; Cristo, M.; Fernandes, M.; Galioto, D.; Machado, M.; Mira, A.; Sá-Sousa, P.; Silva, R.; Sousa, L.G.; Pinto-Cruz, C., 2016. Assessing the conservation status of Mediterranean temporary ponds using biodiversity: a new tool for practitioners. *Hydrobiologia*, 782(1):187-199. <https://doi.org/10.1007/s10750-016-2697-7>

Lüscher, A.; Mueller-Harvey, I.; Soussana, J.F.; Rees, R.M.; Peyraud, J.L. 2014. Potential of legume-based grassland–livestock systems in Europe: a review. *Grass and Forage Science*, 69: 206-228. DOI: <https://doi.org/10.1111/gfs.12124>

Macek, P.; Schöb, C.; Pugnaire, F.I.; Núñez-Ávila, M.; Armesto, J.J. 2018. Shrubs mediate forest start-up and patch dynamics in a semiarid landscape. *Perspectives in Plant Ecology, Evolution and Systematics*, 34: 140-149. DOI: <https://doi.org/10.1016/j.ppees.2018.09.002>

Marcos, G.M.; Obrador, J.J.; García, E.; Cubera, E.; Montero, M.J.; Pulido, F.; Dupraz, C. 2007. Driving competitive and facilitative interactions in Oak Dehesas through management practices. *Agroforestry Systems*, 70: 25-40. DOI: <https://doi.org/10.1007/s10457-007-9036-y>

Pereira, P., Godinho, C., Gomes, M., Rabaça, J.E., 2014. The importance of the surroundings: are bird communities of riparian galleries influenced by agroforestry matrices in SW Iberian Peninsula?. *Annals of Forest Science* 71: 33–41. <https://doi.org/10.1007/s13595-012-0228-x>

Pinto-Correia, T.; Mascarenhas, J. 1999. Contribution to the extensification/intensification debate: new trends in the Portuguese montado. *Landscape and Urban Planning*, 46: 125-131. DOI: [https://doi.org/10.1016/S0169-2046\(99\)00036-5](https://doi.org/10.1016/S0169-2046(99)00036-5)

Pinto-Correia, T.; Ribeiro, N.; Sá-Sousa, P. 2011: Introducing the montado, the cork and holm oak agroforestry system of Southern Portugal. *Agroforest Systems*, 82: 99-104. DOI: <https://doi.org/10.1007/s10457-011-9388-1>

Pinto-Cruz, C.; Molina, J.A.; Barbour, M.; Silva, V.; Espírito-Santo, M.D. 2009. Plant communities as a tool in temporary ponds conservation in SW Portugal. *Hydrobiologia*, 634: 11-24. DOI: <https://doi.org/10.1007/s10750-009-9885-7>

Plieninger, T.; Pulido, F.J.; Schaich, H. 2004. Effects of land-use and landscape structure on holm oak recruitment and regeneration at farm level in *Quercus ilex* L. dehesas. *Journal of Arid Environments*, 57: 345-364. DOI: [https://doi.org/10.1016/S0140-1963\(03\)00103-4](https://doi.org/10.1016/S0140-1963(03)00103-4)

Plieninger, T.; Rolo, V.; Moreno, G. 2010. Large-Scale Patterns of *Quercus ilex*, *Quercus suber*, and *Quercus pyrenaica* Regeneration in Central-Western Spain. *Ecosystems*, 13: 644-660. DOI: <https://doi.org/10.1007/s10021-010-9345-2>

Pulido, F.J.; Díaz, M. 2005. Regeneration of a Mediterranean oak: A whole cycle approach. *Écoscience*, 12 (1): 92-102. DOI: <https://doi.org/10.2980/i1195-6860-12-1-92.1>

Rosset, V.; Simaika, J.P.; Arthaud, F.; Bornette, G.; Vallod, D., Samways, M.J., & Oertli, B., 2013. Comparative assessment of scoring methods to evaluate the conservation value of pond and small lake biodiversity. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 23(1): 23-36. <https://doi.org/10.1002/aqc.2287>

Sales-Baptista, E.; d'Abreu, M.C.; Ferraz-de-Oliveira, M.I. 2016. Overgrazing in the Montado? The need for monitoring grazing pressure at paddock scale. *Agroforestry Systems*, 90: 57-68. DOI: <https://doi.org/10.1007/s10457-014-9785-3>

Serrano, J.; Shahidian, S.; da Silva, J.M.; Sales-Baptista, E.; Ferraz-de-Oliveira, I.; Castro, J.L.; Pereira, A.; D'Abreu, M.C.; Machado, E.; de Carvalho, M. 2017. Tree influence on soil and pasture: contribution of proximal sensing to pasture productivity and quality estimation in montado ecosystems. *International Journal of Remote Sensing*, 39: 14. DOI: <https://doi.org/10.1080/01431161.2017.1404166>

Serrano, J.; Shahidian, S.; Silva, J.M.; Moral, F.; Carvajal-Ramirez, F.; Carreira, E.; Pereira, A.; Carvalho, M. 2020. Evaluation of the Effect of dolomitic lime application on pastures – Case study in the Montado Mediterranean ecosystem. *Sustainability*, 12: 3758. DOI: <https://doi.org/10.3390/su12093758>

Sevov, A.; Yancheva, C.; Kazakova, Y. 2017. Sustainable pasture management. *New Perspectives in Forage Crops*. DOI: <http://dx.doi.org/10.5772/intechopen.72310>

Simões, M.P.; Belo, A.F.; Fernandes, M.; Madeira, M. 2016. Regeneration patterns of *Quercus suber* according to montado management systems. *Agroforest Systems*, 90: 107-115. DOI: <https://doi.org/10.1007/s10457-015-9818-6>

Tulloch, A.I.T.; Barnes, M.D.; Ringma, J.; Fuller, R.A.; Watson, J.E.M. 2016. Understanding the importance of small patches of habitat for conservation. *Journal of Applied Ecology*, 53: 418-429. DOI: <https://doi.org/10.1111/1365-2664.12547>

Varela, E.; Verheyen, K.; Valdés, A.; Soliño, M.; Jacobsen, J.B.; De Smedt, P.; Ehrmann, S.; Gärtner, S.; Górriz, E.; Decocq, G. 2018. Promoting biodiversity values of small forest patches in agricultural landscapes: Ecological drivers and social demand. *Science of the Total Environment*, 619-620: 1319-1329. DOI: <https://doi.org/10.1016/j.scitotenv.2017.11.190>

Waters, C.M.; Orgill, S.E.; Melville, G.J.; Toole, I.D.; Smith, W.J. 2017. Management of grazing intensity in the semi-arid rangelands of Southern Australia: Effects on soil and biodiversity. *Land Degradation & Development*, 28: 1363-1375: DOI: <https://doi.org/10.1002/ldr.2602>

Williams, P.; Whitfield, M.; Biggs, J.; Bray, S.; Fox, G.; Nicolet, P.; Sear, D., 2004. Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape in Southern England. *Biological conservation*, 115(2), 329-341. [https://doi.org/10.1016/S0006-3207\(03\)00153-8](https://doi.org/10.1016/S0006-3207(03)00153-8)