

Supplementary Material

Tab. S1 - SFM indicators for cork oak forests proposed and tested in this study (for details and references, see the section “Development of the indicators”).

Code	Indicator	Reference for good practices
1	Period of cork extraction	May-September. In case of extraordinary climate events (spring and/or summer drought) cork collection is not recommended
2	Cork extraction frequency	9 (10)-12 years, according to the average time needed for cork to reach the suitable thickness for cork stoppers
3	Maximum cork extraction height on stem	
3.1	First extraction height	Modified harvesting coefficient ($HC_{mod} = \text{maximum debarking length} / \text{stem perimeter at 1.30 m stem height}$) = 2
3.2	Next extraction height	$HC_{mod} = 3$
4	Minimum CBH for the first cork extraction	60 cm over the bark at 1.30 m stem height
5	Limiting grazing damage to vegetation	According to local law, unless differently prescribed by a specific grazing management plan. To limit grazing by cattle, sheep and goats (i.e. reduction of number of livestock per unit area or temporary grazing exclusion) in the absence of cork oak regeneration or low seedling recruitment
6	Maximum reduction of tree density (tree number and basal area)	Each thinning intervention can reduce tree density by a maximum of 20% with respect to current stand basal area. Overall removal of basal area at forest management unit level must be below a yearly rate of 2%. Exceptions can occur in the presence of serious tree health issues or of conversion from coppices to high forests
7	Soil erosion prevention	Mechanical interventions (plowing and subsoiling) are allowed only on slopes below 15%. On steeper terrain (>15%) only mechanical interventions proved to be low-impacting (e.g. conservation tillage) are allowed
8	Limiting negative impacts from activities of cork extraction through prevention and/or mitigation measures	
8.1	Remove cork without damaging the cambial tissue	A maximum of 5% of trees per stand damaged by cork extraction is allowed. In the event of an accidental higher rate, trees with healed wounds will be subtracted from the total rate.
8.2	Pruning	Remove dead branches due to canker (casual agent <i>Biscogniauxia mediterranea</i> (De Not) O. Kuntze) and prune them, at the moment of cork extraction, to limit canker diffusion. Disinfecting pruning surfaces to avoid the spread of diseases. Use only chemical products authorized in the forest. Proper equipment and training should be provided to minimize health and environmental risks
8.3	Verify the health status of cork oak trees before cork extraction	In the case of extraordinary drought events or significant pest and pathogen attacks, inform the Authority and suspend cork extraction on stressed and/or damaged trees. Adoption of sanitary measures. is also recommended (i.e. pruning to limit canker diffusion; use of biological control methods for pest management).
8.4	Cork extraction operations can be exclusively performed by specialized personnel, specifically trained and formally authorized (when foreseen)	

Code	Indicator	Reference for good practices
9	Structural diversification of cork oak stand	
9.1	Age/size classes distribution at stand level	1) Density: 50-1000 cork oak tree/ha with CBH > 30 cm. 2) Old trees not exploited for lack of productivity can be released for multi-habitat function (if considered useful and according to indicator 9.3) 3) Big trees: minimum 20% of basal area must be provided given by trees with CBH larger than 85 percentile 4) Small trees: minimum 10% of trees must have CBH<60 cm
9.2	Vegetation cover at stand level	1) Tree crown cover must be between 20% and 80% 2) The total vegetation cover (trees, shrubs, perennial herbs) must be over 85%. Understory vegetation can be reduced to facilitate cork oak (or other broadleaves) regeneration.
9.3	Regeneration (natural and/or artificial)	In the case of degraded and/or burned cork oak stands adopt special care for regeneration, using assisted natural regeneration. In the case of artificial regeneration use genetic resources coming from seed forests located in the same Region of Provenance (RoP) or from the most appropriate RoP considering both current climate and changing future scenarios.
10	Fire management	In the case of high fire recurrence (time frame less than five years), reducing understory vegetation is recommended as a preventative action (i.e. reduction of fuel mass that may facilitate the shift from surface to dangerous crown fires) to safeguard cork oak regeneration. Suspend cork extraction (at least one year) in burned stands.