Increase in biodiversity II. Birds

The Polyfarming system integrates different uses at farm level and, as a result, generates **different habitats for fauna and flora**. By establishing contrasting habitats, which include areas of closed forest, very open forest or dehesa, areas of pasture and garden, **Polyfarming collectively increases the richness of bird species**, since different species coexist in each habitat. In the forest and the dehesa, the typical forest species predominate, while in the pasture and the garden there are species typical of open areas and agricultural areas.

Biodiversity of birds in the different habitats of Polyfarming

In the Polyfarming system, the integration of different uses at the farm level generates **different habitats for fauna and flora**: open pasture or garden areas suitable for many species, and forest areas with different types of management, including stands with characteristics of maturity that also allow the presence of species typical of mature forests. On the Planeses farm, the Polyfarming system has consolidated a series of habitats with highly contrasted characteristics. **In four of these habitats, the composition of birds has been analysed throughout the year over three years** (**Figure 1**): mature forest, dehesa, pasture where cows graze, and garden without tillage.

The total values of the bird samples in the different habitats are presented in **Table 1**. Over three years, 2312 individuals were identified. Of them, **the largest number is found in the pasture zone** (**Table 1**), mainly due to the presence of *Passer domesticus* individuals (**Figure 2A**), which represent more than 50% of the records. The total number of species found in the samplings is high, 41, and it is also high in the pasture where the highest number of them can be found (35), followed by the pasture (25), the orchard (20) and the forest (17). The total diversity (Shannon index) is 1.75. **The highest diversity values** by zones are those of the forest (2.40) and the pasture (2.68), while the lowest are those of the open areas, the meadow (1.27) and the orchard (1.14), mainly due to the great abundance of *P. domesticus*.

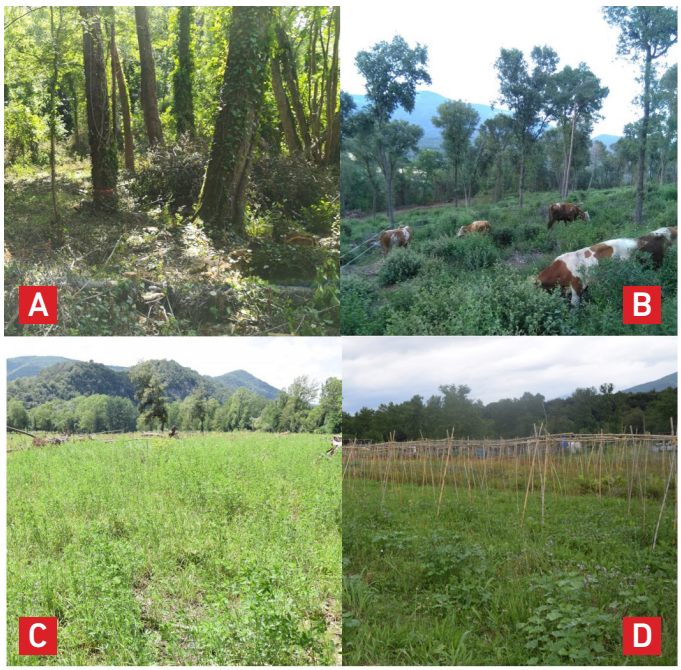

Figure 1. View of the four habitats where bird biodiversity has been sampled on the Planeses farm: (A) mature forest; (B) dehesa; (C) cow pasture; (D) non-tillage garden. Photo: Marc Gràcia.

COMPONENT	#INDIVIDUALS	RICHNESS	DIVERSITY
Forest	134	17	2.40
Dehesa	219	24	2.67
Pasture	1577	35	1.27
Garden	382	20	1.14
All	2312	40	1.75

Table 1. Richness and diversity values of the four areas where birds have been sampled at the Planeses farm.

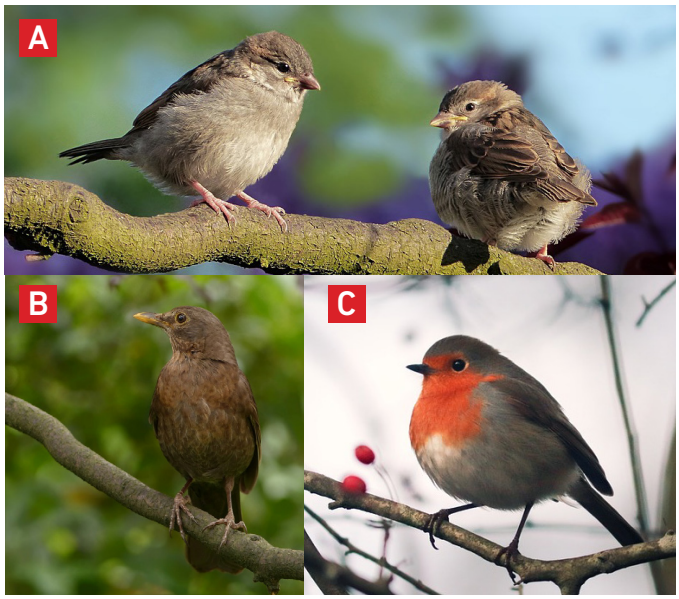

Figure 2. (A) House sparrow (*Passer domesticus*). Photo: Pixabay, Oldiefan. (B) Blackbird (*Turdus merula*). Photo: Pixabay, Oldiefan. (C) Robin (*Eritacus rubecula*). Photo: Pixabay, Manfredrichter. Photo: Pixabay, Manfredrichter.

SPECIES	FOREST	DEHESA	PASTURE	GARDEN
Aegithalos caudatus	0.0	1.8	0.7	0.0
Anthus pratensis	0.0	0.0	0.3	0.3
Carduelis cannabina	0.0	0.0	0.1	0.0
Carduelis carduelis	0.0	1.4	0.9	1.0
Carduelis chloris	0.0	0.0	0.4	0.0
Certhia brachydactyla	9.0	4.6	0.1	0.3
Cisticola juncidis	0.0	0.0	0.1	0.0
Columba palumbus	7.5	1.8	0.2	0.0
Corvus corax	0.0	0.0	0.1	0.0
Corvus corone	0.7	0.0	0.3	0.0
Cyanistes caeruleus	0.0	1.8	0.1	0.0
Dendrocopus major	0.0	1.4	0.0	0.0
Emberiza cirlus	0.0	0.5	0.4	1.0
Erithacus rubecula	17.9	16.9	0.9	1.6
Fringilla coelebs	11.2	9.6	26.7	3.7
Garrulus glandarius	8.2	1.8	0.3	0.3
Hippolais polyglotta	0.0	0.0	0.1	0.0
Hirundo rustica	0.0	0.0	0.1	0.3
Luscinia megarhynchos	1.5	3.2	0.3	1.3
Motacilla alba	0.0	0.0	1.8	0.8
Oriolus oriolus	0.0	0.5	0.2	0.0
Parus major	2.2	6.8	0.3	0.5
Passer domesticus	0.0	1.4	61.4	76.7
Passer montanus	0.0	0.0	0.1	1.3
Phoenicurus ochruros	0.0	0.5	0.6	0.8
Phylloscopus bonelli	1.5	0.0	0.0	0.0
Phylloscopus collybita	0.7	0.9	0.3	0.0
Picus viridis	3.7	2.7	0.1	0.0
Prunella modularis	0.0	0.0	0.1	0.0
Regulus ignicapilla	1.5	0.9	0.0	0.0
Saxicola rubetra	0.0	0.0	0.1	0.0
Serinus serinus	0.0	3.7	0.8	0.8
Sitta europaea	0.7	0.0	0.0	0.0
Streptopelia turtur	0.0	0.0	0.1	0.3
Sylvia atricapilla	10.4	7.3	0.5	2.4
Sylvia communis	0.7	0.0	0.0	0.0
Sylvia melanocephala	0.0	0.9	0.1	0.0
Troglodytes troglodytes	0.7	2.7	0.2	0.3
Turdus merula	18.7	17.8	1.3	1.6
Turdus philomelos	3.0	9.1	0.2	5.0
ALL	100.0	100.0	100.0	100.0

Table 2. Composition of species identified in the four areas of the Planeses farm. The values are the percentages of individuals of the different species identified in all the samplings carried out in each of the habitats.

Table 2 shows the species composition in the four zones. The forest and the dehesa have a similar composition of species, predominantly *Turdus merula, Erithacus rubecula* (**Figure 3**) and *Fringilla coelebs*. The species composition in the pasture and the garden are also similar, with *P. domesticus* standing out in both areas and *F. coelebs* in the pasture. In total, 7 species have been identified only in the pasture, 3 only in the forest and 2 only in the dehesa, while all the species that appear in the garden are also in another area.

Most of the species (94%) and individuals (84%) found in the forest are typical forest species (**Figure 3**). Most species (76%) and individuals (90%) of the dehesa are also forest species. On the other hand, both **in the pasture and in the garden, the majority of individuals are from agricultural areas** (64 and 80%, respectively), while at species level the forest species dominate (46 and 44% respectively), with similar proportions of agricultural species and those of open areas (**Figure 3**).

The conclusion drawn from these results is that the implementation of the Polyfarming system leads to an increase in the biodiversity of birds. The reason for this is that generating highly contrasted habitats, including areas of closed forest, very open forest or dehesa, pasture and garden, favours the presence of species typical from forests, open areas and agricultural lands.

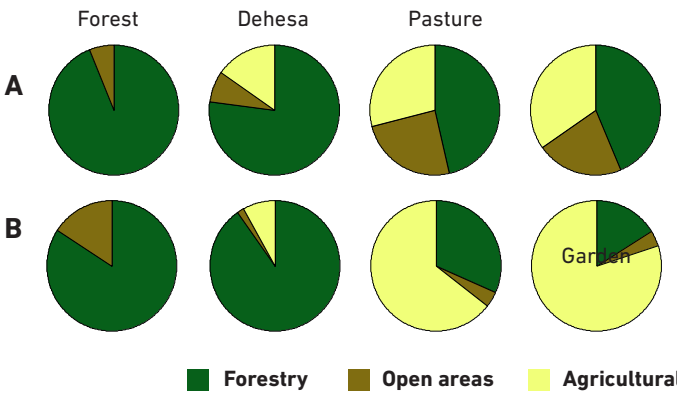

Figure 3. Proportion of (A) species and (B) individuals in three species categories: forest (green), open area (brown) and agricultural species (yellow) in the four Polyfarming habitats sampled.