Assessment of the vegetation structure influence on bird communities’ occurrence in Iberian agro-forestry systems

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Objectives

• To study of the relationships between the vegetation structure and the breeding bird (passerine) community composition.

• To identify physiognomic types of vegetation with faunistic importance, based on different measures, including vegetation vertical structure, percentage of vegetation cover types, and vegetation diversity measures.

• To develop a methodology to classify vegetation in order to understand the breeding bird composition and distribution.

• This approach for classifying habitat types allows a consistent development of wildlife management strategies in agro-forestry systems.
Methods

Data collection

• 4 transects - 2 in Évora (Santa Sofia and Guadalupe/Valverde) and 2 in Setúbal (Marco do Grilo and Lagoa do Golfo).

• The transects have a total length of 2 km, divided in 10 sections of 200 m each.

• Avian species:
  - Census using the Line Transects method (BIBBY et al., 1992).
  - Bird censuses were carried out between April and June 1999. 6 visits in each transect. 24 censuses in total.
  - Experienced field workers took note of all visual and auditive contacts.
• **Vegetation:**


- All plant species were registered. A percent cover for the 3 vertical layers was assessed (tree, shrub, and herbaceous layers).

**Data analysis**

Avian diversity and plant diversity values were obtained using the Shannon-Wiener Diversity Index (MAGURRAN, 1988).

Vertical structure of vegetation was measured using the *Foliage Height Diversity* (ANDERSON & OHMART, 1986).
Vegetation

Avian communities

Avian diversity

Sections classification

Physiognomic types

Principal Component Analysis

Species classification

Relationships between physiognomic types and habitat guilds

Principal Component Analysis

Feeding and Nesting guilds

Vegetation attributes Vs. Avian richness and diversity

Vegetation

percentage cover of vegetation strata (vertical layers)

Vertical structure diversity and floristic diversity

Linear regression

Methods
Results

Absolute frequencies of passerine species - Évora

S = 39; n = 6
Results

Absolute frequencies of passerine species - Setúbal

S = 27; n = 6
Principal Component Analysis - Santa Sofia (Évora)

*Pearson* correlation coefficient - 3 first PCA axes

<table>
<thead>
<tr>
<th>Variables</th>
<th>PC1</th>
<th>PC2</th>
<th>PC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliage Height diversity</td>
<td>-0.2851</td>
<td>0.7461</td>
<td>0.4223</td>
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<tr>
<td>Floristic diversity</td>
<td>0.4490</td>
<td>0.7880</td>
<td>0.3922</td>
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<tr>
<td>Tree cover (%)</td>
<td>-0.2066</td>
<td>0.8158*</td>
<td>-0.0124</td>
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<tr>
<td>Shrub cover (%)</td>
<td>0.1874</td>
<td>0.9678**</td>
<td>-0.0008</td>
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<tr>
<td>Herbaceous cover (%)</td>
<td>-0.7929*</td>
<td>0.0428</td>
<td>0.4135</td>
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<table>
<thead>
<tr>
<th></th>
<th>Values</th>
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<tr>
<td>Eigenvalue</td>
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<td>10.65</td>
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<td>Variance explained (%)</td>
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<td>31.3</td>
<td>17.8</td>
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<td>Cumulative variance</td>
<td>38.1</td>
<td>69.4</td>
<td>87.2</td>
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*p<0.05; **p<0.01; ***p<0.001*
Principal Component Analysis - Santa Sofia (Évora)
Species ordination - PC1 and PC2

High structural diversity "Montado"

"Montado" with a shrubby understory

"Montado" with a herbaceous understory
### Principal Component Analysis - Marco do Grilo (Setúbal)

*Pearson* correlation coefficient - 3 first PCA axes

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<th>Variables</th>
<th>PC1</th>
<th>PC2</th>
<th>PC3</th>
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<tbody>
<tr>
<td>Foliage Height diversity</td>
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<td>Floristic diversity</td>
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<tr>
<td>Tree cover (%)</td>
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<td>-0.7474</td>
<td>0.9456**</td>
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<tr>
<td>Shrub cover (%)</td>
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<td>-0.1133</td>
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<tr>
<td>Herbaceous cover (%)</td>
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<td>0.4973</td>
<td>-0.9876***</td>
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<th>Eigenvalue</th>
<th>Variance explained (%)</th>
<th>Cumulative variance (%)</th>
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<td>7.10</td>
<td>33.8</td>
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<td>6.04</td>
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<td>5.07</td>
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*p<0.05; **p<0.01; ***p<0.001
Principal Component Analysis - Marco do Grilo (Setúbal)
Species ordination - PC1 and PC3

TREE COVER

HERBACEOUS COVER

CP 1 (33.8%)

CP 3 (24.2%)

Dense Pineyard

Sparse Pineyard/
Open areas
Agglomerative technique (UPGMA) of the dissimilarity values (Pearson coefficient) for avian communities

Évora transects

Legend: letters - transects, numbers - sections

Physiognomic types

- Herbaceous communities
- Sparse “Montado” with herbaceous understory
- Sparse “Montado” with a shrub/herbaceous mosaic
- Different types of “Montado”
Agglomerative technique (UPGMA) of the dissimilarity values (Pearson coefficient) for avian communities

Setúbal transects

Legend: letters - transects, numbers - sections

Physiognomic types

Medium density Pineyard with a shrubby understory

Sparse Pineyard with a high density shrubby understory

High density Pineyard

Shrub communities

Dissimilaridade
Conclusions

Relationships between avian communities and vegetation measures

Evora

- The main feature that influences the passerines distribution seems to be the understory characteristics.

- The Classification Analysis confirmed the results obtained with the PCA, addressing the importance of the dominance/co-dominance of the shrub and herbaceous layers in the differentiation of the avian communities.

Setúbal

- The tree cover density is the variable that better explains the differentiation of the avian communities.
Conclusions

*Relationships between the vegetation attributes and the avian diversity*

- Didn’t exist a relationship between the vertical diversity of vegetation and the avian diversity in the studied agro-forestry systems.

Évora

- For the “Montado” system, a increase of the tree cover is associated to a increase in avian richness and diversity, possibly due to the existence of different habitat structures.