ASSESSING GRAZING IMPACT:
INDICATORS OF GRAZING PRESSURE IN MONTADOS

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WHY IS IT IMPORTANT?
Grazing pressure

The ratio of forage demand to forage available at one point in time.
Grazing pressure is dynamic.

With higher grazing pressure, overgrazing risk increases.

Sales-Baptista, et al., 2015
The number of animals a land manager places on a piece of land for a specified period of time

Used as proxy for grazing pressure at landscape and economical scales
Stocking density

Amount of animals present on the land at any given time

Used in ecological surveys for estimating populations
Indicators

To monitor grazing pressure we need **SMART** indicators:

- **Specific**: measures what they claim
- **Measurable**: accessible data that we know how to find
- **Attainable**: quick and simple to measure
- **Relevant**: the information must be useful for our purpose
- **Time-bound**: We must able to compare results over time
HOW TO ASSESS GRAZING ON-FARM?
Representative samples

Feed resources over large areas

- Farms frequently have more than 500 ha
- Paddock area could have more than 70 ha
Representative samples

Grazing animals contribute to patchiness

- feed resources
- locations

Sales-Baptista, 1995
When assessing disturbances due to grazing pressure it is critical that sampling methods take grazing behaviour into account.
Management grazing intensity for enhancing Montado High Nature Value
Questions and constraints

What we want to know?
Grazing impact on biodiversity

What practices we want to test?
Grazing pressure

How will we conduct the survey?
Not interfering with farm practices

What will we measure and how?
Animal and vegetation variables
Sampling

Monfurado
Natura 2000 site

17 Farms

29 Grazing Paddocks
Stratified Sampling

58 Sampling Plots

1.5 ha each plot

Grazing Behaviour

Grazing sites
Resting sites

Based: Manager reports of preferred occupation
Stratified Sampling

Strata of contrasting occupation:

**High and Low grazing pressure**

**Defined** in orthophotomaps (grid 6 squares of 500 m²)

**Based** on independent site proprieties:
Places of watering points, fences and gates
Random Sampling

Vegetation
15 Oak Trees

Transect within plots

~2000 m² each

Oak Tree
Random Sampling

5 Oak Trees within transect

Vegetation

Shrubs

Pasture

8 Quadrats

(1m²)
Random Sampling within transect plots

Animal Dung Counting

2 Transects (5 x 40m)
Data

We have assessed **66 indicators** from 2320 samples as indirect variables of grazing pressure.

**Tree regeneration**

1. Seedlings: $h \leq 10$ cm (densidade)
2. Saplings - class 1: $10 < h \leq 70$ cm. Medir DB
3. Saplings - class 2: $70 < h \leq 130$ cm
4. Young trees - class 1: $h > 130$ cm and $\text{CAP} \leq 9.5$ cm
5. Young trees - class 2: $h > 130$ cm and $9.5 < \text{CAP} \leq 37$ cm
6. Young trees - class 3: $h > 130$ cm and $37 < \text{CAP} \leq 69$ cm
7. Virgin trees (not exploited): $h > 130$ cm and $\text{CAP} > 69$ cm

**Cover index**

\[ IC = 1 - \prod_{i=1}^{4} \left(1 - \frac{C_i}{100}\right) \]
Statistical analysis

1. Assessment of distribution and homogeneity of variance and selection of indicators ($p > 0.70$).

2. Principal component analysis (varimax rotation) using the selected indicators to extract factor scores (eigenvalue $> 1$).

3. Linear regression to evaluate the performance of the new variable produced through the PCA.
## t-test

<table>
<thead>
<tr>
<th>Variables</th>
<th>t-val.</th>
<th>df</th>
<th>p</th>
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<td>Shrub cover S</td>
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# Levene’s test

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<td>Shrub cover S</td>
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# Brown-Forsythe test

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## Wilcoxon-Mann-Whitney test

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<td>294.50</td>
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<td>Tree regeneration(^{1-7/UC})</td>
<td>293.50</td>
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<td>0.048</td>
<td>-1.98</td>
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<td><strong>Shrub cover(^{A/UC})</strong></td>
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<td>0.026</td>
<td>-2.27</td>
<td>0.023</td>
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<tr>
<td><strong>Shrub cover(^S)</strong></td>
<td>252.00</td>
<td>-2.62</td>
<td>0.009</td>
<td>-2.76</td>
<td>0.006</td>
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</table>
Shrub Cover

Shrub Cover $^\text{A/UC}$

- Mean

- Mean $\pm$ SE

Shrub Cover $^\text{S}$

- Mean

- Mean $\pm$ SE

Grazing Pressure

High

Low
<table>
<thead>
<tr>
<th></th>
<th>PCA1</th>
<th>PCA2</th>
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<td>Shrub cover</td>
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<tr>
<td>Shrub cover</td>
<td>0.806</td>
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<tr>
<td>Eigenvalue</td>
<td>2.578</td>
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<td>% of total variance</td>
<td>51.553</td>
<td>21.318</td>
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</table>
Linear regression

\[ y = -12.49x + 35.764 \]

\[ R^2 = 0.4251 \]
WHAT HAVE WE LEARNED?
Sampling

The disparity between grazing strata proves useful

- as a measure of **patchiness** of pasture
- **enable comparisons** of grazing pressure within and between paddocks

Requires a small sample size which can **save** a lot of time, money and effort.
Sampling

However the gain of the approach depends on the differences among stratum averages:

- some animal and vegetation variables should not be used as indicators

- may not be of relevance for specific species (e.g. birds surveys)
Cattle have a steady state of excretion and an even excreta distribution.

Mainly depend on site and not on forage characteristics.
WHAT WE RECOMMEND?
Indicators

For **future assessment protocols** of livestock impact on biodiversity

- the use of dung counting should not be used as a proxy of grazing impact
- measures of vegetation (tree regeneration and shrub diversity) should be favoured
THANKS!