Protocol for assessing bird abundance and richness in vineyards. A case study in Penedès area.

Francesc Xavier Macià Valverde[1] Ignasi Torre[1], Josep R. Torrentó Marselles[2]
(2) Correspondence author: Diputació de Barcelona. Urgell 187, 08036 Barcelona, Spain
(1) Museu Ciències Naurals, Granollers, Spain

Abstract: Bird abundance and richness were evaluate during the breeding period of 2011 in Penedès wine appellation of origin area, Barcelona (Spain) using an adapted point counts method in different vineyard landscapes matrix with different habitat composition and complexity. It was found that bird communities were mainly affected by habitat composition. Species richness was higher in vineyards with a more complex structure landscape.

Key words: Bird abundance, richness, breeding period, intensive, vineyards, landscape.

Introduction

Birds are considered a useful group indicating richness of species and biodiversity (Bibby *et al.* 1992, Burguess *et al.* 2002) because of the narrow link between species and habitat properties. In addition, avian communities are very dynamic and sensitive to ecological changes in the study areas. Farmland birds have undergone an evident population decline in last decades across Europe (Donald *et al.* 2001a, b; Voríšek *et al.* 2008). According to the combined multi-species index of farmland birds in Europe the decline was a 29% in last 22 years (Gregory *et al.* 2005). Preliminary results are presented concerning a bird study carried out in a vineyard landscape, with a gradient involving different habitat complexity, during the 2011 breeding period.

Material and Methods

This study was carried out in two Mediterranean landscape areas close to Garraf and Foix natural reserves, in Penedès wine appellation of origin area (Barcelona, NE Spain). Vineyards located in Avinyonet del Penedès were surrounded with the most complex landscape structure. In those fields organic farming was carried out. Plots sited in Castellet area were surrounded with more simple landscape structure, and management practice in vineyards was conventional.

Bird counts

For each area, two bird censuses were conducted during the breeding period (may-june) of 2011. Twenty point-counts with bands (0-10, 10-25, 25-50, 50-100m) were employed to assess abundance and richness of bird species Censuses protocol according to Bibby *et al.* (1992), Fuller & Langslow (1984) and Herrando *et al.* (2002).

Analysis

Maximum numbers of the two census of each counting station were used to perform the analysis of abundance.

In order to have comparable estimates of parameters like species richness, diversity, equitability and dominance, rarefaction and cumulative species curves to assess completeness

of inventories were calculated (Moreno & Halffter 2000). Ecosim 7.0 software (Gotelli & Entsminger 2001) and EstimateS software (Colwell 2009) was used.

Every sampling locality was characterized by the habitat features (i.e. Land use) measured around the centre of each counting station. Buffers at three different radiuses around these points were considered (100, 200 and 500 m) to understand the spatial scale of the responses of birds. Bird species were grouped considering their main habitat, according to Brotons *et al.* (2004). When species were found in two different categories, one of them was selected according its behaviour in the study area.

A multivariate statistical approach was performed to analyse the influence of environmental variables in a landscape scale. Canonical Correspondence Analysis (Ter Braak & Smilauer 2002) was used to study the relationship between environment and bird communities, using the partitioning of variance approach outlined by Borcard *et al.* (1992).

Results and discussion

Bird communities were mainly affected by habitat composition (see Table 1, Table 2 and Figure 1), so 49% of the variance in the bird communities was explained by 7 habitats descriptors and the locality (Avinyonet or Castellet). However, locality explained only barely the variance suggesting little influence of different farm practices (conventional or organic).

Table 1. Habitat influence in bird community.

Habitat	*Variance*	*P*	*Habitat*	*Variance*	*P*
Forest	12%	**0,002**	Building	3%	0,72
Abandoned fields	9%	**0,016**	Uprooted	3%	0,83
Annual crops	8%	**0,016**	Scrubland	2%	0,95
Vineyard	6%	0,24	Locality	6%	0,14

Table 2. Variance explained by both axes on bird abundance, and bird classification according to habitat use.

Forest species	*%*	*Openland and Farmland species*	*%*	*Shrubland species*	*%*
Erithacus rubecula	44	*Galerida cristata*	31	*Lullula arborea*	24
Phylloscopus bonelli	71	*Saxicola torquatus*	37	*Oenanthe hispanica*	37
Troglodytes troglodytes	44	*Hippolais polyglotta*	31	*Sylvia melanocephala*	21
Lophophanes cristatus	69	*Passer domesticus*	22	*Sylvia undata*	38
Aegithalos caudatus	44	*Carduelis chloris*	33		
Certhia brachydactyla	71				

The first axis (Figure 1) can be considered a gradient from farmland habitats (vineyard, buildings, annual crops) to forests, and the second axis from farmland habitats (buildings, annual crops) to abandoned fields and scrublands. The first axis explains higher variance for the variation in abundance of the forest species and the second axis higher variance for the variation in abundance of farmland species. Melodious Warbler is a farmland species that showed association with forest habitat because breeds in edges of forests, usually in contact

with vineyards. Woodlark, Black-eared Wheathear and Dartford Warbler are scrubland species that generally breeds in the first periods of succession of vegetation on abandoned fields or post-fire episodes. Stonechat use to breed farmland areas with scrubland.

Richness was higher in Avinyonet plots (Figure 2), the area with the most diverse landscape structure (Avinyonet H' = 1.42; Castellet H' = 0.95), in agreement with Fischer *et al.*, 2011.

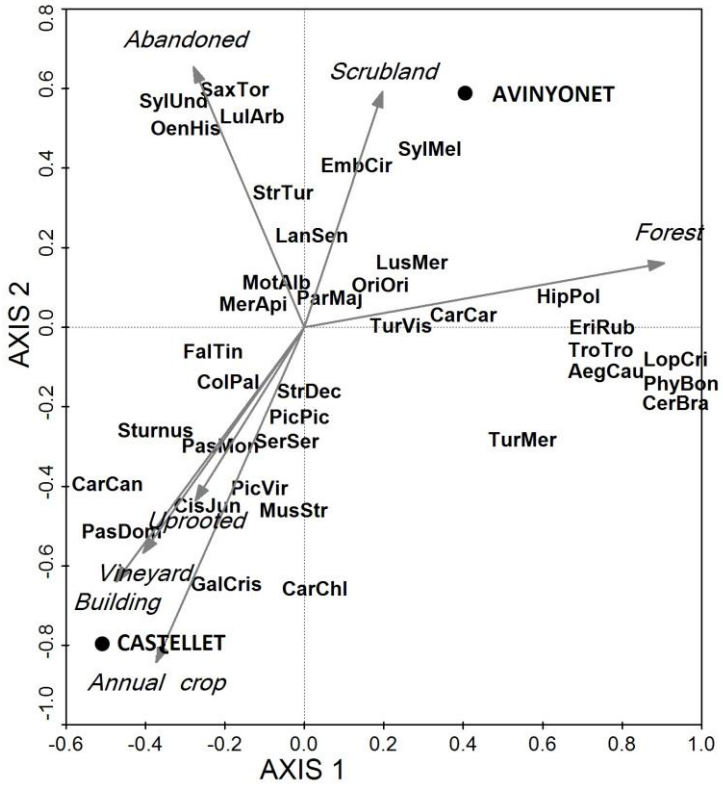

Figure 1. Influence of habitat descriptors on bird community. Scientific names are here abbreviated using the first tree letters of the genus name and the first tree of the species name.

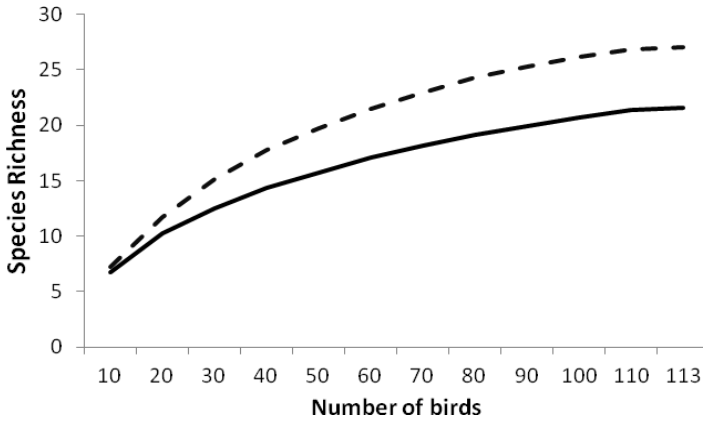

Figure 2. Rarefaction curves of species richness in relation to counted number of birds. Avinyonet plots (broken line) and Castellet plots (continuous line).

Acknowledgements

The authors would like to thank Mr. Daniel Sanchez for help in cartography. Thanks to all producers collaborating in this project for allowing us to use their fields. Thanks also to Dr. Maarten Van Helden for his helpful comments on the work. This work was supported through LIFE+ 2009 BioDiVine program

References

Bibby C.J., Burgess, N.D. & Hill., D.A. 1992: *Bird Census Techniques*. Cambridge Univ. Press, Cambridge.

Borcard, D., Legendre, P. & Drapeau, P. 1992: Partialling out the spatial component of ecological variation. *Ecology* 73: 1045-1055.

Brotons, L., Herrando, S., Estrada, J. & Pedrocchi, V. 2004: *Patrons generals dels canvis en la distribució de les espècies i l'ús del sòl en el període entre els dos atles*. In: Estrada, J. Pedrocchi, V., Brotons, L. & Herrando (eds.). Atles dels ocells nidificants de Catalunya 1999-2002. Institut Català d'Ornitologia (ICO)/Lynx Edicions, Barcelona.

Burguess, N. D., Rahbek, C., Larsen, F.W., Williams, P. & Balmford, A. 2002: How much of the vertebrate diversity of sub-Saharan Africa is catered for by recent conservation proposals? *Biol. Conserv.* 107: 327-339.

Colwell, R. K. 2009: *EstimateS: Statistical estimation of species richness and shared species from samples. Version 8.2*. User's Guide and application published at: http://viceroy.eeb.uconn.edu/EstimateS

Donald, P.F., Pisano, G. & Rayment, M.D. 2001a: The common agricultural policy, EU enlargement and the conservation of Europe's farmland birds. *Agr. Ecosyst. Environ*. 1823: 1-16.

Donald, P.F., Green, R.E. & Heath, M.F. 2001b: Agricultural intensification and the collapse of Europe's farmland bird populations. *Proc. R. Soc. Lond. B* 268: 25-29.

Fischer, C., Flohre, A., Clement, L.W., Batáry, P., Weisser, W. W., Tscharntke, T. & Thies, C. 2011: Mixed effects of landscape structure and farming practice on bird diversity. *Agr. Ecosyst. and Environ.* 141: 119-125.

Fuller R.J. & D.R. Langslow 1984: Estimating numbers of birds by point counts: how long should counts last? *Bird Study* 31: 195-202.

Gotelli N.J. and Entsminger G.L. 2001. *Ecosim: Null Models Software for Ecology.* User's guide and application published at http:/ homepages. together. Net /~gentsmin /ecosim.htm.

Gregory, R.D., Van Strien, A.J., Vorisek, Po., Gmelig Meyling, A.W., Noble, D.G., Foppen, R.P.B. & Gibbons, D.W. 2005: Developing indicators for European Birds. *Phil. Trans. R. Doc. Lon. B* 360: 269-288.

Herrando, S., Brotons, L., del Amo, R. & Llacuna, S. 2002: Bird community succession in a dry mediterranean shrubland. *Ardea* 90 (2): 303-310.

Moreno, C. E. & Halffter, G. 2000: Assessing the completeness of bat biodiversity inventories using species accumulation curves. *Journal of Applied Ecology* 37: 149-158.

Prodon, R. 1976: Le substrat, facteur écologique et éthologique de la vie en eau courante: observations et expériences sur les larves de Micropterna testacea et Cordulegaster annulatus. *Thèse 3e cycle*, Univ. Lyon I.

Ter Braak, C. J. & Smilauer, P. 2002: *CANOCO reference manual and CanoDraw for Windows*. User's Guide: Software for canonical community ordination (version 4.5), Microcomputer Power, NY.

Voríšek, P., Gregory, R.D., Arco, J., van Strien, A.J. & Meyling, A. J. 2008: Population trends of terrestrial bird species in Europe: results from the Pan-European Common Bird Monitoring Scheme. *Revista Catalana de Ornitologia* 24: 4-14.