BIODIVERSITY MONITORING

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DEHESAS AND MONTADOS

DEHESAS AND MONTADOS ARE EXTENSIVE WOOD PASTURES DEVOTED TO LIVESTOCK REARING IN THE IBERIAN PENINSULA.

There is a high heterogeneity in these landscapes with dispersed trees working as keystone species. Besides their use for cork production and extensive livestock rearing, they provide an important habitat for many threated large species. The traditional practice grazing has been used for centuries in the Dehesas and Montados. Landscape heterogeneity combined with traditional practices contribute positively to the soil quality and biodiversity.

These landscapes are increasingly under threat from the intensification of livestock, the lack of natural regeneration and the decline of the trees, caused by different pathogenic agents among which root rot stands out, killing them in huge numbers. This is combined with an increasing amount of people leaving the countryside, requiring urgent action both on the ground and at national and regional level.

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Alliance for Mediterranean Nature & Culture

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Sheep

1. OBJECTIVES

Evaluation of the impact of some traditional practices with the assumption that they play a positive role on the health and functioning of the soil-grass-tree system, and thus indirectly on the plant and mesofauna diversity, the base of the overall biodiversity and recovery of the functionality of ecosystems (water and nutrient cycles). The traditional practices under evaluation are transhumance, guided shepherding, adaptive grazing and redileo (penning).

SELECTED INDICATORS

Monitoring at the parcel level is based on easily applicable indicators of soil/grass health, structural diversity (habitat + state of woody vegetation), and biological activity and/or key species. These were complemented with an overarching taxonomical inventory of plants, butterflies and coprophagous beetles (Table 1). In addition, a landscape level analysis was carried out to evaluate dehesas/montados of High Natural Value (HNV index).

INDICES	BIOLOGICAL ACTIVITY	BIODIVERSIY
Grass Health Index (ISP)	**Plants:** Presence of indicator species	**Plants:** Floristic Inventory
Structural Complexity Index (SCI)	**Butterflies:** Count by morpho-species	**Coprophagous beetles:** Traps and species determination
Soil Health Index (Microbial diversity and enzymatic activity)	**Coprophagous beetles:** state of excrements of sheep/goats	
	Ants: Density of anthills	
	Earthworms: Earthworm activity and density (excreta)	

Table 1: Levels of monitoring at parcel scale (health/quality indices, biological activity and biodiversity). The evaluated variables are summarized for each level.

2. METHODS

A total of 6 farms (9.000 ha) were monitored in Extremadura (Spain), where cultural practices were implemented: adaptive grazing, redileo, difference between cow into sheep and transhumance. A selection of 3 replicated farms per practice. Within each farm, there were three replicate plots for each practice with 3 respective control plots. At landscape level, a specific methodology was developed in order to characterize HNV in dehesas and montados, using land use maps and identification by an experts panel.

2.1. INDICES

Precise protocols are established for the evaluation of the health status of the grassland (ISP) and the quality of the site/landscape (ICS/ICP).

METHODS FOR DATA COLLECTION

Grass Health Index (ISP)

Developed by the University of Extremadura, Trashumancia y Naturaleza and WWF Spain and adapted to Dehesas/ Montados from the Rangeland Health Index (Borrelli & Oliva, 2001). This index reflects the health of grasslands using 11 easy-to-see bio-indicators (among others percentage of bare soil, presence of trees, traces of water erosion, etc.). Said indicators have to be calibrated with reference areas, places considered as the best expression of biodiversity, site stability and ecosystem function within an ecological area. A score from -100 to +100 is deducted from the observations and evaluates the conservation status of the grassland (Table 2, Figure 1).

NUM	ATTRIBUTE	BIOLOGICAL INDICATOR	SCORE	WATER CICLE	MINERAL CICLE	ENERGY FLOW	COMMUNITY DINAMICS
1	Bare soil	% Bare soil	20 to -20	✔	✔	✔	✔
2	Crust/ compaction	Supercicial crust hardness	10 to -10	✔			
3	Water erosion	Active microsurces, gully	0 to 20	✔			
4	Soil fauna	Evidenceof microfauna	10 to 0		✔		
5	Dung decomposition	Dung actiquity	10 to 0		✔		
6	Perennial grass	Cover	10 to 0			✔	✔
7	Legumes	Abundance and vigor	10 to 0			✔	✔
8	Shrubs	Type	10 to -10			✔	✔
9	Trees	Adult tree health	10 to -10			✔	✔
10		Regenerartion	10 to -10			✔	✔
11	Productivity	% Potential	10 to -10			✔	✔

Table 2. Summary of attributes, biological indicators and scores of Rangeland Health Index. ✔ = Ecological Process

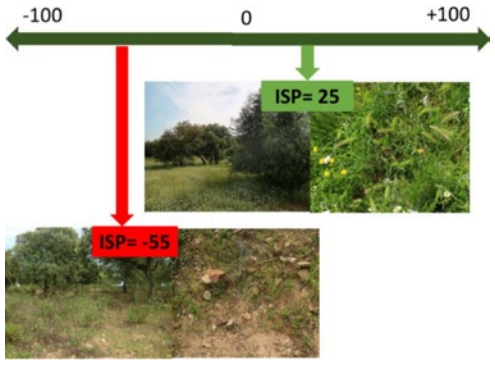

Figure 1. Example of the score of RHI in two dehesas .

Structural Complexity Index (SCI)

Adapted to Dehesas/Montados, this index developed by Zenner & Hibbs (2000) reflects the complexity of the selected area and the potential biodiversity it can hold in four different levels:

1. Structure, health and regeneration of the arboreal stratum
2. Scrub stratum
3. Dead wood and degree of grazing
4. Singular elements (terraces, dry-stone walls...)

Dehesas soil health index

Index for quality of soil measuring microbial diversity and enzymatic activity.

2.1.2. PLANTS

Plants are an indicator of primary production and provide different services for other organisms (food, shelter, breeding sites). Key species are identified in the context of the dehesas/montados, with a higher number of these species indicates a greater global floristic diversity. The list of indicator species has been made from the analysis of more than 300 floristic inventories.

METHODS FOR DATA COLLECTION

For the identification of the key species, a surface is chosen of 10 x 10 meters (100 m^2) in each sampling site. The location for these surfaces is chosen at representative places, for example avoiding the shade of the trees. On the surface of the 100 m^2, all the key species found are identified and noted on the field form. The coverage-abundance of the different species is determined using the Braun-Blanquet scale (1928).

INDEX	COVER
+	Presence
1	< 5%
2	5-25%
3	25-50%
4	50-75%
5	> 75%

Table 3. Braun-Blanquet cover-abundance scale

2.1.3. COPROPHAGOUS BEETLES

Coprophagous beetles play a key role in nutrient cycling by recycling animal manure. They are therefore more sensitive to changes in livestock management. The biological activity of the coprophagous beetles is evaluated through the qualitative study of the state of the animal droppings. An evaluation form was made to define coprophagous activity in cow excrements and experiment to detect coprophagous activity in excrements of sheep and goats.

METHODS FOR DATA COLLECTION

Observations have to be made in favourable periods (spring and autumn), and on recent dung that was deposited in these periods. Sampling stations are chosen where cattle have been recently present. At each sampling station 10 dung are evaluated, considering their state of decomposition, if they are completely disintegrated, etc. In addition, an evaluation is done whether the manure has galleries, how the manure is consumed, as well as the associated animals.

2.1.4. BUTTERFLIES

The butterfly abundance and richness is a reflection of the conservation of natural resources. Butterfly species are identified along a foot transect.

METHODS FOR DATA COLLECTION

Data collection is carried out by linear transects on foot, at a constant speed of 15 minutes. The morpho-species of butterflies are identified, as well as the number of individuals of each one. The count of the different morphospecies of butterflies is carried out within a band of 2.5 m on both sides of the observer and 5 m in front of him/her.

2.1.5. EARTHWORMS

Earthworms are key organisms due to their role in organic matter decomposition, soil structure development and nutrient cycling. This indicator evaluates their activity by looking at the degree of abundance of excreta of earthworms.

Iberian pigs in the dehesa © Concha Salguero

METHODS FOR DATA COLLECTION

It is recommendable to perform the data collection in spring or autumn, as the earthworm migrate to deeper layers of soil in very cold or hot climatic conditions. For the data collection, 50 x 50 cm frames are used along a 25 m transect (10 frames per transect). Three transects will be carried out in representative areas at each sampling station. The activity of earthworms is measured by evaluating on a scale of 1 to 5 the abundance of worm excreta, where 1 signifies no excreta and 5 a great abundance.

2.1.6. ANTS

Ants play an important role in the nutrient cycle and soil enrichment. The biological activity of ants is evaluated through the abundance of anthills on a certain surface.

METHODS FOR DATA COLLECTION

A count of the number of anthills is carried out along a 25 m transect, one meter on each side of the transect, representing a total area of 50 m2. Three transects are carried out in representative areas at each sampling station. The end result is the abundance of number of anthills per surface.

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2.1.7. HNV INDEX

High Nature Value Systems (HNVS) are productive agricultural, livestock or forestry areas, traditionally subjected to low-intensity uses and management practices that support natural habitats and wild species of high conservation value.

Using a GIS system, elements defining a high potential of biodiversity are identified. This methodology, developed by WWF Spain and GANNIK, allows monitoring the evolution of these High Nature Value areas over time. On top of that, by integrating the information on Site Quality Index/Potential Biodiversity Index (SCI) with existing cartographic data on land cover and land use (SIGPAC, SIOSE, etc.), the dehesas/montados are evaluated on their High Natural Value (Martinez-Agirre & Astrain 2020).

METHODS FOR DATA COLLECTION

A meeting with experts was organized to determine and define the elements of High Nature Value dehesas/montados. The methodology is based on the work by Iragui et al. (2010) for the identification of HNV Agrarian and Forestry Systems in Navarra at a regional level. Said methodology is based on the previously classification of HNV agricultural lands into three types, proposed by Oppermann et al. (2012):

- Type 1: Agricultural land with a high proportion of semi-natural vegetation
- Type 2: Agricultural land with a high degree of heterogeneity, with a mosaic of semi-natural vegetation and agricultural uses with a low degree of intensification, together with other small structural elements.
- Type 3: Agricultural lands that hosts threatened species or high proportions of their European or global populations, and may include areas with intensive management.

Due to the spatial heterogeneity and the semi-natural nature of the dehesas/montados, it is considered that the HNV dehesas will already correspond to Types 1 and 2. Therefore, for the identification of HNV dehesas, those dehesas that meet HNV requirements should be:

- Type 1. They correspond to dehesas covered by permanent pastures, not cultivated and without irrigation.
- Type 3. Dehesas that still do not meet the HNV Type 1 requirements, are home to threatened species or high proportions of their European or global populations.

3. REFERENCES

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