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The Ornithic Community of the "Taburno-Camposauro" Regional Park (Benevento – South Italy) according to taxonomic categories, phenology, and environmental types

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Abstract

The avifauna of the Taburno-Camposauro Regional Park (RP in Province of Benevento - South Italy) was investigated from February 2019 to January 2022, as part of the project financed by Fondazione con il Sud "Sve(g)liamo la dormiente." The bird community was monitored with the VCP (Variable Circular Plot) method, which allowed the identification of 23 observation points in all the representative environmental typologies of the Park. Observations were carried out once per phenological season over the 3-year study. At the end each point has been visited 12 times (264 total monitoring sessions). The VCP were grouped according to the prevailing environmental typology, identified by the coding provided by "Carta della Natura": mesophilous forest, chestnut grove, beech grove, extensive crops, olive grove, dry grassland, coniferous forests. At the end of the study, 85 species were observed, 8 of which are included in Annex I of the Dir. 2009/147/EC (*Pernis apivorus, Circaetus gallicus, Aquila chrysaetos*, *Milvus migrans, Falco peregrinus, Lanius collurio, Lullula arborea, Anthus campestris).*
The taxonomic distribution of the species shows that *Passeriformes* represent 70% of the community, followed by *Accipitriformes* (7%), *Strigiformes*, *Piciformes,* and *Columbiformes* (5%). As regards the phenological categories, 70% are residents, 19% are nesting migrants, 6% are migrants and 5% are wintering, Species richness has been compared with the environmental typologies and appears to be at its maximum in extensive crops, at its minimum in coniferous reforestation and beech forests. Chaffinch and blackcap were the most frequent species in 4 environmental typologies.

Key-words: forest avifauna, open environments, bird community, PR Taburno-Camposauro, campanian Appennines.

Riassunto

L'avifauna del PR Taburno-Camposauro è stata studiata dal mese di febbraio 2019 a gennaio 2022 nell'ambito del progetto finanziato da Fondazione con il Sud "Sve(g)liamo la dormiente". La comunità ornitica è stata monitorata col metodo dei punti di ascolto a raggio variabile (VCP) individuando 23 punti ricadenti nelle tipologie ambientali rappresentative del Parco. Questi sono stati effettuati una volta per ogni stagione fenologica nei 3 anni di studio per cui ogni punto è stato visitato 12 volte per 264 uscite complessive. I punti di ascolto sono stati raggruppati per tipologia ambientale prevalente in base alla codificazione della Carta della Natura: bosco mesofilo, castagneto, faggeta, colture estensive, oliveto, prateria arida, conifere. Al termine dello studio sono state rilevate 85 specie di cui 8 inserite nell'All.I della Dir. Uccelli (*Pernis apivorus, Circaetus gallicus, Aquila chrysaetos*, *Milvus migrans, Falco peregrinus, Lanius collurio, Lullula arborea, Anthus campestris)*.

La ripartizione da un punto di vista tassonomico mostra che i Passeriformi rappresentano il 70% della comunità, seguiti da Accipitriformi con il 7%, dagli Strigiformi, i Piciformi e i Columbiformi con il 5%. Per quanto riguarda le categorie fenologiche, il 70% sono residenti, il 19% migratrici nidificanti, il 6% migratrici e il 5% svernanti. La ricchezza di specie è stata confrontata con le tipologie ambientali e risulta essere massima nelle colture estensive, minima nelle riforestazioni a conifere e nella faggeta. Fringuello e capinera risultano essere le specie più frequenti in 4 tipologie ambientali.

Parole chiave: avifauna forestale, ambienti aperti, comunità ornitica, PR Taburno-Camposauro, Appennino campano.

Introduction

Forest ecosystems host almost half of the European animal and plant species. In addition to that 39 of the 132 EU habitats in Italy recognized by the Council Directive 92/43/EEC are forest, and 12 of whom are priority interest (Barbera et.al., 2022). Forest formations are associated with other environmental types, such as upland plateaus managed with grasslands or meadows/grazing, and traditional agricultural systems that contribute to the increase of local biodiversity. The avifauna of forest environments currently enjoys a good conservation status nationwide, with generally positive population trends (Londi *et al*., 2019); on the contrary open environments avifauna shows a consistent decrease, as evidenced by the Farmland Bird Index in whose latest update shows that there are 15 threatened or with unfavorable conservation status species out of the total 41 species that make up the FBI_{pm} index (Farmland Bird Index for mountain grasslands) (National Rural Network & LIPU, 2023). Our work aims to fill a knowledge gap on the avifauna of the Taburno-Camposauro Regional Park by analyzing the bird communities in its forests and mountain grasslands.

Study area

The Taburno-Camposauro Regional Park covers about 13,000 hectares in the province of Benevento (Campania – South of Italy). The Park was designated, and its boundaries defined by Regional Law No. 33 on September 1, 1993. The Park Authority was established by Regional Council Resolution No. 1404 on April 12, 2002, and by Decree of the President of the Regional Council of Campania No. 779 on November 6, 2002. It protects the carbonate massif of Mount Taburno 1394 m high (to the south), Mount Camposauro 1388 m high and Mount Pentima 1170 m high (to the north)

and the forests, especially beech forests, that grow there. The Park overlaps with two sites of commmity importance (ZSC), "IT802007 Camposauro" and "IT802008 Taburno". At the base of the massif, particularly along the east, west, and south-facing slopes, there are stands of downy oak (*Quercus pubescens*). These stands indicate a broader historical distribution of this species before human intervention significantly thinned the forest, replacing it with cultivated land, particularly orchards and olive groves. Notably, some large trees remain among the fields. Along the detrital zone of the slopes, up to elevations of 750-800 m, the vegetation is less xerophytic than that of the downy oak forests. This area features coppice woods composed of manna ash (*Fraxinus ornus*), hop hornbeam (*Ostrya carpinifolia*), downy oak, hazel (*Corylus avellana*), and various maples (*Acer campestre*, *A. monspessulanum*, *A. neapolitanum*). Around 600 m, turkey oak (*Quercus cerris*) also appears, representing remnants of woods previously cut by humans, with a few old trees. Chestnut (*Castanea sativa*) is quite widespread, especially on the east and north slopes of Taburno and Camposauro. On the northern slope of Monte Pentime, an interesting forest formation can be found, predominantly consisting of chestnut, maples, hazel, manna ash, and hawthorn (*Crataegus monogyna)*. Furthermore, the Regional Park includes in its southern part, one of the largest state-owned forests in the Campania region, called the Taburno Forest which covers about 614 ha.

This area is characterized by an association of european beech (*Fagus sylvatica*) and silver fir (*Abies alba*), the latter introduced during the Bourbon era in 1838. The fir plantation currently covers about 18 hectares, with trees ranging from 50 to 70 years old, and some specimens exceeding 100 years. At elevations generally above 1000 m, there are grasslands of karstic or tectonic origin. These are mainly thermoxerophilous pastures belonging to the *Xerobromion* associations.

The limestone mountainous complex is isolated from the Apennine that runs through Campania region. The two main blocks, Taburno and Camposauro, are separated by the tectonic basin of Piana di Prata, following the classic Horst-Graben geological system. The same extensional phenomenon has separated Camposauro from Monte Pentime, where evident fault mirrors can be observed. The limestones of these three main blocks date back to the period between the Triassic (200 million years ago) and the Upper Jurassic (140 million years ago). The presence of blue clays and fossil sands suggests that the area was once a shallow sea with varying depths, from a few to several tens of meters. In the bottoms of the karst-tectonic basins, pyroclastic material covers extensive stretches of limestone rock and contributes to soil formation, resulting in mixed terrains due to its degradability.

Karst phenomena are frequent, with the presence of dolines and karst fields such as those of Campo di Cepino, Campo Trellica, and Campo di Camposauro. Caves like San Mauro (569 m above sea level), Madonna del Taburno (550 m above sea level), and San Simeone (525 m above sea level) are also present, all located on the southern slope of Taburno.

The calcareous nature of the mountainous reliefs results in high drainage of meteoric waters, which are channeled underground and re-emerge at the base. This is the case with the famous Fizzo Springs and the numerous abundant springs at the base of Camposauro that feed the Calore River and Lake Telese. The mountainous massif lacks surface hydrography, but numerous watercourses flow around it, all part of the hydrography of the Volturno River Basin. Among these, the main ones are: the Jenga and Jerino rivers to the east, the Isclero to the west (originating from the Partenio chain), and the Calore Beneventano River, which is one of the main tributaries of the Volturno to the north.

Materials and methods

Avifauna monitoring of the Taburno-Camposauro Regional Park began in February 2019. The 15- minute variable circular plot (VCP Reynolds et al., 1980) was chosen as the field methodology. All individuals detected by listening or sighting were noted. Also, all individuals were distinguished into contacts made within and over a distance of 100 m from the observer. In the following GIS analyses, a total of 23 VCP were identified. They fall within all environmental types surveyed in the Regional Park and they are evenly distributed throughout the territory. Each of these points was visited four times a year (once per season) over the three years. The VCP were grouped according to the prevailing environment present in each of them, listed hereafter: (MW) mixed woodland, (CW) chestnut woodland, (B) beech forest, (EC) extensive crops, (O) olive grove, (DG) dry grassland, coniferous reforestation. In accordance with the IOC WORLD BIRD LIST, this paper provides the list of the identified species along with their conservation status the SPEC category (Burfield et al., 2023), based on the presence of the species in Annex I of the Dir. 2009/147/EC , their inclusion in the National Red List (Gustin et al, 2019), their taxonomic orders and their phenological categories. The Passerines/Non Passerine (P/NP), species richness (S) and abundance of individuals (A) were calculated for each VCP. Mean indices values were merged by season and environment typology. In the VCPs, detection frequencies of each species were calculated by limiting the analysis to resident species, by counting the number of detections with a given species in that VCP against the number of repetitions at that point. The points were merged by environment and the two most frequently contacted species for each environmental type were then reported. In case of ex aequo, all species with equal frequency were reported. The Ornithological Value Index of breeding species was calculated using the following algorithm OVI= Stot [Σ (SSPEC1 × 1,00) + (SSPEC2 × 0,75) + (SSPEC3 × 0,50) + (SNONSPECE × 0,25) +(SCR × 1,0) + (SEN × 0,80) + (SVU × 0,60) + (SNT × 0,40) + (SLC × 0,20) + (S147 x 1,0)]× 100-1.

Results

Tab. 1 shows the check-list of detected birds. It can be noticed that 85 species were detected during our survey, and 8 of them are included in Annex I of the Dir. 2009/147/EC;, 3 of them are SPEC1, 3 of them are SPEC2, 12 of them are SPEC3, and 23 are included in the National Red List, 22 of them in the Least concern (LC) category and 1 of them in the Vulnerable (VU) category. The OVI index, calculated for breeding species only, was 24.32 a low-average value compared to that of the Castel Volturno State Natural Reserve of 2.47 (Mastronardi et al., 2020), the Matese Regional Park of 68.06 (Fraissinet et al., 2009) and the province of Naples of 45.88 (Fraissinet & Mastronardi, 2010). Fig. 1 shows that Passeriformes is the most represented order with 70% of detections, followed by *Accipitriformes* and immediately after by *Strigiformes*, *Piciformes,* and *Columbiformes*. The Non-Passerine/Passerine (NP/P) index is 0.44. Also, Fig. 2 highlights that the highest percentage of species are breeding residents, followed by breeding migrants. The two categories bring the percentage of nesting species in the Park to 89% of the total of detected species. The percentage of wintering and non-breeding migratory species is very low, 5% and 6% respectively. The analysis summarized in Fig. 3 shows that extensive crops have the highest values of species richness, followed by the olive grove. In all other environments, species richness shows similar values, with its minimum in beech forests. Abundance follows a similar trend with its highest value in extensive crops, followed by the olive grove, and a minimum

in coniferous reforestations. Referring to the trends of the two indices in the seasons, Fig.4 shows slight differences between the seasons. However, the season with the highest species richness is spring, followed by summer. Winter shows the lowest values. The abundance of individuals is higher in summer and spring, and again winter shows the lowest values. Tab. 2 highlights that eurasian chaffinch and eurasian blackcap are the most frequent species in four environmental types, the blackbird instead is more frequent only in two environmental types. All other species are found to be the most frequent in only one environmental type.

Tab.1: Checklist of detected species, their conservation status (presence in Annex I of the Dir. 2009/147/EC, SPEC category and national Red List listing) and phenology.

Common name	Species name	Annex I	SPEC category	National Red List	Phenology
Quail	*Coturnix coturnix*		SPEC3	LC	M,B
Common swift	*Apus apus*		SPEC3	LC	M
Cuckoo	*Cuculus canorus*			LC	M,B
Columbus var. domestica	*Columba livia* var. *domestica*			LC	SB
Wood pidgeon	*Columba palumbus*		NON SPEC^{E}	LC	SB
Eurasian collared dove	*Streptopelia decaocto*			LC	SB
Wild turtledove	*Streptopelia turtur*		SPEC1	VU	M,B
Woodcock	*Scolopax rusticola*			LC	W, M
Honey buzzard	*Pernis apivorus*	x		LC	M,B
Short-toed snake eagle	*Circaetus gallicus*	x		LC	M,B
Golden eagle	*Aquila chrysaetos*	x		LC	Mreg
Eurasian sparrowhawk	*Accipiter nisus*			LC	SB, M,W
Black kite	*Milvus migrans*	x		LC	M
Buzzard	*Buteo buteo*		NON SPEC^{E}	LC	M,W,SB
Barn owl	*Tyto alba*			LC	SB
Little owl	*Athene noctua*		SPEC3	LC	SB
Scops owl	*Otus scops*		NON SPEC^{E}	LC	M,B
Tawny owl	*Strix aluco*		NON SPEC^{E}	LC	SB
Eurasian hoopooe	*Upupa epops*			LC	M,B
European bee-eater	*Merops apiaster*			LC	M
Eurasian wryneck	*Jynx torquilla*			LC	M,B
Lesser spotted woodpecker	*Dryobates minor*			LC	SB
Great spotted woodpecker	*Dendrocopos major*			LC	SB
European green woodpecker	*Picus viridis*			LC	SB
Common kestrel	*Falco tinnunculus*		SPEC3	LC	SB
Peregrine falcon	*Falco peregrinus*	x		LC	SB
Woodchat shrike	*Lanius senator*		SPEC1	LC	Mirr

Red-backed shrike	*Lanius collurio*	x	NON SPEC[E]	LC	M,B
Golden oriole	*Oriolus oriolus*			LC	M,B
Eurasian jay	*Garrulus glandarius*			LC	SB
Eurasian magpie	*Pica pica*			LC	SB
Western jackdaw	*Coloeus monedula*		NON SPEC[E]	LC	SB
Hooded crow	*Corvus cornix*			LC	SB
Common raven	*Corvus corax*			LC	SB
Marsh tit	*Poecile palustris*		NON SPEC[E]	LC	SB
Coal tit	*Periparus ater*			LC	SB
Great tit	*Parus major*			LC	SB
Blue tit	*Cyanistes caeruleus*		NON SPEC[E]	LC	SB
Wood lark	*Lullula arborea*	x	NON SPEC[E]	LC	SB,M,W
Crested lark	*Galerida cristata*		SPEC3	LC	SB?
Barn swallow	*Hirundo rustica*		SPEC3	LC	M,B
Western house martin	*Delichon urbicum*		SPEC2	LC	M,B
Long-tailed tit	*Aegithalos caudatus*			LC	SB
Chiffchaff	*Phylloscopus collybita*		NON SPEC[E]	LC	SB,W,M
Wood warbler	*Phylloscopus sibilatrix*			LC	M,B
Melodious warbler	*Hippolais polyglotta*		NON SPEC[E]	LC	M
Zitting cisticola	*Cisticola juncidis*		NON SPEC[E]	LC	SB
Eurasian blackcap	*Sylvia atricapilla*			LC	SB,M,W
Lesser whitethroat	*Curruca curruca*			LC	M
Sardiniand warbler	*Curruca melanocephala*			LC	SB
Eastern subalpine warbler	*Curruca cantillans*		NON SPEC[E]	LC	M,B
Greater whitethroat	*Curruca communis*		NON SPEC[E]	LC	M,B
Firecrest	*Regulus ignicapilla*		NON SPEC[E]	LC	SB, M,W
Eurasian wren	*Troglodytes troglodytes*			LC	SB
Wood nuthatch	*Sitta europaea*			LC	SB
Short-toed treecreeper	*Certhia brachydactyla*		NON SPEC[E]	LC	SB
Common starling	*Sturnus vulgaris*			LC	SB,M,W
Blackbird	*Turdus merula*		NON SPEC[E]	LC	SB,M,W
Mistle thrush	*Turdus viscivorus*		NON SPEC[E]	LC	SB,M,W
Song thrush	*Turdus philomelos*		NON SPEC[E]	LC	M,W,B
Spotted flycatcher	*Muscicapa striata*		NON SPEC[E]	LC	M
Robin	*Erithacus rubecula*		NON SPEC[E]	LC	W,M,B
Nightingale	*Luscinia megarhynchos*		NON SPEC[E]	LC	M,B

Common redstart	*Phoenicurus phoenicurus*		NON SPEC[E]	LC	W,B,M
Black redstarrt	*Phoenicurus ochruros*			LC	W,B,M
Blue rock thrush	*Monticola solitarius*			LC	SB,M,W
Stonechat	*Saxicola rubicola*			LC	M,W,SB
Italian sparrow	*Passer italiae*		SPEC1	VU	SB
Eurasian tree sparrow	*Passer montanus*		SPEC3	LC	SB
Dunnock	*Prunella modularis*		SPEC2	LC	W,M
Western yellow wagstail	*Motacilla flava*			LC	M,B?
White wagtail	*Motacilla alba*			LC	SB,M,W
Grey wagtail	*Motacilla cinerea*		SPEC3	LC	SB,M,W
Tawny pipit	*Anthus campestris*	x	SPEC3	LC	M,B
Meadow pipit	*Anthus pratensis*		SPEC2	LC	M,W
Tree pipit	*Anthus trivialis*		SPEC3	LC	M,B
Water pipit	*Anthus spinoletta*			LC	M,W
Chaffinch	*Fringilla coelebs*		NON SPEC[E]	LC	SB, M,W
Greenfinch	*Chloris chloris*		NON SPEC[E]	LC	SB,M,W
Common linet	*Linaria cannabina*		NON SPEC[E]	LC	SB
Goldfinch	*Carduelis carduelis*		NON SPEC[E]	LC	SB
Serin	*Serinus serinus*		NON SPEC[E]	LC	SB,M,W
Eurasian siskin	*Spinus spinus*		NON SPEC[E]	LC	W, M
Corn bunting	*Emberiza calandra*		NON SPEC[E]	LC	SB,M,W
Black bunting	*Emberiza cirlus*		NON SPEC[E]	LC	SB,M,W

Tab.2: Detection frequency of resident species. For each environment type are here summarized the first two most frequent species. In case of ex aequo, all species with the same frequency are reported. B=beech forest; EC=extensive crops; CW=chestnut woodland; O=olive grove; MW=mixed woodland; DG= dry grassland; C= coniferous reforestation.

	B	EC	CW	MW	O	DG	C
Wood nuthatch	X						
Chaffinch	X		X	X			X
Eurasian blackcap		X		X	X		X
European greenfinch		X					
Hooded crow		X					
Blackbird			X	X			
Great tit						X	
Robin				X			
Chiffchaff				X			
Italian tree sparrow					X		
Eurasian jay						X	
Eurasian blue tit			X				

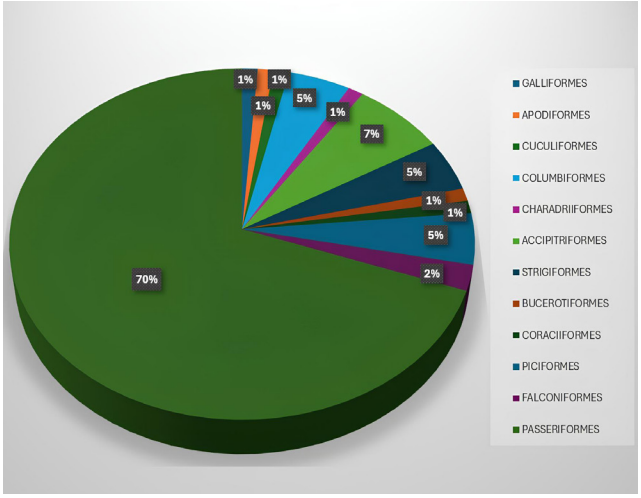

Fig.1: Distribution of the detected species in taxonomic orders

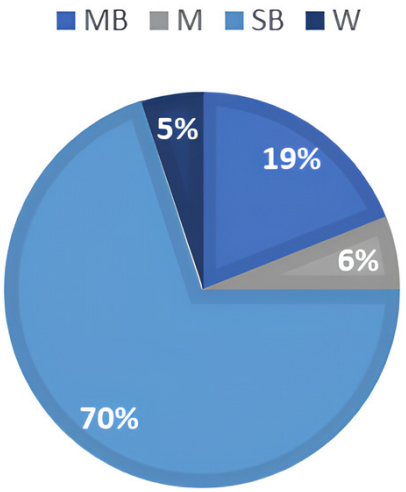

Fig. 2: Percentage distribution of the phenological categories of the detected species (MB = Migratory breeding; B = Breeding; SB = Resident Breeding; W = Wintering)

Discussion

The Taburno-Camposauro Regional Park has a rich and diverse ornithic community, making it a significant area for wildlife conservation in the Campania Region and beyond, not just for birds. The 85 species recorded rely on such stopover areas for the natural and proper progression of their biological cycles. The NP/P ratio is consistent with values observed in inland areas lacking significant wetland zones, which typically host a high number of species from other orders, thereby increasing the index value. The frequency of species detection in the various environments shows how important is the presence of different environmental types in the Regional Park, that support a diverse ornithic community and thus high biodiversity. In particular, attention should be paid to extensive crops and upland pastures that, despite they have shown the highest species richness and abundance of individuals, these environments host species with negative trends at the European level. The distribution according to phenological categories shows a peak in species richness and abundance during the spring and summer months, which is expected in a high-altitude territory. Therefore, maximum conservation attention should be given during this period, as the risk of disturbing breeding fauna is also highest. Open environments still show good species diversity, particularly the plains used for extensive cultivation, such as the tectonic Prata basin. This open area is influenced by the surrounding slopes covered with mesophilic mixed forests, Turkey oak woods, and chestnut groves, which increase species richness with typical woodland species. The plain's surface is characterized by a mosaic of pasture meadows and small gardens scattered with individual trees or groves, mainly large willows (*Salix sp.*) and various conifers (*Pinus sp.*, *Abies sp.*). Landscape elements such as fences and hedges, as well as several buildings in various states of preservation, are abundant. Sheep and goat farming is widespread. All these factors contribute to the high number of bird species, including some of high conservation value. The lowest species richness was recorded in conifer reforestations, consistent with other studies conducted in Italy and abroad (Disney & Stokes, 1976; Pielou, 1966), followed by beech forests. There is a lack of selective species for forest environments, where a rather poor and trivialized avifauna was found. The medium-low OVI is an important

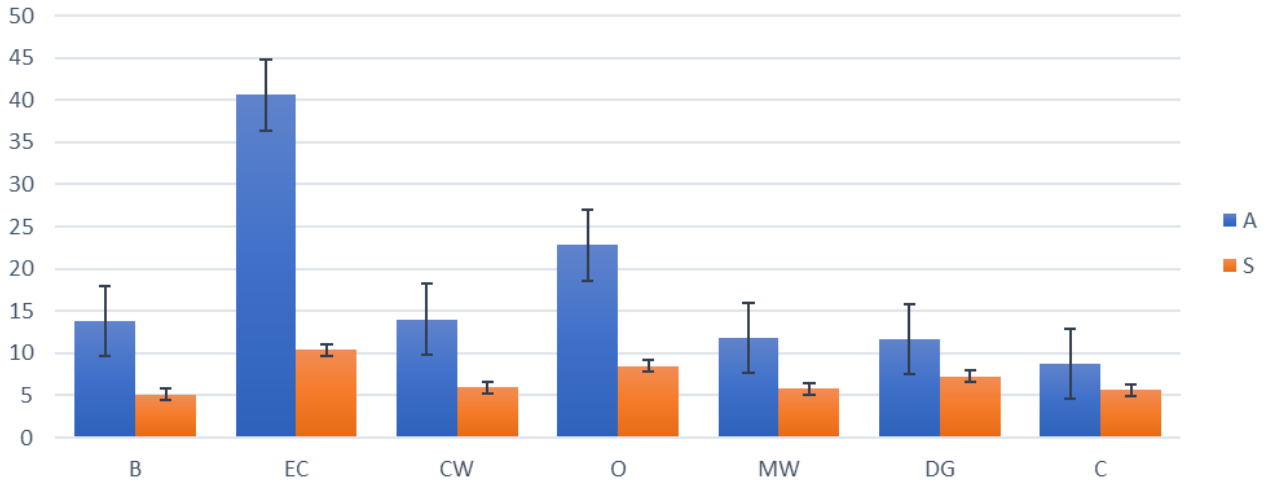

Fig. 3: Mean values of the indices of Abundance (A) and Species Richness (S) in the environmental types. B= beech woodland; EC= extensive cultivation; CW= chestnut woodland; O= olive woodland; MW= mixed woodland; DG= dry grassland; C= coniferous reforestation.

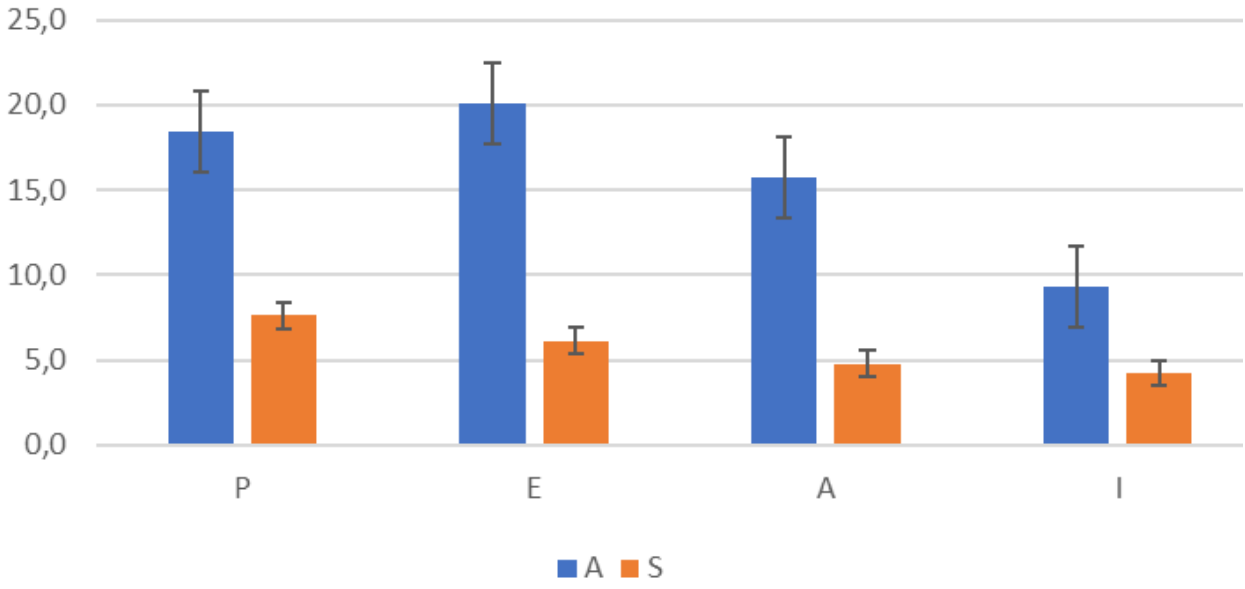

Fig. 4: Mean values of abundance (A) and species richness (S) in astronomical seasons. S= spring; Su = summer; A= autumn; W = winter

evidence of that.
This calls for reflection on forest management, which should favor the regeneration capacity of the ecosystem and the natural evolution towards old-growth forests.

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Conceptualisation: E.E., D.M.
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Methodology: E.E., D.M.
Project Administration not applicable
Resources: not applicable
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