



Marteloscope Sierra de Fonfaraón y Mulleiroso

Field guide

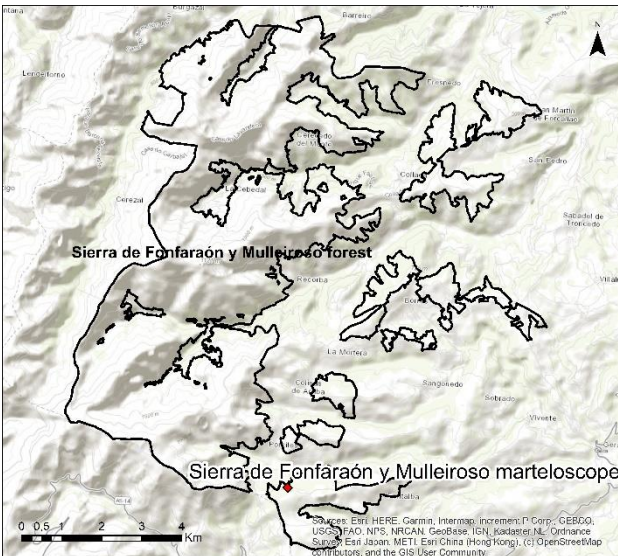


Sierra de Fonfaraón y Mulleiroso forest

The forest of Sierra de Fonfaraón y Mulleiroso is located in the municipality of Tineo (Asturias). It is a public forest owned by Tineo's city council and managed by the Consejería de Medio Rural y Cohesión Territorial (Gobierno del Principado de Asturias).

Historically the main activity in this forest has been grazing, which has had its intensity reduced in the last 30 years. This has facilitated the restoration of the tree cover. The forest currently has important stands of conifers (created in the last 25 years) and broadleaves. However, most of the forest is composed of flat terrains dominated by thickets of gorse (*Ulex europaeus*, *Ulex gallii*) and heather (*Erica arborea*, *Erica aragonensis*, *Erica cinerea*), with the presence of *Genista tridentata*, *Arbutus unedo* and some shrubby *Quercus pyrenaica*.

The forest is located in the mountains of Fonfaraón and La Cogocha, with an altitudinal range between 333 m on the banks of the Navelgas River and the Yerbo Stream, to the north; and the 1290 m of Pico Mulleiroso, to the west. The average altitude is 778 m. The terrain is rugged with moderate slopes. The flattest areas are occupied by grassland, mostly natural but also planted with species of great production. The north and east orientations are predominant.



Location of the Sierra de Fonfaraón y Mulleiroso forest.



5497 ha
Total forest area

9.62 m³/ha
Annual increment in
the forested area

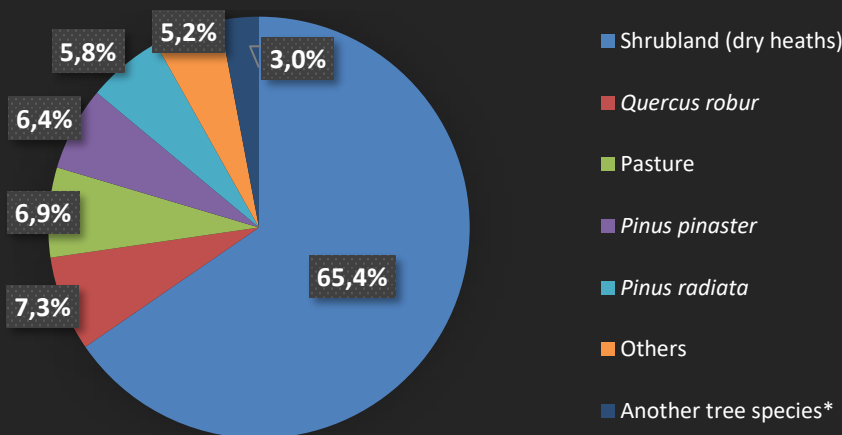
112,909 m³
Actual average stock

1244 ha
Forested area

91 m³/ha
Stock in the forested
area

3614 ha
Shrublands

64 % conifers
36 % broadleaves



**Pinus sylvestris*, *Betula celtiberica*, *Pseudotsuga menziesii*, *Pinus nigra* and *Quercus pyrenaica*, among others.

0.1 LU/ha
Range count
for shrublands

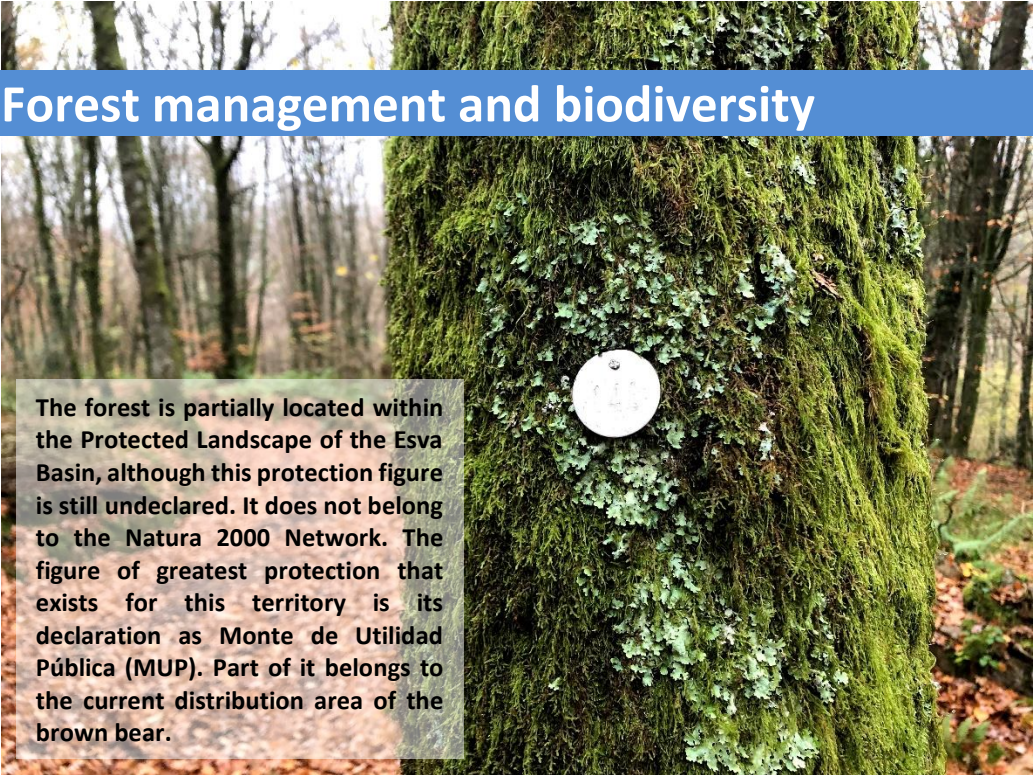
42.9 m/ha
Roads and trails
density

27.7 t/ha
Dry matter biomass

1.5 LU/ha
Range count
for pastures

50.3 t/ha
CO₂

Forest management and biodiversity

A close-up photograph of a tree trunk in a forest. The trunk is heavily covered in vibrant green moss and liverworts. A white circular marker is attached to the trunk. The background shows a blurred forest scene with trees and fallen leaves.

The forest is partially located within the Protected Landscape of the Esva Basin, although this protection figure is still undeclared. It does not belong to the Natura 2000 Network. The figure of greatest protection that exists for this territory is its declaration as Monte de Utilidad Pública (MUP). Part of it belongs to the current distribution area of the brown bear.

The predominant tree formations are the forests of *Quercus robur* and the reforestations of *Pinus pinaster* and *Pinus radiata*. There are also small stands of chestnut, birch and beech. The presence of accompanying species, such as *Ilex aquifolium*, *Acer pseudoplatanus* or *Prunus avium*, is currently very scarce. Therefore, efforts are being made to promote such species, as they contribute to the biodiversity of the forest.

The forest has been in a phase of capitalization, without having extracted hardly any wood in recent years. Therefore, the priority has been its protective function against erosion, which is favoured by the recurrent forest fires that occur in the area.

All the planned forestry actions will tend towards the conservation and improvement of the habitats most demanded by the brown bear (*Ursus arctos*). Phytocides will not be used in the cleanings and irregular edges will be left to enhance the edge or ecotone effect. Dominated and dying trees, which serve as a refuge for biodiversity, will be retained as well. Pruning debris will be left in the soil, preventing erosion and nutrient export, while favouring invertebrate populations.

Livestock use (mainly equine and beef) is still very important in the forest, especially in grasslands and, to a lesser extent, in scrub areas.

73.1 %

of the forest area are habitats
of community interest (HCI)

3614.1 ha

of HCI 4030 "European dry heaths"

406.4 ha

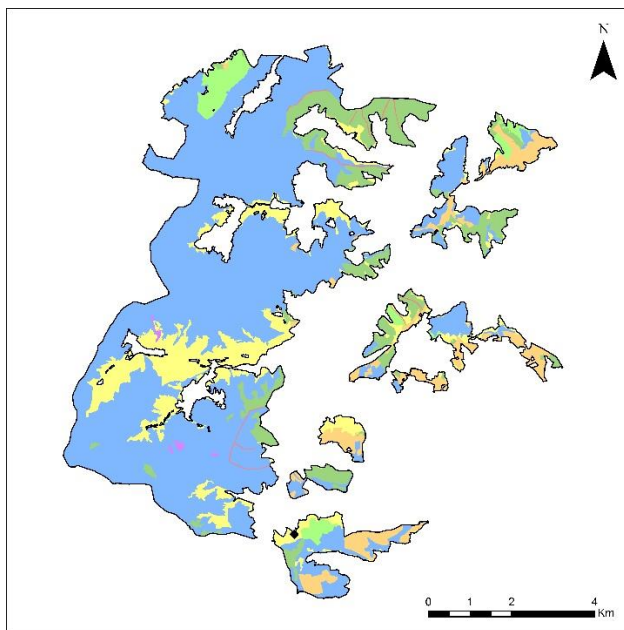
of HCI 9230 "Mediterranean-Ibero-
Atlantic and Galaico-Portuguese
oak woods of *Quercus robur* and
Quercus pyrenaica"

1.18 m³/ha

of standing deadwood

8,902.51 m²

lying deadwood surface



Land cover according to
Mapa Forestal de España
(1:25.000).

Legend

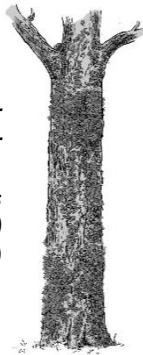
- ◆ Marteloscope
- Broad-leaved forest
- Conifer forest
- Mixed forest
- Shrubland
- Scarce vegetation
- Firebreaks
- Agricultural lands and pasture

Habitat structures

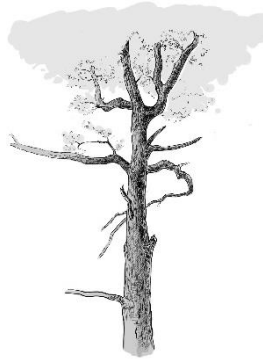
Large quantities of deadwood and a high density of old microhabitat-bearing trees are characteristic elements of natural forests, especially of the old-growth phases. These phases are often absent or rare in managed forests, even in forests under close-to-nature management. Also in selective harvests and thinnings, 'defective' trees referring to these old-growth phases (hollow, dead and languishing trees) are often removed. Yet, an important share of forest biodiversity is strictly or primarily dependent on these elements for their survival, especially 'saproxyllic' species, those are species depending on deadwood.

Most species dependent on old-growth elements and phases have become threatened. Conservation of biodiversity in commercial forest stands is mainly a question of conservation of adequate amounts of deadwood and retention of such microhabitat structures.

Lianas and other climbing plants cover the trunk surface (e.g. *Hedera helix*, *Clematis vitalba*)
(EP33)



Dead branches and limbs / crown deadwood
(DE11)



Tree trunk covered by foliose and fruticose lichens (often in association with bryophytes)
(EP32)



Tree trunk covered by mosses and liverworts
(EP31)



Most common habitat structures in the marteloscope.

...and biodiversity



Ursus arctos



Chioglossa lusitanica



Lucanus cervus



Canis lupus



Lepus granatensis



Cervus elaphus

Site conditions

Coordinates (X; Y):	208,504; 4,799,670 (ETRS 89 UTM Zone 30N).
Type of forest:	Montane oak forest with beech.
Natural forest community:	<i>Blechno spicanti – Querceto roboris sigmetum.</i>
Soil:	Ranker (protoranker, silty grey ranker and brown ranker) above sandstone, granite and schist.
Geology:	Slate and quartzite (Silurian).
Altitude:	819 m.a.s.l.
Mean annual temperature:	10.6 °C.
Annual precipitation:	1207 mm.
Summer precipitation (June 1st – August 31st):	163 mm.
Mean period of drought:	None.

The climate is temperate oceanic, with abundant rainfall and average monthly temperatures between 24°C and 0°C. Snowfall in winter and rainstorms in summer are common, without periods of drought. These climatic conditions do not pose serious limitations to the growth of forest stands. The forest in the marteloscope is an oak grove of *Quercus robur* accompanied by beech (*Fagus sylvatica*). To a lesser extent, there are also other broadleaves such as birch, maple and chestnut trees. There are no conifers. *Pteridium aquilinum*, *Vaccinium myrtillus* and *Erica sp.* stand out as part of the understory.

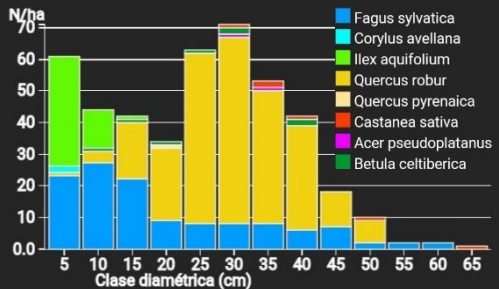


Stand characteristics

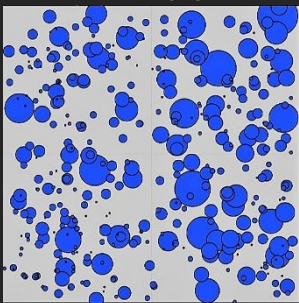
Very close to the southern limits of the MUP "Sierra de Fonfaraón y Mulleiroso" is located the [Sierra de Fonfaraón y Mulleiroso](#) Marteloscope. It is a mature forest with a predominance of old-growth trees.

Stand data

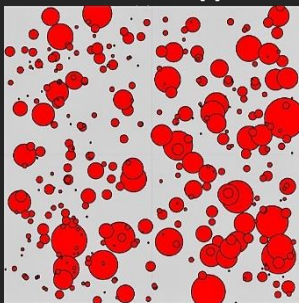
N [stems/ha]	443
BA [m ² /ha]	30.5
Volume [m ³ /ha]	209.4
Habitat value [points]	7,951
Economic value [€]	10,314
Standing deadwood [m ³ /ha]	4.9
Lying deadwood [m ³ /ha]	3.0



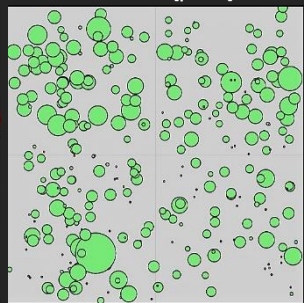
Volume [m³]



Economic value [€]



Habitat value [points]



The **economic value** (in €) is estimated for each tree based on volume, stem quality and corresponding local timber price lists.

The **habitat value** (in points) is assessed for each tree based on tree microhabitats, taking into account the rarity of each habitat and duration for it to develop.

The evaluation of the habitat value is based on a comprehensive catalogue of tree microhabitats. It comprises 23 saproxylic and epixylic features such as cavities, large dead branches, cracks and loose bark, epiphytes, sap runs, or trunk rot characteristics. Tree microhabitats are of prime importance for specialized and often endangered forest species of flora and fauna.

Ecological value assessment

Each tree-related microhabitat represents a habitat structure. There are three variables related to each of them, given values from 1 (minimum significance for that given variable) to 5 (maximum relevance).

These three variables are:

Score: Importance of habitat structure as a refuge for biodiversity.

Rarity: Infrequency or scarcity.

Development: Time needed for its growth.



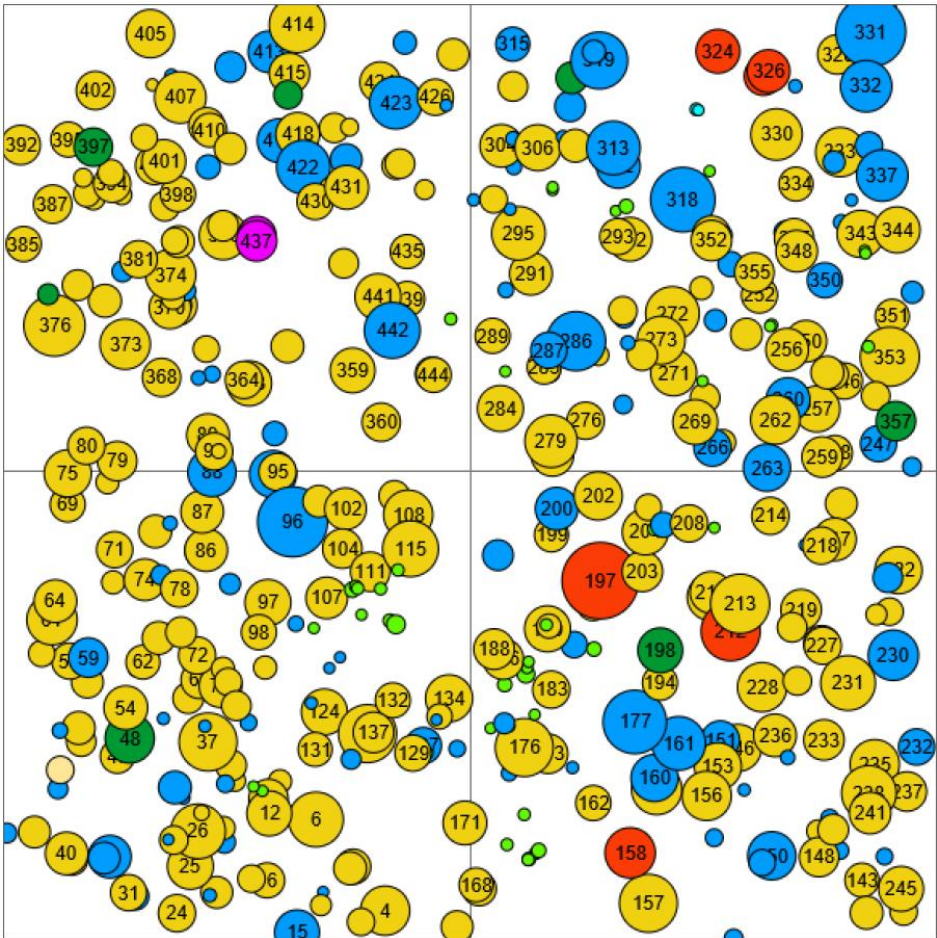
Example of EP33 found in the marteloscope.

The ecological value of each habitat structure is therefore calculated by **adding the rarity and development values, and multiplying that sum by the score value**. The ecological value of a tree will therefore be the addition of the values of each of its habitat structures. Finally, the total ecological value of the marteloscope, would be either the addition of the values of all the trees, or the addition of the value of all the structures (there can be several per tree).

Table used for the calculation of the ecological value. Due to space limitations, only the 10 highest values are displayed. For more details about microhabitats see Kraus et al. (2016).

	Habitat structure code	Score	Rarity	Development	Habitat structure value	Nº of trees with this structure	Ecological value
Saproxilyc microhabitats	CV11	2	4	2	12	8	96
	CV15	5	5	5	50	2	100
	CV21	2	5	5	20	6	120
	IN21	2	4	3	14	19	266
	DE11	1	3	4	7	150	1050
	DE12	2	3	4	14	57	798
Epixylic microhabitats	EP12	4	5	4	36	2	72
	EP31	1	3	1	4	75	300
	EP32	2	4	2	12	83	996
	EP33	3	5	3	24	163	3912

Marteloscope tree map



The size of these circles is a relative representation of the diameters of the different trees. In no case is it their actual diameter.

- *Fagus sylvatica*
- *Corylus avellana*
- *Ilex aquifolium*
- *Quercus robur*
- *Castanea sativa*
- *Betula celtiberica*
- *Acer pseudoplatanus*

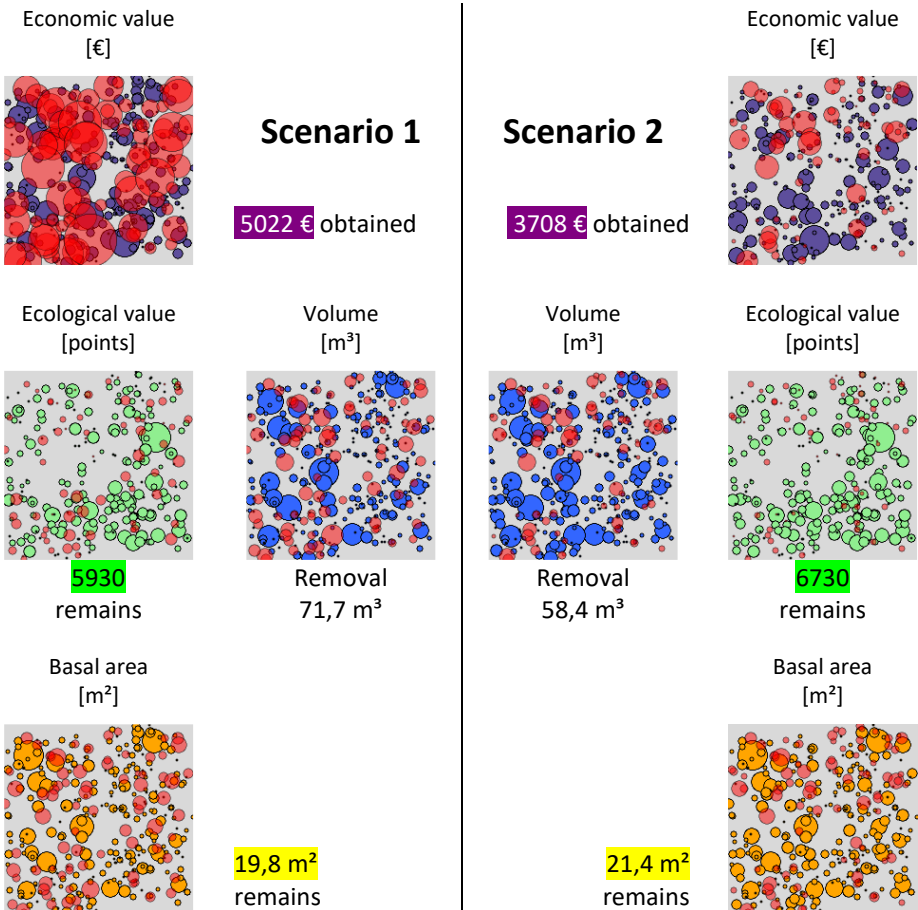


Example of interventions

A comparison of two interventions is shown as a result of a virtual tree selection exercise in the **Sierra de Fonfaraón y Mulleiros** marteloscope. Following the guidelines of this forest management plan, the objective in both exercises is to maintain around 50% of the initial basal area of the standing oak, respecting its target diameter (30 cm). In addition, 5% of the trees with the highest habitat value are retained for both cases.

Scenario 1: The proposed cutting optimizes the economic return. Trees are selected from the highest to the lowest economic value until the objective is met. The best quality wood is extracted ($\geq 30\text{€}/\text{tree}$).

Scenario 2: The proposed cutting optimizes the ecological value of the remaining microhabitats. Trees are selected from the lowest to the highest value of habitats until the objective is met. Trees with habitat values < 30 ecopoints are extracted.



References

Photographs page 7: Pablo Ezequiel Pérez Valdés

The different graphs, tables, screenshots, and other exercise results were created using the 'I+' software:

1) iplus.efi.int

2) Schuck, A., Kraus, D., Krumm, F., Held, A., Schmitt, H., 2015. Integrate+ marteloscopes – Calibrating silvicultural decision making. Integrate+ Technical Paper No. 1. 12 p.

García, E., (2015): Observatorio de precios de productos forestales, RedFor, Confederación de organizaciones de selvicultores de España. https://selvicultor.net/redfor/wp-content/uploads/Observatorio-de-precios-Completo_Sep-2015_Final.pdf

García, R. y Garrote, J., 2016. Proyecto de Ordenación de los Montes "Sierra de Fonfaraón y Mulleiroso" y "Foz, Zardaín, Yerbo y Fresnedo". Estudio Técnico Moal Muniellos. Dirección General de Montes e Infraestructuras Agrarias. Consejería de Desarrollo Rural y Recursos Naturales. Gobierno del Principado de Asturias. 185 p.

Kraus, D., Bütler, R., Krumm, F., Lachat, T., Larrieu, L., Mergner, U., Paillet, Y., Rydkvist, T., Schuck, A., and Winter, S., 2016. Catalogue of tree microhabitats – Reference field list. Integrate+ Technical Paper. 16p.

The Integrate Network is an alliance of representatives of different European countries that promotes the integration of nature conservation into sustainable forest management at the policy, practice and research level. Forest management challenges related to nature conservation are rather similar across Europe. The Integrate Network promotes the exchange of successful management practices and experiences amongst its Members. The European Forest Institute (EFI) accompanies the process in its role as facilitator and scientific advisor.



Rojó Serrano, L., Garrote Haigermoser, J., Ramírez-López, M., García-Lanchares, C., Martínez Ruiz, A., Dregorio Aguilar, A., 2022. The Sierra de Fonfaraón y Mulleiroso marteloscope field guide. Integrate Network Technical Paper. 14 p.

MITECO, 2022

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