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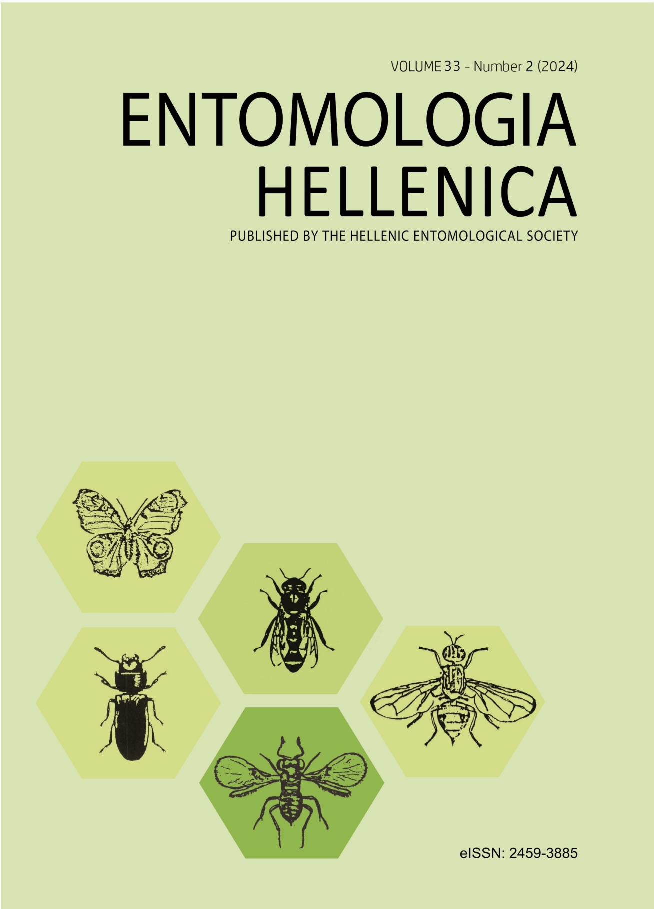

Indications of Understorey Management Practices impact on Vascular Plant and Arthropod Diversity in Olive Groves on Lesvos, Greece

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Indications of Understorey Management Practices impact on Vascular Plant and Arthropod Diversity in Olive Groves on Lesvos, Greece

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ABSTRACT

This study investigates the impact of three understorey management practices – herbicide application, understorey clearing, and undisturbed understorey – on the biodiversity of plant and arthropods in olive groves in the Gera region on Lesvos, Greece. The study found that herbicide application had a negative effect on plant diversity, but less pronounced effects on arthropods. The rapid recovery of arthropod biodiversity is likely due to the high structural complexity in the Gera region. Abandoned olive groves displayed the lowest arthropod abundance and vegetation, leading to gradual impoverishment of plant biodiversity and negative impacts on arthropod diversity. The proportion of annual species in the plant cover was positively associated with arthropod abundance. The study proposes a new eco-scheme that supports farmers for maintaining understorey plant cover, with periodical clearing through ruminant grazing, to enhance plant and arthropod biodiversity in olive grove systems.

KEY WORDS: Mediterranean ecosystems, olive cultivation, agrobiodiversity, plant diversity, arthropod diversity, understorey management practices.

Introduction

A crop that has traditionally been extensively managed in structurally complex and stable agro-forestry systems, supporting high levels of biodiversity, is the olive tree (*Olea europaea* L.) (Sobreiro et al. 2023; Stattegger et al. 2023; Vasconcelos et al. 2022). The importance of olive groves globally is evident, with the world's cultivation area being approximately 10.3 Mha in 2021, yielding around 23 million tons of olives worth 23.891 million US dollars (FAOSTAT 2022; Jiménez 2023). Of the total production, 95% is originated in the Mediterranean region, signifying the importance of olive groves for the region (Fraga et al. 2020; FAOSTAT 2022).

During the recent years, olive grove management has become more intensive (Carpio et al. 2019), involving increased use of synthetic fertilizers and pesticides and irrigation, changes in soil management techniques, and a shift from traditional low-density (50-200 trees ha^{-1}) agroforestry systems to intensive (401 to 1500 trees ha^{-1}) or super-intensive (1501-2500 trees ha^{-1}) monoculture cropping systems (Guzmán et al. 2022; Jiménez et al. 2023; Jiménez-Alfaro et al. 2020; Sobreiro et al. 2023). On the other hand, there is an increasing trend of agricultural abandonment of marginal olive groves (Van der Sluis et al. 2014). This trend is caused by a combination of agricultural policies and a transition of the economy towards the service sector, causing the marginalisation of farming and an increasing trend of people abandoning

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rural areas (rural exodus) (Carmona-Torres et al. 2023).

The intensification of olive cultivation has negative impacts on biodiversity and agroecosystems, leading to the simplification of landscapes and removal of natural vegetation. Sustainably managed olive groves have the capacity to support high levels of biodiversity, which provide a range of ecosystem services (Bateni et al. 2021; Berg et al. 2018). In olive groves, functional diversity plays a pivotal role in crop protection, biological control of pests and overall productivity (Castro et al. 2021; Gkisakis et al. 2016). Plant life provides balance to any ecosystem, as it contributes to the moderation of climate, regulation of water flow and reduction of soil erosion, reducing the risk of runoff and nutrient loss (Solomou & Sfougaris 2021).

This paper presents the first results of this research. The study investigates the impact of three different olive grove understorey management practices (agrochemical use, undisturbed understorey, mechanical clearing of understorey) on plant and arthropod species richness and diversity. The aim of this study is to add to the knowledge of agrobiodiversity in olive grove systems through investigating the effects of selected management practices on richness and abundance of plant and arthropod species.

Materials and Methods

The studied olive groves are situated in the Gera region, located in the south-eastern part of Lesvos. The region spans an area of 86.4 km^2 and its landscape is hilly and characterized by continuous olive groves arranged in terraces, reaching elevations up to 550 metres above sea level. There is minimal cultivation of land for other agricultural activities, and some olive plantations have been abandoned over the past few decades (Dimopoulos et al. 2023). The island of Lesvos has a typically Mediterranean climate, characterized by short, mild winters and hot, dry summers, with significant variations in climatic conditions resulting from the influence of regional mountains and atmospheric circulation patterns (Douma et al. 2016; Stattegger et al. 2023).

Three of the sampling plots are organically managed with undisturbed plant cover, three of the sampling plots are organically managed with cleared understorey, and three of the sampling plots are conventionally managed and occasionally sprayed with herbicides, as is typical in some traditionally managed fields. The cleared sampling plots are grazed by sheep during the summer months and with electrical hand mowers and chainsaws where necessary during the harvest period (October – January). The sprayed sampling plots are sprayed with herbicide, with last spraying having occurred in May 2023. To reduce the influence of surrounding landscape complexity, it was ensured that each sampling plot was surrounded by other plots with similar management practices.

The diversity of the plant ground cover in each sampling plot during the months of March and April was estimated using three linear transect walks of 25m in length of SW-NE direction (Chalmers & Parker 1989; Pieper 1978). Soil arthropod populations were monitored with pitfall traps, while flying insect populations were sampled with yellow sticky traps. Of both trap types, three were positioned within each sampling plot. After a period of seven days, the samples were collected from the traps. Moreover, three sensors (iButtons) were installed in each field to monitor hourly measurements of temperature (ºC) and humidity (%RH).

The data was analysed using the statistical programme IBM SPSS Statistics (Version 29.01.0 2021). The summary statistics of the collected plant and arthropod data were quantitatively described to summarize the plant and arthropod richness and abundance observed across the sampling plots representing the different understorey regimes. and presented with a frequency table. For the collected plant data, several indices of α-diversity, referring to the species richness within a functional community on a local scale, and evenness, a measure of the relative abundance of the different species in an area, were calculated. An analysis of variance test (ANOVA) was conducted to analyse whether the total arthropod abundance and the abundance of certain arthropod taxa differ significantly across the olive groves with different understorey treatments. Following the ANOVA tests, post-hoc tests (Fisher's Least Significant Difference (LSD)) were conducted to further investigate and compare specific groups within the data to determine which pairs differ significantly from each other. To demonstrate the changes in temperature and relative humidity across the sampling periods, the mean, minimum and maximum hourly temperature and humidity were calculated. Besides the comparisons of plant and arthropod richness and abundance across the whole period, it was also analysed whether there were variations in the average and total number of collected specimens for each understorey treatment and across both trap types. For this, summary statistics were obtained and an ANOVA test, followed by a post-hoc test (LSD) were conducted. A linear regression model was carried out to research the relationship between arthropod abundance (dependent factor) and the mean temperature, mean humidity, and presence of annual plant species (as percentage of the total plant cover in March and April, and as percentage of the total floristic composition in May).

Results

From Fig. 1, it can be observed that the sprayed fields have the highest percentage of bare ground (56.7% in April and 38.7% in April, followed by fields with cleared understorey (4.7% in March and 6.7% in April) and undisturbed understorey (1.3% in March and 0.7% in April). The presence of grasses was most abundant in the olive groves with cleared understorey across both months (58% in March and 56% in April), although the percentage of grass cover increased for both undisturbed (33,3% in March and 58% in April) and sprayed fields (16,7% in March and 31,3% in April). The perennial plant coverage was relatively similar across all understorey management regimes. The annual plant coverage was found to be highest in the cleared fields (15,3% in March and 9,3% in April), followed by the undisturbed fields (6% in March and 0,7% in April), and the sprayed fields (0,7% in March and 1,3% in April). The presence of shrubs was predominantly found in the undisturbed fields (18,7% in March and 7,3% in April), but a minimal shrub cover was also detected in the sprayed fields in March (1,3%).

A total of 95 plant taxa were found across the nine sampling plots. These plant taxa belong to 15 orders, 25 families, 60 genera and 78 species. More in detail, 45 plant taxa were observed in the sampling plots with cleared understorey, corresponding to 12 orders, 15 families, 34 genera, and 34 species. In the sprayed fields, 37 taxa were observed, corresponding to 12 orders, 15 families, 26 genera and 32 species. 46 plant taxa were observed in the sampling plots with undisturbed understorey, corresponding to 13 orders, 19 families, 31 genera and 35 species. The species-richest families observed across all nine sampling plots are Poaceae (20,7%), Asteraceae (18,5%), and Fabaceae (13,0%), together comprising more than half of all observed taxa (Table 1).

In terms of α-diversity values, calculated using the Shannon, Menhinick, Margalef, and Simpson indices, it can be derived that α-diversity is lower in the sampling plots with sprayed understorey compared to the cleared and undisturbed sampling plots (Table 2). While α-diversity values for the cleared sampling plots were higher using the Shannon and Menhinick indices, the α-diversity values for the undisturbed sampling plots were higher using the Margalef and Simpson indices. The Simpson's Evenness index was highest in the undisturbed olive groves, narrowly followed by the cleared olive groves, and lastly the sprayed olive groves.

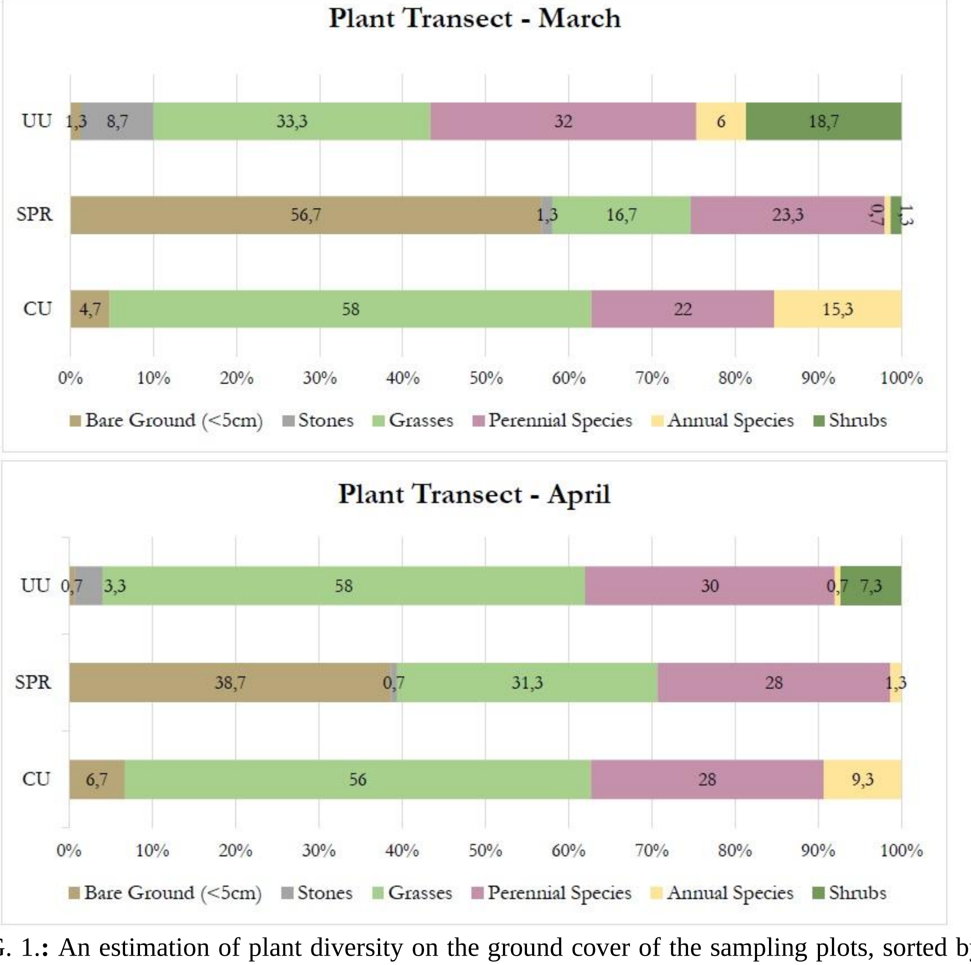

FIG. 1.**:** An estimation of plant diversity on the ground cover of the sampling plots, sorted by understorey management practices. CU = cleared understorey, SPR = sprayed understorey, UU = undisturbed understorey.

A total of 18.403 arthropods were captured, classified into 23 orders, as well as another 29 families, 19 genera and 3 species, found in all three researched understorey management practices (Table 3). The most dominant order in the whole sampling period were Diptera, accounting for 51,69% of the total catches, followed by Hymenoptera (18,21%), Hemiptera

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(13,53%), Coleoptera (5,93%) and Psocoptera (4,78%).

Of the total, 17.009 arthropods were captured via the yellow sticky traps, while 1.394 arthropods were captured via the pitfall traps. In the pitfall traps, arthropods belonging to 17 orders, 12 families, 5 genera and 2 species were found. In the yellow sticky traps, arthropods belonging to 3 classes, 11 orders, 10 families, 5 genera and 1 species were found.

TABLE 1. The most common vascular plant families observed in the nine sampling plots.

Poaceae	20,7%
Asteraceae	18,5%
Fabaceae	13,0%
Apiaceae	5,4%
Caryopyllaceae	4,4%
Gerniaceae	4,4%
Plantaginaceae	4,4%
Other families	29,2%
Total	100,0%

TABLE 2. Values of α-diversity (α) and evenness indices for sampling plots with cleared, sprayed and undisturbed understorey.

	Index	Cleared	Sprayed	Undisturbed
a	Shannon	2,243	1,619	2,144
	Menhinick	1,107	0,822	0,992
	Margalef	6,484	6,296	7,188
	Simpson	0,925	0,876	0,928
Evenness	Simpson's Evenness Index	13,259	8,037	13,925

Values of arthropod catches fluctuated across the different understorey management practices. In the fields with cleared understorey, a total of 6.564 arthropod specimens were collected, while in the sprayed fields and the undisturbed fields 6.253 and 5.586 arthropod specimens were collected respectively. The mean abundance in the cleared fields was the highest, with an average of 20,84 arthropod specimens found. This was followed by the sprayed fields, with a slightly lower average of 20,64 arthropod specimens found, and lastly the undisturbed fields, with an average of 18,94 specimens found (Fig. 2). However, these variations in relative abundance are not statistically significant (Table 4).

The relative abundance of specific taxa observed across the different understorey treatments was compared (Table 5). While the abundance of specific taxa differed across understorey management regimes, these differences were mostly not significant. Overall, a significantly higher soil arthropod abundance was observed in the sampling plots with sprayed understorey. When it comes to specific orders, the abundance of leafhoppers ($p = ,004$) and true bugs (Hemiptera) ($p = ,005$) was significantly higher in sampling plots with undisturbed understorey. The abundance of Hymenoptera, on the other hand, was significantly higher in the sampling plots with sprayed understorey ($p = ,031$). Lastly, the abundance of Psocoptera was significantly higher in the sampling plots with cleared understorey ($p = ,014$).

To investigate the effects of the recorded temperature, relative humidity, and annual plants (as percentage of total plant cover) on total arthropod abundance, a linear regression model was performed (Table 6). When looking at the effects of the individual variables, the results suggest that the percentage of annual plant species has a significant (p = ,005) and relatively strong positive effect on arthropod abundance (unstandardized coefficient B: 7,726). The percentage of annual plant species also has a relatively stronger effect compared to mean temperature (% annuals standardized coefficient B: 0,544; mean temperature standardized coefficient B: 0,045), the effect of which also does not display statistical significance (p = 0,789). The collinearity statistics suggest that there is no multicollinearity between the two explanatory variables of this model based on the tolerance (0,939) and VIF values (1,065).

TABLE 3. Arthropod taxa observed throughout the three rounds of field work conducted in March, April and May 2024. In total 18,403 arthropods were collected.

Order	Understorey Management		
	Cleared	**Sprayed**	**Undisturbed**
Acari	0	2	1
Aranae	109	254	192
Chilopoda	0	0	1
Clitelatta	0	2	0
Coleoptera	442	429	220
Collembola	0	0	1
Diplopoda	34	3	1
Diptera	3.480	3.250	2.783
Embioptera	0	0	1
Gastropoda	10	1	0
Hemiptera	836	443	1.211
Hymenoptera	1.106	1.413	833
Isopoda	0	1	1
Isoptera	6	52	9
Lepidoptera	36	44	46
Neuroptera	2	0	4
Opiliones	1	2	2
Opisthopora	0	2	0
Pseudoscorpiones	1	0	0
Psocoptera	413	302	164
Raphidioptera	0	4	1
Siphonaptera	1	0	0
Sterrnorrhyncha	14	1	4
Thysanoptera	73	48	110
Total	**6.564**	**6.253**	**5.585**

When looking at the effects of the explanatory variable (% annual plant species) across the different understorey management regimes, it can be observed that the only significant model was for the sampling plots with cleared understorey (CU: p = ,037; SPR: p = ,178; UU: p = ,763) (Table 7). For the CU model, the percentage of annual plant species has a strong positive effect on arthropod abundance (unstandardized coefficient (B): 10,411; standardized coefficient B: 0,601) that is statistically significant (p < ,05).

TABLE 4. Results of the post-hoc test (LSD) analysing the relationship between understorey management type and arthropod abundance.

Type of Management (I)	Type of Management (J)	Mean Difference (I-J)	Significance
Cleared	Sprayed	,201	,953
	Undisturbed	1,903	,580
Sprayed	Cleared	-,201	,953
	Undisturbed	1,701	,624
Undisturbed	Cleared	-1,903	,580
	Sprayed	-1,701	,624

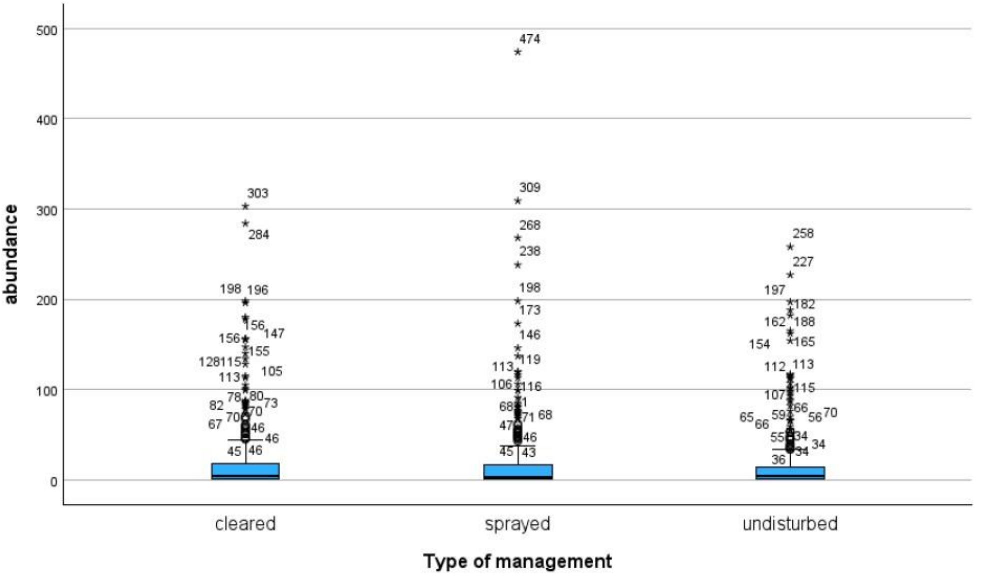

FIG. 2.**:** Boxplot of mean arthropod abundance across the sampling plots representing the different understorey management regimes.

Discussion

The aim of this study was to perform a preliminary investigation on whether plant and arthropod diversity patterns in olive groves located in the Gera region on Lesvos, Greece, differ significantly across the three different analysed management practices (i.e. spraying of herbicides, clearing of the understorey, and undisturbed understorey).

Our study provides valuable insights into arthropod richness and abundance in olive groves under different treatments, during the peak activity period in Lesvos region (March-May). Its short duration limits the long-term study of arthropod communities in this agroecosystem, which

TABLE 5. One-way ANOVA test between overall arthropod richness, abundance, and the olive grove's understorey treatment.

	Understorey Management					
	Cleared		Sprayed		Undisturbed	
	Average	St. Dev.	Average	St. Dev.	Average	St. Dev.
Soil arthropod abundance	4,57	8,05	6,07	11,15	2,70	3,06
Flying insect abundance	30,98	49,96	28,59	56,45	24,08	42,55
Acari	-	-	1,00	,00	1,00	-
Araneae	3,89	5,21	7,94	11,60	7,11	13,26
Carabidae	2,00	1,41	1,00	,00	1,33	,52
Chilopoda						
Cicadellidae	26,88	30,20	13,07	18,35	42,63	43,52
Clitelatta	-	-	2,00	-	-	-
Coleoptera	5,59	9,95	6,22	11,47	3,10	3,71
Collembola	-	-	-	-	1,00	-
Diplopoda	3,40	3,37	1,00	,00	1,00	-
Diptera	82,86	80,66	83,33	101,27	81,85	71,07
Formicidae	4,94	5,63	9,64	14,06	4,05	4,63
Gastropoda	2,00	1,00	1,00	-	1,83	,98
Glaphyridae	30,00	39,60	17,63	27,11	1,67	1,15
Hemiptera	22,00	27,06	10,78	16,18	32,73	40,57
Hymenoptera	22,57	24,45	29,44	33,38	15,72	18,20
Malacostraca	-	-	1,00	-	1,00	-
Isoptera	1,50	1,00	13,00	17,09	1,50	,84
Lepidoptera	2,25	1,81	2,93	2,52	2,88	2,92
Neuroptera	1,00	,00	1,00	,00	1,00	,00
Opiliones	1,00	-	1,00	,00	1,00	,00
Opisthopora	-	-	2,00	-	-	-
Phasmatodea	-	-	-	-	1,00	-
Pseudoscorpiones	1,00	-	-	-	-	-
Psocoptera	17,96	13,85	11,62	15,09	7,13	4,39
Raphidioptera	-	-	2,00	1,41	1,00	-
Siphonaptera	1,00	-	-	-	-	-
Sterrnorrhyncha	2,80	2,49	1,00	-	4,00	-
Stylommatophora	4,00	-	-	-	-	-
Thysanoptera	6,46	4,70	3,43	3,03	8,46	7,66

*Statistically significant differences (p<,005) are marked with gray shade

are known to exhibit fluctuations, both seasonally and annually. Weather conditions, crop phenology, and pest outbreaks influence arthropod populations (Stavrianakis et al. 2024), and a more extended investigation would allow us to assess the consistency of our findings over time. Despite these limitations, our results contribute to the growing body of knowledge on arthropod communities in olive groves and provide a foundation for future research aimed at understanding the factors, such as farming practices, driving their diversity and abundance.

Following the results from this research, it seems that olive grove abandonment and understorey management through clearing have similarly positive effects on the diversity of plant species. However, it is likely that the highest taxonomic diversity being observed in the abandoned fields with undisturbed understorey is due to the different successional stages of abandonment observed in these sampling plots. In the early stages of land abandonment (< 20 years), plant diversity increases, with herbaceous plants and woody shrubs coexisting. However, these higher biodiversity levels tend to decrease as plant succession progresses (De Paz et al. 2022). The abandonment of traditional olive groves causes a gradual decrease in plant diversity mainly through a lower proportion of annual species and the prevention of the establishment and growth of shade-intolerant perennial herbs that are characteristic for traditional olive groves (Maccherini et al. 2013; Kakampoura & Panitsa 2022). The biodiversity impacts of abandonment are especially high because, unlike other more intensively managed agricultural systems, traditionally cultivated olive orchards support a high level of biodiversity (Loumou & Giourga 2003). Besides long-term negative biodiversity impacts, abandonment of olive groves also has a number of other negative environmental impacts, such as increased risk of fires and soil erosion (Jiménez et al. 2023).

TABLE 6. ANOVA for the linear regression model with arthropod abundance as the dependent variable and mean temperature and % of annual plant species as the predictors. And contribution of each variable to the model.

Model		Sum of Squares	df	Mean Square	F	Sig.	R^2 (adjusted)
	Regression	505703,21	2	252851,61	5,394	,012*	25,3%
1	Residual	1125039,31	24	46876,64			
	Total	1630742,52	26				

a. Dependent variable arthropod abundance
b. Predictors: (Constant): mean temperature, % annuals

Model	Understandarized coefficient (B)	Standarized coefficient (B)	95% Confidence Interval		Sig.	Collinearity	
			Lower Bound	Upper Bound		Tolerance	VIF
(Constant)	503,523		-7,41	1014,45	,053		
% annuals	7,726	,544	2,60	12,85	,005*	,939	1,065
Mean temperature	3,903	,045	-27,18	34,99	,789	,939	1,065

* $p<0.05$

The discrepancy between the number of species observed in the organically managed sampling plots versus the conventionally managed sampling plots treated with herbicides were not as pronounced as in prior studies (Solomou & Sfougaris 2011; 2013; 2021), likely due to the limited and sporadic application of herbicides in the sprayed sampling plots. Still, the organically managed sampling plots with understorey periodically cleared by sheep and mechanical hand mowers, displayed higher plant biomass and diversity. Interestingly, a higher abundance of annual plant species could be observed in the sampling plots with cleared understorey, which is confirmed by previous studies (Solomou & Sfougaris 2011; Kakampoura & Panitsa 2022; Stavrianakis et al. 2024). These annual species support important plant-insect interactions, which in turn provide pollination services to nearby agricultural areas (Kakampoura & Panitsa 2022).

In line with findings from previous research, the highest arthropod abundance was observed in the olive groves with cleared understorey (6564 specimens), while the lowest arthropod abundance was observed in the olive groves with undisturbed understorey (5586 specimens). The variation between arthropod abundance between olive groves with cleared and sprayed understorey is, however, minimal, with 6253 arthropod specimens collected in the sprayed sampling plots. The similar values of abundance observed in cleared and sprayed sampling plots might be explained by the high landscape complexity of the study area, with a complex mosaic of olive orchards typically under traditional, low-intensive management with limited input of synthetic agrochemicals. This is in line with the intermediate landscape complexity hypothesis, which states that in both simple landscapes with <1% of non-crop habitat and complex landscapes with >20% of non-crop habitat, only minimal positive effects of local management practices aimed at conserving biodiversity (such as organic farming) can be expected because of poor species pools in cleared landscapes and high immigration from semi-natural habitats in complex landscapes (Tscharntke et al. 2005; 2012). Instead, such local management practices are more effective in simple landscapes with a high proportion of non-crop habitat (>20%) (Tscharntke et al. 2005; 2012).

TABLE 7. ANOVA for the linear regression models with arthropod abundance as the dependent variable and mean temperature and % of annual species as the explanatory variables, separated by understorey management regime. And contribution of each explanatory variable to the model presented.

Model	F	df	Sig.	R^2 (adjusted)
CU	6,028	2	,037*	55,7%
SPR	2,337	2	,178	25%
UU	,283	2	,763	-21,8%

Model		Understandarized coefficient (B)	Standarized coefficient (B)	95% Confidence Interval		Sig.	Collinearity	
				Lower Bound	Upper Bound		Tolerance	VIF
CU	(Constant)	-251,137		-1318,232	815,958	,586		
	% annuals	10,411	,601	-,004	20,826	,05*	,919	1,089
	Mean temperature	47,000	,409	-22,119	116,120	,147	,919	1,089
SPR	(Constant)	1217,619		217,851	2217,386	,025*		
	% annuals	8,465	,731	-1,412	18,343	,081	,771	1,298
	Mean temperature	-36,965	-,511	-98,704	24,773	,193	,771	1,298
UU	(Constant)	494,155		-647,291	1635,601	,330		
	% annuals	4,083	,268	-10,804	18,971	,527	,951	1,051
	Mean temperature	5,039	,074	-61,639	71,718	,859	,951	1,051

* $p<0.05$

The lowest abundance of arthropods was observed in the abandoned olive groves with undisturbed understorey (5.586 specimens), which is likely due to the increased dominance of woody shrubs over the different successional stages of abandonment, thereby reducing the number of annual flowering species and perennial herbaceous species, eventually resulting in reduced arthropod diversity levels (De Paz et al. 2022). Since the floral diversity in the abandoned groves studied in this thesis is still relatively diverse due to the short time span since abandonment, it is expected that the arthropod diversity in these groves will only decrease. Some groups may, however, benefit from the structurally more complex vegetation of abandoned olive groves. A significantly higher abundance of leafhoppers (Hemiptera Cicadellidae) was observed in the sampling plots with undisturbed understorey. This might be due to the herbivorous nature of this group, benefiting from the abundance of well-developed shrubs in abandoned olive groves. However, leafhoppers can also act as pests due to the direct damage to leaves or vectors of diseases, having potential negative effects on ecosystem health (Carpio et al. 2020; Dalmaso et al. 2023). Mean temperature proved to not be a significant explanatory variable for arthropod abundance in this study ($p = 0,789$). This can likely be explained by the limited sampling period of this study, with measurements only being taken during the Spring season. While temperature (and relative humidity) have been proven to have strong effects on arthropods (Chown et al. 2011).

The observed reduction in plant species richness and coverage following herbicide application and understorey clearing was expected due to its direct impact on plant communities. However, the link between plant diversity and arthropod abundance is more complex (Stavrianakis et al. 2023). While a direct correlation might be anticipated, factors such as habitat structure, plant community composition, and the timing of interventions can influence arthropod diversity.

Olive groves with diverse understorey plant cover provide such a complex environment that supports a wider range of arthropod species. Herbicide application and understorey clearing can simplify this structure, limiting suitable habitats for arthropods. Additionally, certain plant species may provide specific resources or attract particular arthropod groups (Schaffers et al. 2008). The timing of these interventions can also influence the impact on arthropod populations. Understanding these ecological mechanisms is crucial for conserving arthropod biodiversity in olive grove systems.

As a result, the study proposes a new eco-scheme that supports farmers for maintaining understorey plant cover, with periodical clearing through ruminant grazing, to enhance plant and arthropod biodiversity in olive grove systems. This eco-scheme represents a novel approach to biodiversity management in olive groves. By incentivizing farmers to maintain understorey plant cover while implementing periodic clearing through ruminant grazing, the scheme aims to strike a balance between agricultural productivity and ecological conservation. This approach differs from traditional management practices that often involve intensive herbicide use or complete understorey removal, which can have detrimental effects on biodiversity.

The innovation of the eco-scheme lies in its recognition that a diverse understorey plant community plays a crucial role in supporting arthropod biodiversity. By promoting a mosaic of habitats through periodic clearing, the scheme helps to create a more structurally complex environment that can accommodate a wider range of species. Additionally, the use of ruminant grazing offers a sustainable and environmentally friendly method for managing understorey vegetation, reducing the need for chemical inputs.

In conclusion, our initial findings highlight the significant role that landscape structure plays in supporting biodiversity within olive grove ecosystems. These results suggest that even under low-intensity management practices, olive groves can maintain a healthy level of plant and arthropod diversity when situated within landscapes that promote ecological connectivity. Further research in this direction is important to refine Integrated Pest Management (IPM) protocols and inform policy decisions within the Common Agricultural Policy (CAP) to balance agricultural productivity with long-term biodiversity conservation within olive-growing regions.

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Ενδείξεις για την επίδραση των πρακτικών διαχείρισης του υποορόφου στην ποικιλότητα των αγγειακών φυτών και των αρθρόποδων σε ελαιώνες στη Λέσβο, Ελλάδα

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ΠΕΡΙΛΗΨΗ

Η παρούσα μελέτη διερευνά την επίδραση τριών πρακτικών διαχείρισης του υποορόφου - εφαρμογή ζιζανιοκτόνων, εκκαθάριση του υποορόφου και αδιατάρακτος υποορόφος - στη βιοποικιλότητα των φυτών και των αρθρόποδων σε ελαιώνες στην περιοχή της Γέρας στη Λέσβο, Ελλάδα. Η μελέτη διαπίστωσε ότι η εφαρμογή ζιζανιοκτόνων είχε αρνητική επίδραση στην ποικιλότητα των φυτών, αλλά λιγότερο έντονες επιπτώσεις στα αρθρόποδα. Η ταχεία ανάκαμψη της βιοποικιλότητας των αρθρόποδων οφείλεται πιθανότατα στην υψηλή δομική πολυπλοκότητα στην περιοχή της Γέρας. Οι εγκαταλελειμμένοι ελαιώνες εμφάνισαν τη χαμηλότερη αφθονία αρθροπόδων και βλάστησης, οδηγώντας σε σταδιακή φτωχοποίηση της φυτικής βιοποικιλότητας και αρνητικές επιπτώσεις στην ποικιλότητα των αρθροπόδων. Το ποσοστό των ετήσιων ειδών στη φυτοκάλυψη συσχετίστηκε θετικά με την αφθονία αρθρόποδων. Η μελέτη προτείνει ένα νέο οικολογικό σχήμα που υποστηρίζει τους γεωργούς για τη διατήρηση της φυτοκάλυψης του υποορόφου, με περιοδικό καθαρισμό μέσω της βόσκησης μηρυκαστικών, για την ενίσχυση της βιοποικιλότητας των φυτών και των αρθρόποδων στους ελαιώνες.

