sustainability

MDPI

Article

Plant Diversity in Archaeological Sites and Its Bioindication Values for Nature Conservation: Assessments in the UNESCO Site Etruscan Necropolis of Tarquinia (Italy)

Giulio Zangari *, **Flavia Bartoli**, **Fernando Lucchese** and **Giulia Caneva**

Department of Science, University Roma Tre, Viale Marconi 446, 00146 Rome, Italy; flavia.bartoli@uniroma3.it (F.B.); fernando.lucchese@uniroma3.it (F.L.); giulia.caneva@uniroma3.it (G.C.)
* Correspondence: giulio.zangari@uniroma3.it

Abstract: In archaeological sites, plants can be a risk for monument conservation. However, in these sites, a refugium for plant biodiversity is often detected, such as in the UNESCO site Etruscan necropolis of "Monterozzi" in Tarquinia, which still holds a Special Protection Area for bats. In this site, we previously evaluated the positive and negative effects of vascular plants on the conservation of the hypogeal tombs. To contribute in assessing the role of archaeological sites in supporting plant diversity and interpreting its bioindication values for nature conservation, we analyse in this relevant place the floristic interest and richness and the plant communities growing on tumuli, trampled, and less disturbed areas. The results revealed the presence of several plants with high naturalistic interest, such as the community's representative of synanthropic and natural Mediterranean grasslands, which arise both from the present and the past uses of the area. The high naturalistic values of the site are also assessed, considering its remarkable richness of species/area compared with the well-known archaeological sites of Rome. These findings further indicate that plant diversity needs to be considered in planning management activities in archaeological sites to also protect their natural values.

Keywords: floristic assessment; ruderal vegetation; cultural heritage conservation; biodiversity conservation; plant ecology; archaeological sites management

Citation: Zangari, G.; Bartoli, F.; Lucchese, F.; Caneva, G. Plant Diversity in Archaeological Sites and Its Bioindication Values for Nature Conservation: Assessments in the UNESCO Site Etruscan Necropolis of Tarquinia (Italy). *Sustainability* **2023**, *15*, 16469. https://doi.org/10.3390/su152316469

Academic Editors: Panayiotis Dimitrakopoulos, Ana Catarina Pinheiro and Cristina Galacho

Received: 16 October 2023
Revised: 17 November 2023
Accepted: 28 November 2023
Published: 30 November 2023

1. Introduction

Plant growth in archaeological areas can cause several problems for the management and conservation of archaeological monuments, leading to biodeterioration [1–9]. Biodeterioration can be caused by mechanical stress on stone materials, including root damage to the walls of buried archaeological structures, or by chemical erosion processes due to the release of acid metabolites and chelating agents [6,10–12]. Then, it is also necessary to evaluate the characteristics, benefits, or harmful potential of species that may ultimately avoid or mitigate conflict between vegetation and archaeological ruins [13–15].

Furthermore, in addition to the important role of maintaining the natural vegetation cover in such areas, previous studies have also shown that archaeological sites can provide refuges for plant and animal species, protecting them from human impact and stresses associated with urban development and thus helping to conserve their levels of biodiversity [16–29]. Indeed, cultural heritage management activity provides some protection for natural heritage compared to other highly disturbed human ecosystems. This allows the growth of vegetation with natural or semi-natural features in these areas, with species and plant communities of conservation interest [28,30,31]. In some instances, it has been observed that the latter could even quadruple in number compared to other human-modified contexts, where they are often threatened [29,32–36]. Furthermore, vegetation cover may positively influence the conservation of monuments, as in the case of several hypogeal structures, via maintaining constant microclimatic conditions and thus limiting deterioration phenomena mainly due to water evaporation and phenomena of salt efflorescence [14,37,38]. Moreover, vegetation can provide interesting tools to define a preventive conservation plan, thereby reducing the weathering effect, protecting the monument and contributing to their conservation against aggressive weathering agents [39,40].

Several investigations on the use of plant species or communities as bioindicators of edaphic and environmental conditions, such as of human and animal activities, have been carried out in recent decades, especially in urban environments, to achieve a deeper knowledge of the natural plant heritage and its protection from the threatening expansion of urban areas [27,41–44]. In fact, plant species, with their diversity, structure, chorology and autecology, represent valuable tools for analysing ecosystems and understanding changes in the main environmental factors which occur at spatial and temporal levels [45–50]. Protecting biodiversity is also essential for a range of goods and services that are of fundamental importance to human well-being and the functioning of ecosystems [48]. Therefore, species loss adversely affects the overall functioning of an ecosystem since the latter is determined by combined effects [51,52]. Consequently, it is essential to focus on how ecosystems can be managed to provide ecosystem services to society and the environment efficiently. Indeed, a great deal of international effort has been directed towards conserving biodiversity, including green areas and infrastructure in anthropised environments, to advance global biodiversity and sustainability goals [53–58].

In archaeological areas, the study of plant biodiversity and the ecological dynamics by which it is driven is functional both to the conservation of the species and habitats they contain and to the promotion of sustainable tourism. In fact, management of archaeological areas carried out taking into account the naturalistic peculiarities of these areas allows for planning of the modalities of tourist fruition and of maintenance operations in order to prevent harmful effects on the vegetation [59–65].

Therefore, to contribute to the naturalistic knowledge of an archaeological area of relevant cultural interest, we selected the Etruscan archaeological site of "Monterozzi" in Tarquinia, which has been included in the UNESCO World Heritage Sites (WHS) since 2004 together with the site of Cerveteri [66]. This site has a particular naturalistic relevance since it contains a SAC (Special Area of Conservation), code IT6010028 (Habitats Directive 92/43/EEC), for the protection of five species of bats and is also included within a broader SPA (Special Protection Area), code IT6030005, for the conservation of various plants, animals, and habitats. Its naturalistic value was preliminarily confirmed by our recent floristic analysis of the area [67], showing that the plant communities host a high floristic richness, with the presence of protected, endangered, or rare species for the region, as in the case of several orchids. We also carried out in the site research on the influence of the vegetation cover on the conservation of underground wall paintings [10,14,68], such as on the identification of herbaceous roots penetrating in the hypogeas [10]. However, no studies have been carried out here on the bioindication role of the plant species and communities growing on the site and the associated environmental drivers.

Then, this research aims to further contribute to the knowledge of plant diversity in archaeological sites as bioindicators of edaphic and environmental factors and to the related naturalistic values. In particular, we will analyse (I) the general floristic characteristics, defining their naturalistic interest; (II) the ecological and syntaxonomical characteristics of vegetation types and their species richness; and finally, (III) bioindication values of vegetation types about the past and present conditions.

2. Materials and Methods

2.1. The Site

The Etruscan "Monterozzi" Necropolis of Tarquinia, which was used from the 7th to the 2nd century BC, holds paintings of extraordinary value, and is "the only significant evidence of pre-Roman classical art existing in the Mediterranean basin" [66]. The site is located in central Italy, around 4 km from the Tyrrhenian Sea and 70 km NW from Rome, at an altitude of around 200 m a.s.l.

The area falls within the Mediterranean bioclimate (characterised by a lower mesomediterranean thermotype and an upper dry ombrotype) [69]. Meteorological data on temperature and rainfall obtained from the public archive database show an average annual rainfall of 648.2 mm, with an average monthly value of 55.0 mm, with July being the driest (20.7 mm) and November the wettest (102.5 mm) (http://www.idrografico.regione.lazio.it/annali/index.htm, accessed on 1 July 2022). Temperatures show a certain variability among the seasons, with an average annual temperature of 15.7 °C, the temperature of the coldest month 9.6 °C, the temperature of the warmest month 24.3 °C, and the average minimum temperature of the coldest month 3.3 °C.

The Mitrakos indexes [70] were used for defining both the intensity and duration of cold (stress from winter cold) and aridity (summer drought stress). Such indexes are defined as follows:

- Monthly temperature stress (MCS) = 8 (10 − t) where t = average minimum monthly temperature [°C];
- Winter Cold Stress (WCS) = sum of MCSs of December, January and February;
- Year Cold Stress (YCS) = sum of MCSs of all months of the year;
- Monthly Drought Stress (MDS) = 2 (50 − p), where p = monthly rainfall [mm];
- Summer Drought Stress (SDS) = sum of MDSs of June, July, and August;
- Year Drought Stress (YDS) = sum MDSs of all months of the year.

Data from [71] showed that the values of Winter Cold Stress in Tarquinia were not high (WCS = 76.5, YCS = 91.5), whereas the values for the Summer Aridity Stress were quite high (SDS = 166.6, YDS = 184.8).

The necropolis rises on a Pliocene plan and includes more than 6000 underground tombs excavated in the rock and covered with soil mounds, which were often destroyed. The geological substrate of the site is mainly composed of clays and marls [72], sometimes with olistostromes in the northern parts and detritic and organogenic limestones in the southern one [73].

Our study area covers approximately 5.7 ha, with a plant cover constituted mainly of grasslands interspersed by small shrub formations in some parts. The grassland plant cover is managed with mowing activities several times during the year.

2.2. Floristic Analysis and Evaluation of the Naturalistic Interest

During spring and autumn 2020–2021, we carried out a broad survey in the area to collect floristic information on species and life forms, observing and picking the plant individual that was further dried and stored as herbarium samples. Plant species were identified using the "Flora d'Italia" [74], which was also helpful for attributing chorological data. We also checked and updated the plant names according to the "The World of Flora Online project" [75] and the Portal to the Flora of Italy version 2021.2 [76].

Then, we assessed the natural value of the species (based on conservation interest, rarity, vulnerability, and endemism), following a methodology proposed by Caneva [13] and successively applied by Cicinelli et al. [77]. In particular, we considered their inclusion in lists protected by local, national, and international laws and their inclusion in international directives (Habitat Directive—92/43/EEC and the CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora), and in the red list of threatened vascular plants in Italy [78], Latium Regional Law on protected spontaneous plants (l.r. 19 Settembre 1974, n. 61). Further information on frequency and relictuality were obtained via Atlases of the vascular flora of Latium [79,80], highlighting the first record in the site and attributing the following categories: RR = extremely rare; MR = very rare; and PC = uncommon [79,80].

2.3. Ecological and Syntaxonomical Characteristics of Vegetation Types and Their Species Richness

During spring 2021, we also carried out 42 vegetation surveys within the study area on tumuli, trampled areas and other zones less subject to visitor influence (Figure 1), using the phytosociological approach of the Zurigo-Montpellier school [81].

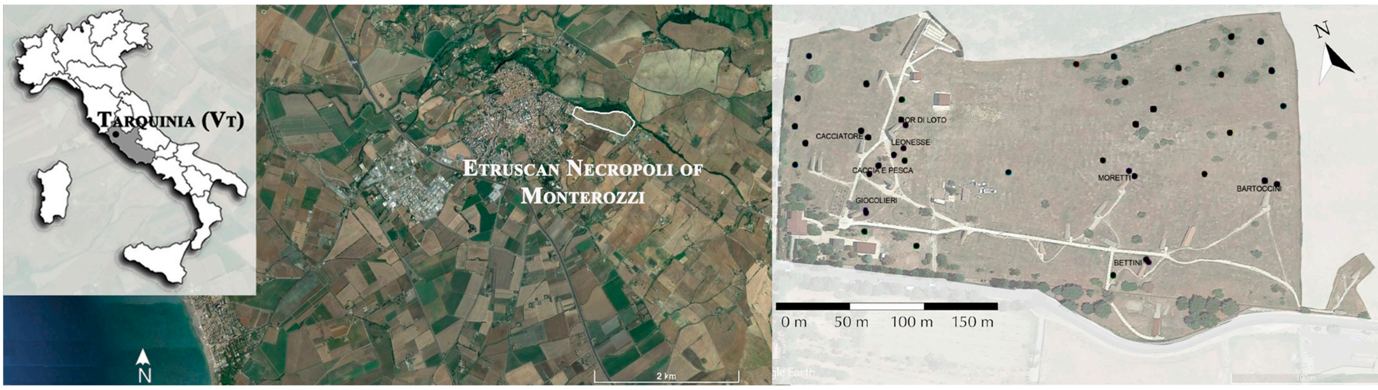

Figure 1. Etruscan Necropolis of Monterozzi, Tarquinia (VT), Italy: geographical placement and map of the 42 surveys carried out within site. The sampling locations covered the burial mounds, the zones frequented by visitors and the surrounding areas less subject to disturbance.

According to such methodology, in each plot of 25 m^2, carried out in a homogeneous zone, we identified the occurring species, assessing their cover values (using the coverage index of plants of the Braun–Blanquet scale: + = 0.5%; 1 = 1–5%; 2 = 5–25%; 3 = 25–50%; 4 = 50–75%; 5 = 75–100%), and the most relevant environmental variables and edaphic factors, such as slope, aspect, altitude and soil features.

To describe the plant composition and the ecological characteristics of the communities, we performed a cluster analysis and an NMDS (Non-Metric Multidimensional Scaling) ordination graph for quantitative data (abundance). Non-metric multidimensional scaling (NMDS) is an unconstrained analysis, which, unlike methods which attempt to maximise the variance or correspondence between objects in an ordination, attempts to represent, as closely as possible, the pairwise dissimilarity between objects in a low-dimensional space. The dissimilarity matrix of the data was calculated using the Bray–Curtis dissimilarity index, which takes into account the abundance and presence or absence of species in each dataset to assess the diversity and compare the composition of species in different environments. A hierarchical cluster analysis was performed on this matrix using the mean agglomeration method UPGMA (unweighted pair group method with arithmetic mean), which uses the unweighted arithmetic averages of the measures of dissimilarity, thus avoiding characterising the dissimilarity by extreme values (minimum and maximum). The Silhouette index [82], which studies the separation distance between clusters by measuring how close each point in one cluster is to points in the neighbouring clusters, was used to decide the optimal number of clusters. A dendrogram of the dissimilarities between samples and between species was then derived and sorted according to distance matrices. An indicator species analysis of the individual clusters was then performed, which identifies the associations between the species or combinations of them and the clusters using the Indval index, which considers the indices of fidelity and specificity [83,84]. A synoptic table was elaborated using the percentage frequency of occurring species among the different clusters. The ordination graph of sampling sites was obtained by the NMDS method. To highlight the ecological variations between the vegetation clusters, we projected environmental variables measured in the field on the NMDS plots.

Furthermore, we carried out a syntaxonomic analysis of the plant communities based on the ecological interpretation, which was suggested by a wide literature and synthesised in the Italian Vegetation Prodrome [85]. We also considered a wider analysis of European vegetation, and finally, the syntaxonomic classification and nomenclature follow [86] and for some particular syntaxa [87].

Finally, we evaluated the species richness per plot in the Monterozzi site to discriminate the richness among the different identified plant communities. We compared this richness and the occurrence of species with conservation interest collected in the site with those obtained from bibliographic data of all Roman archaeological areas [27]. For the latter, we selected only 12 sites, for a total of 63 relieves, comparable in size areas and similar vegetation types to our surveys. Thus, we considered that the species–area relationship is approximately described by a power function of the form S = cAz, which is usually presented as a log10 transformation of variables [88]. We then applied the formula $\log_{10} S = \log_{10} C + z \log_{10} A$ (S is the number of species and A is the area size) and thus performed regression analysis. Following the same method, we performed a residual analysis of species richness across the different vegetation clusters of the Monterozzi Site. Software R (Version 4.2.1) [89] was used for all statistical analyses with the packages: ade4, vegan, gclus, cluster, vegclust and indicspecies.

2.4. The Bioindication Values of the Different Plant Communities

For analysing their bioindication values, we obtained information from the scientific literature on the habitats usually hosting the detected floristic elements [85–87]. Furthermore, we also collected the Ellenberg Indicators Values (EIVs; see [90,91]) of the species to derive information on the influence of the associated environmental variables: light (Light), temperature (Temp), moisture (Moist), nitrogen (Nutr), continentality (Cont) and soil pH (React). We calculated the average indicator values of such communities, also considering the cover values of the species, and then we compared them to highlight differences.

3. Results

3.1. Floristic Analysis and Evaluation of Naturalistic Interest

Improving the previous floristic analysis [92], where 110 species have been described, in the present plots, we detected 167 species, included in 39 families and 126 genera. The most represented families were Asteraceae (35 = 19.6%), Fabaceae (24 = 13.4%) and Poaceae (22 = 12.3%), while the most species-rich genera resulted in *Trifolium* (7) (Fabaceae), *Medicago* (5) (Fabaceae), *Crepis* (4) (Asteraceae), *Plantago* (4) (Asteraceae) and *Erodium* (4) (Geraniaceae). The most frequent species are listed in Table 1, which enhances the highest frequency of *Hyoseris radiata*, *Plantago lanceolata*, *Seseli tortuosum*, *Salvia verbenaca* and *Avena barbata*.

Table 1. List of species with a conservation interest.

	Frequency (Latium)	Endemics	CITES	Latium Reg. Law
* *Ajuga iva*	PC			
* *Carduus nutans*	PC			
Centaurea aspera	MR			
Crepis bursifolia L.	PC			
Crepis capillaris	RR			
* *Helianthemum apenninum*	PC			
* *Helianthemum salicifolium*	PC			
Hyoseris radiata	PC			
Linaria purpurea		X		X
* *Onosma echioides*	PC	X		
Ophrys bombyliflora			X	
Ophrys tarquinia		X	X	
Serapias parviflora	PC		X	
* *Trifolium spumosum*	RR			

Frequency is based on [79] (RR = extremely rare; MR = very rare; PC = uncommon). Species marked with an asterisk are those found for the first time at the site; the others had already been mentioned in [67].

From a floristic point of view, Therophytes, which exceed 50%, are the most recurrent species, followed by Hemicryptophytes (34%), and in decreasing order, Geophytes (8%), Chamaephytes (4%) and Phanerophytes (4%). Most species have a Mediterranean chorotype (61%) with a similar contribution of the Euri-Mediterranean (33%) and Steno-Mediterranean (28%) species. Species with a wide distribution and Eurasian species follow next with a frequency of 18% and 16%, respectively. Several endemic, boreal and Atlantic species are also present, with a lower percentage. *Erigeron sumatrensis* resulted in the only exotic species.

Several occurring species have a particular conservation interest, as shown in Table 1, and are infrequent, rare or very rare occurrences in Latium [73], as in the case of *Trifolium spumosum*, of which only very few reports exist in this region.

Furthermore, several species that were found to have a high frequency within the site are relatively rare or not very common at the regional level. For example, the species *Hyoseris radiata*, which has the highest frequency at the site (88%), is uncommon in the region, and *Centaurea aspera*, which has a high frequency at the site (69%), is reported to occur very rarely in the region. In addition, several other protected species (Figure 2) were observed: endemic species, species protected by regional regulations and several orchid species listed by CITES.

Figure 2. Some of the detected species with conservation interest growing in the Etruscan necropolis of Monterozzi (Tarquinia, Central Italy). (**a**) *Ophrys bombyliflora*; (**b**) *Serapias parviflora*; (**c**) *Ophrys tarquinia*.

3.2. Ecological and Syntaxonomical Characteristics of Vegetation Types and Their Species Richness

3.2.1. Ecological Statistical Evaluations

The dendrogram of the cluster analysis concerning dissimilarities between relieves in the plots enhanced the presence of different communities (Figure 3). Separating the clusters at the highest level, the resulting main groups were (1) (Cl. A) shrub formations of Mediterranean scrub dominated by *Rhamnus alaternus* (Figure 4A); (2) (Cl. B1) therophytic grasslands with high cover of the chamaephyte *Teucrium capitatum* and with frequent occurrence of several geophytes, such as the orchids *Serapias parviflora* and *Ophrys bombyliflora* (Figure 4B1); (3) (Cl. B2) grasslands dominated by *Asphodelus ramosus* (Figure 4B2); (4) (Cl. C) variable herbaceous synanthropic vegetation growing on grave mounds (Figure 4C); (5) (Cl. D) grasslands dominated by *Dasypyrum villosum* and *Avena barbata* (Figure 4D); and (6) (Cl. E) grasslands dominated by *Malva sylvestris* and *Hordeum murinum* subsp. *leporinum* (Figure 4E).

The grasslands dominated by *Asphodelus ramosus* and therophytic grasslands showed a lower separation since some of these sampling areas were grouped together, and some of them were also mixed with the grave mounds. All the samples carried out on the grave mounds fall into a main cluster, even if with a certain further differentiation. In fact, the tombs of Leonesse and Fiore di Loto create a separate cluster from all the other tombs.

The indicator species of the different groups according to the IndVal index, which considers the indices of specificity (A) and fidelity (B), is reported in Table S1. The most indicative species of Cluster E include *Hordeum murinum* subsp. *leporinum*, *Erodium cicutarium* and *Calendula arvensis.* Concerning Cluster D, among the most indicative species, we found *Silene italica*, *Vicia hybrida*, *Anchusa azurea* and *Avena sterilis* (Figure 4D). Cluster A is characterised by *Convolvulus cantabrica*, *Urospermum dalechampii* and *Trifolium stellatum* for most of the tombs and, more rarely, *Carduus pycnocephalus*, *Convolvulus althaeoides* and *Campanula erinus*. For Clusters B1 and B2, *Lysimachia linum-stellatum*, *Linum bienne*, *Teucrium capitatum*, *Sanguisorba minor*, *Asperula aristata* and *Ononis reclinata* resulted in the most indicative species, whereas for Cluster C, they were *Brachypodium rupestre*, *Allium roseum* and *Ornithogalum narbonense*.

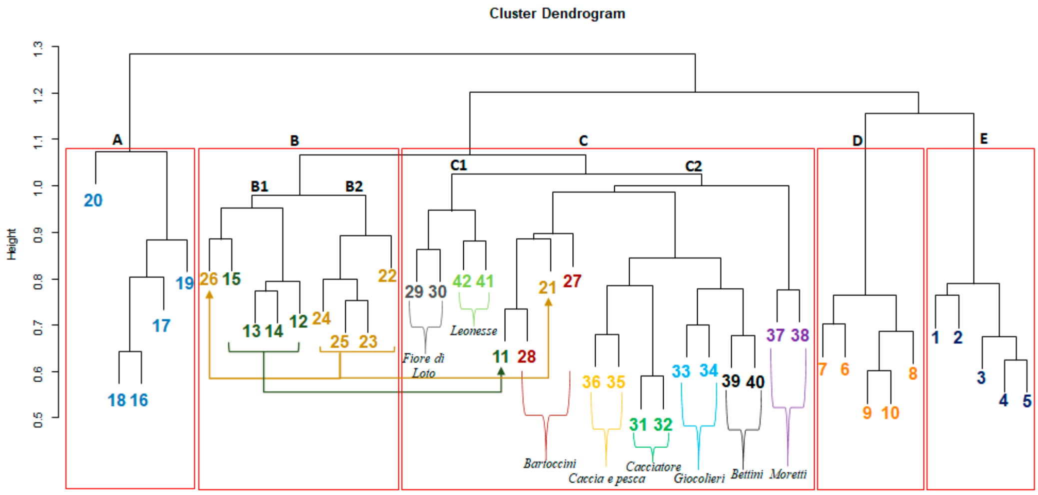

Figure 3. Dendrogram of vegetation abundance from data matrix of the Etruscan necropolis of Monterozzi (Tarquinia, Central Italy). Plant communities (clusters): (**A**) shrub formations of Mediterranean maquis; (**B1**) therophytic grasslands with *T. capitatum*; (**B2**) grasslands dominated by *A. ramosus*; (**C1**) vegetation growing on grave mounds with recently placed grass turf; (**C2**) spontaneous vegetation growing on grave mounds; (**D**) grasslands dominated by *D. villosum* and *A. barbata*; (**E**) grasslands dominated by *M. sylvestris* and *H. murinum* subsp. *leporinum*. The numbers from 1 to 42 indicate the different sampling areas.

Figure 4. Vegetation types growing in the Etruscan necropolis of Monterozzi (Tarquinia, Central Italy), pictures taken in May 2021. Vegetation types (clusters): (**A**) shrub formations of Mediterranean scrub; (**B1**) therophytic grasslands dominated by *T. capitatum*; (**B2**) grasslands dominated by *A. ramosus*; (**C**) vegetation growing on grave mounds; (**D**) grasslands dominated by *D. villosum* and *A. barbata*; (**E**) grasslands dominated by *M. sylvestris* and *H. murinum* subsp. *leporinum*. The numbers from 1 to 42 indicate the different sampling areas.

The ordinations with the arrangement of clusters obtained via the NMDS in an ecological space are shown in Figure 5. Such ordination confirms the results from the cluster analysis concerning the organisation of the groups.

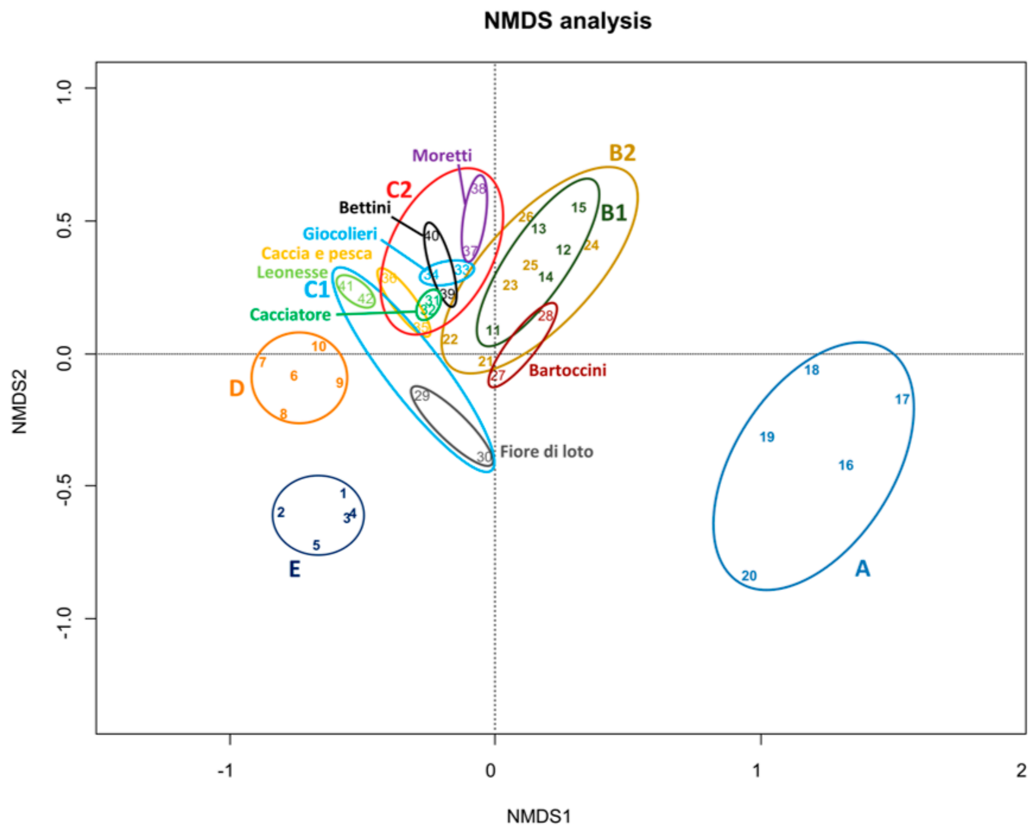

Figure 5. NMDS ordination of the Monterozzi site sampling areas. Clusters are circled and overimposed on NMDS plots. ((**A**) *R. alaternus* communities, (**B1**) therophytic grassland communities, (**B2**) *A. ramosus* communities, (**C**) grave mounds communities, (**C1**) Leonesse and the Fiore di Loto tombs and (**C2**) the other tombs, (**D**) *D. villosum* communities, (**E**) *M. sylvestris* communities).

The variability observed along the *x*-axis seems to follow anthropogenic disturbance, which has the highest values in Cluster D and E and the lowest in Cluster A. The variability explained by the *y*-axis seems mainly linked to the soil characteristics since the detected shrublands and grasslands (Clusters A–E) grow in deeper soils, and the other therophytic grasslands grow mainly in thin soils with rockiness.

3.2.2. Syntaxonomic Analysis

The syntaxonomic analysis of the vegetation growing at the Monterozzi archaeological site showed a certain variability and richness of the vegetation types present in the area. Such types describe communities or fragments which are representative of different alliances, orders, and classes (Tables 2, 3 and S2–S4 as synthetic descriptions) [78,79].

3.2.3. Floristic Richness Assessment of the Plant Communities

The graph of floristic richness in the different plant communities (Figure 6) shows a gradient from the therophytic grasslands with the dominance of *Teucrium capitatum* (B1) with the highest species richness, followed by grasslands dominated by *Asphodelus ramosus* (B2). The latter are followed by tumulis' vegetation (C) and grasslands dominated by *Dasypyrum villosum* and *Avena barbata* (D). After that, we find the grasslands dominated by *Malva sylvestris* and *Hordeum murinum* subsp. *leporini* (E), and last are the shrub formations of Mediterranean scrub dominated by *Rhamnus alaternus* (A).

Table 2. Synoptic table showing percentage frequency of occurring species among the different clusters. Clusters: A—*R. alaternus* communities, B1—Therophytic grasslands communities, B2—*A. ramosus* communities, C—Grave mounds communities, D—*D. villosum* communities, E—*M. sylvestris* communities.

Synoptic Table						
Clusters	**A**	**B1**	**B2**	**C**	**D**	**E**
Oleo-Ceratonion siliquae Br.-Bl. ex Guinochet et Drouineau 1944						
Phillyrea latifolia L.	III	I				
Clematis flammula L.	V	III				
Rhamnus alaternus L.	V		II			
Asparagus acutifolius L.	V					
Rubia peregrina L.	V					
Pistacia terebinthus L.	III					
Pistacio lentisci-Rhamnetalia alaterni Rivas-Mart. 1975 and Quercetea ilicis Br.-Bl. ex A. Bolòs et O. de Bolòs in A. Bolòs y Vayreda 1950						
Fraxinus ornus L.	I					
Chamaerops humilis L.	I					
Brachypodium rupestre (Host) Roem. & Schult.	IV	II				
Spartium junceum L.	V	I				
Hordeetum leporini Br.-Bl. (1931) 1936 malvetosum sylvestris Braun-Blanquet et al., 1952						
Hordeum murinum subsp. leporinum (Link) Arcang.						V
Malva sylvestris L.				III	IV	V
Echium plantagineum L.		I	II	IV	IV	I
Crepis bursifolia L.	I			I	I	II
***Hordeion leporini* Braun-Blanquet (1931) 1947**						
Erodium ciconium (L.) L'Hér.				I	V	III
Capsella bursa-pastoris Medik.			II		I	IV
Anthemis arvensis L.	I	V	V	V	III	IV
Medicago polymorpha L.				II	IV	IV
Plantago lagopus L.	I	IV	III	II		V
Diplotaxis tenuifolia (L.) DC.		I			II	I
Geranium molle L.			II	I	V	IV
Veronica polita Fr.		III	III		I	I
Galactites tomentosus Moench						I
***Vulpio ligusticae-Dasypyretum villosi* Fanelli 1998 and *Securigero securidacae-Dasypyrion villosi* Cano-Ortiz, Biondi et Cano in Cano-Ortiz et al. ex Di Pietro in Di Pietro et al., 2015**						
Dasypyrum villosum (L.) P. Candargy		I	III	III	V	
Avena barbata Pott ex Link	I	III	V	V	V	V
Reichardia picroides (L.) Roth	II	V	V	V	IV	II
Avena sterilis L.			II	II	IV	
Foeniculum vulgare Mill.			II	III	I	II
Lotus ornithopodioides L.	I	III		IV	III	
Festuca ligustica Bertol.		III		I	I	II
***Brometalia rubenti-tectorum* (Rivas Godayet Rivas-Mart. 1973) Rivas-Mart. et Izco 1977 and *Chenopodietea* Br.-Bl. in Br.-Bl. et al., 1952**						
Crepis sancta (L.) Babc.		I		II	V	V
Bromus madritensis L.			II	I	III	I
Convolvulus arvensis L.					IV	II
Reseda lutea L.	I			II		I
Papaver rhoeas L.				II	I	
Poa annua L.	I			I		IV
Scandix pecten-veneris L.	I			II		I
Senecio vulgaris L.						II
Tordylium apulum L.	IV	II	V		II	II
Raphanus raphanistrum L.					II	
Vicia sativa L.				II	IV	
Sonchus oleraceus L.			II	II	II	
Carduus pycnocephalus L.	III	I				
Ajuga chamaepitys (L.) Schreb.			II			

Table 2. *Cont.*

Synoptic Table						
Clusters	**A**	**B1**	**B2**	**C**	**D**	**E**
Nigella damascena L.		I				
Rostraria cristata (L.) Tzvelev		IV		II		
Calendula arvensis M.Bieb.		I	II	III	III	V
Cerastium ligusticum Viv.		III	II		II	I
Sherardia arvensis L.		IV	III	V	IV	V
Trifolium campestre Schreb.	I	V	IV	III	I	
Euphorbia helioscopia L.	II	III	V	V	IV	II
***Hypochoeridion Achyrophori* Biondi et Guerra 2008**						
Hypochaeris achyrophorus L.		IV	II	III		
Medicago truncatula Gaertn.		IV	IV	V	IV	II
Ononis reclinata L.		V	V	IV		
Linum strictum L.		II				
Sixalix atropurpurea (L.) Greuter & Burdet	I	IV	III	II		
Catapodium rigidum (L.) C.E.Hubb.		IV	V			I
Helianthemum salicifolium (L.) Mill.		IV	III			II
Medicago minima (L.) L.		I	IV	I	II	
Campanula erinus L.		V		I		
Aegilops geniculata Roth		II	V	IV	IV	
***Ptilostemono stellati-Vulpietalia ciliatae* Mucina ined. and *Stipo-Trachynietea distachyae* S. Brullo in S. Brullo et al., 2001**						
Dactylis glomerata L. subsp. *hispanica* (Roth) Nyman	II	V	V	V	V	IV
Festuca ambigua Le Gall		IV	V	III	I	
Trifolium scabrum L.		IV	V	IV	I	
Trifolium stellatum L.		IV	V	V	IV	
Briza maxima L.	I	II	II	I		
Crepis neglecta L.	II	IV	III	I		
Lagurus ovatus L.			II	I		
Hippocrepis biflora Spreng.		I	II	I		
Onobrychis caput-galli (L.) Lam.		V	II	IV	I	
Plantago bellardii All.		II		I		
Romulea columnae Sebast. & Mauri		I	IV	I		
Parentucellia latifolia (L.) Caruel		III	III			
***Scorzoneretalia villosae* Kovač ević 1959 and *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947**						
Onosma echioides (L.) L.		III	II	I		
Anthyllis vulneraria L. subsp. *rubriflora* (DC.) Arcang.		III	II	I		
Teucrium capitatum L.		IV	III	I		
Satureja montana L.		II				
Helianthemum apenninum Mill.		II	III			
Ophrys bombyliflora Link	I	IV	III	I		
Ophrys tarquinia P. Delforge		I				
Centaurea aspera L.	III	III	V	IV	IV	IV
Serapias parviflora Parl.	I	IV	II	I		
Convolvulus cantabrica L.		V	IV	V		II
Petrorhagia saxifraga Link		I	II	IV	II	II
Thesium humifusum DC.		I				
Sanguisorba minor Scop.	I	V	IV	II		
Bromus erectus Huds.		I	II	II	I	II
Galium lucidum All.		III				
***Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow1951**						
Plantago lanceolata L.		V	V	V	III	II
Convolvulus althaeoides L.				II		I
Echium vulgare L.	I					I
Picris hieracioides Sm.	I			II		I
Poa bulbosa L.		II		I		II
Medicago sativa L.	I	I	II	III	IV	V
Crepis capillaris (L.) Wallr.		II	II		I	
Linum bienne Mill.		IV	III			
Salvia verbenaca L.	I	V	V	V	II	IV

Table 2. *Cont.*

Synoptic Table						
Clusters	**A**	**B1**	**B2**	**C**	**D**	**E**
Leontodon tuberosus L.	IV	IV	III	III	I	I
Tragopogon porrifolius L.			II	III		
***Asphodelo ramosi-Feruletum communis* Biondi et al., 2016**						
Asphodelus microcarpus Rchb.	III	III	V	I		
Ferula communis L.			V	I		
***Asphodelo ramosi-Ferulion communis* Biondi et al., 2016 and *Asphodeletalia ramosi* Biondi et al., 2016**						
Anemone hortensis L.	IV	I	IV	I	II	
Carlina corymbosa L.		I				
***Charybdido pancratii-Asphodeletea ramosi* Biondi et al., 2016**						
Hyoseris radiata L.	IV	V	V	V	III	IV
Galium lucidum subsp. corrudifolium (Vill.) Bonnier	II	II				
Leopoldia comosa (L.) Parl.		I	III	I		
***Scrophulario-Helichrysetalia* S. Brullo 1984 and *Drypidetea spinosae* Quézel 1964**						
Chondrilla juncea L.				I		
Linaria purpurea (L.) Mill.	I	I	II	II		
Micromeria graeca (L.) Benth. ex Rchb. subsp. *tenuifolia* (Ten.) Nyman	I			I		
Urospermum dalechampii (L.) Scop.		V	IV	V	IV	II
Companions						
Astragalus hamosus L.		I	III	II	III	IV
Seseli tortuosum L.	IV	V	V	V	II	II
Silene italica (L.) Pers.		I			V	II
Vicia hybrida L.		I		I	V	I
Erodium cicutarium (L.) L'Hér.		I	III	II		IV
Lysimachia linum-stellatum L.		V	V	I		I
Verbascum sinuatum L.		I		II	I	III
Plantago media L.	I					II
Cynodon dactylon (L.) Pers.		I	II	II		
Cerastium glomeratum Thuill.		II	IV	II	I	IV
Valeriana eriocarpa (Desv.) Christenh. & Byng		III	III	II		I
Erodium malacoides (L.) L'Hér.						II
Erodium moschatum (L.) L'Hér.						II
Theligonum cynocrambe L.						II
Anchusa azurea Mill.					III	
Anisantha diandra (Roth) Tutin ex Tzvelev				I	I	
Trifolium spumosum L.					I	
Orobanche ramosa L.	I	I	II		I	
Ajuga iva (L.) Schreb.		III	III	II		
Allium roseum L.	I	I		II		
Anisantha rubens (L.) Nevski		I		I		
Bellardia trixago (L.) All.		I				
Blackstonia perfoliata (L.) Huds.		IV	II	I		
Carduus nutans L.		III	II	II		
Centaurium erythraea Rafn		IV				
Clinopodium nepeta (L.) Kuntze		I	II	III		
Crupina vulgaris Pers. ex Cass.			II			
Filago germanica (L.) Huds.		III				
Galium murale All.			II			
Hedypnois rhagadioloides (L.) F.W.Schmidt			II			
Lysimachia arvensis (L.) U.Manns & Anderb.		V	III	II		
Phleum hirsutum Honck.			II	I		
Poa trivialis L.			II			
Polygala monspeliaca L.	I	II	II			
Silene pendula L.		I				
Sinapis alba L.	I		II			
Stachys ocymastrum Briq.			III			
Trifolium resupinatum L.		I	IV			
Hypericum perfoliatum L.		I		I		

Table 2. *Cont.*

Synoptic Table						
Clusters	**A**	**B1**	**B2**	**C**	**D**	**E**
Lathyrus cicera Hauman			II	II		
Medicago orbicularis (L.) Bartal.			II	I		
Borago officinalis L.		I			I	
Bellis perennis L.			II		I	I
Sonchus bulbosus (L.) N. Kilian & Greuter	III			I		
Ornithogalum narbonense L.	I			I		
Pallenis spinosa (L.) Cass.	I			I		
Lolium perenne L.	I			I		
Anthyllis circinnata (L.) D.D.Sokoloff	I					
Arabis hirsuta (L.) Scop.	I					
Cirsium vulgare (Savi) Ten.	I			I		
Helichrysum italicum (Roth) G.Don	I					
Euonymus europaeus L.	I					
Sonchus asper (L.) Hill	I			II		
Fumaria capreolata L.	I					
Lactuca serriola L.	I			I		
Cuscuta epithymum L.	I			II		

Table 3. Syntaxonomic scheme.

1. **ANTHROPOGENIC VEGETATION**
1.1 MEDITERRANEAN SEGETAL AND RUDERAL VEGETATION OF MAN-MADE HABITATS
CHENOPODIETEA Br.-Bl. in Br.-Bl. et al., 1952
Brometalia rubenti-tectorum Rivas-Mart. et Izco 1977
Hordeion murini Br.-Bl. in Br.-Bl. et al., 1936
Hordeetum leporini Br.-Bl. (1931) 1936
malvetosum sylvestris Braun-Blanquet et al., 1952
Securigero securidacae-Dasypyrion villosi Cano-Ortiz, Biondi et Cano in Cano-Ortiz et al. ex Di Pietro in Di Pietro et al., 2015
Vulpio ligusticae-Dasypyretum villosi Fanelli 1998

1.2 MEDITERRANEAN AND SUB-MEDITERRANEAN VEGETATION OF PERENNIAL *GRASSLANDSINPOSTABANDONOFAGRO − PASTORALACTIVITY*
CHARYBDIDO PANCRATII-ASPHODELETEA RAMOSI Biondi et al., 2016
Asphodeletalia ramosi Biondi et al., 2016
Asphodelo ramosi-Ferulion communis Biondi et al., 2016
Asphodelo ramosi-Feruletum communis Biondi et al., 2016

1.3 PERENNIAL (SUB)XEROPHILOUS RUDERAL VEGETATION OF THE TEMPERATE AND *SUBMEDITERRANEANREGIONS*
ARTEMISIETEA VULGARIS Lohmeyer et al. in Tx. ex von Rochow1951

2. NATURAL GRASSLANDS
2.1 MEDITERRANEAN CALCIPHILOUS ANNUAL AND EPHEMEROID SWARDS AND *GRASSLANDS*
STIPO-TRACHYNIETEA DISTACHYAE S. Brullo in S. Brullo et al., 2001
Ptilostemono stellati-Vulpietalia ciliatae Mucina ined.
Hypochoeridion achyrophori Biondi et Guerra 2008

2.2 SUBMEDITERRANEAN DRY GRASSLAND AND STEPPE VEGETATION
FESTUCO-BROMETEA Br.-Bl. et Tx. ex Soó 1947
Scorzoneretalia villosae Kovač ević 1959

3. SUBMEDITERRANEAN VEGETATION OF SCREE AND ROCKY HABITATS
DRYPIDETEA SPINOSAE Quézel 1964
Scrophulario-Helichrysetalia S. Brullo 1984

Table 3. *Cont.*

4. MEDITERRANEAN FORESTS AND SCRUB
QUERCETEA ILICIS Br.-Bl. ex A. Bolòs et O. de Bolòsin A. Bolòs y Vayreda 1950
Pistacio lentisci-Rhamnetalia alaterni Rivas-Mart. 1975
Oleo-Ceratonion siliquae Br.-Bl. ex Guinochet et Drouineau 1944

3.2.4. Floristic Richness Assessment of the Plant Communities

The graph of floristic richness in the different plant communities (Figure 6) shows a gradient from the therophytic grasslands with the dominance of *Teucrium capitatum* (B1) with the highest species richness, followed by grasslands dominated by *Asphodelus ramosus* (B2). The latter are followed by tumulis' vegetation (C) and grasslands dominated by *Dasypyrum villosum* and *Avena barbata* (D). After that, we find the grasslands dominated by *Malva sylvestris* and *Hordeum murinum* subsp. *leporini* (E), and last are the shrub formations of Mediterranean scrub dominated by *Rhamnus alaternus* (A).

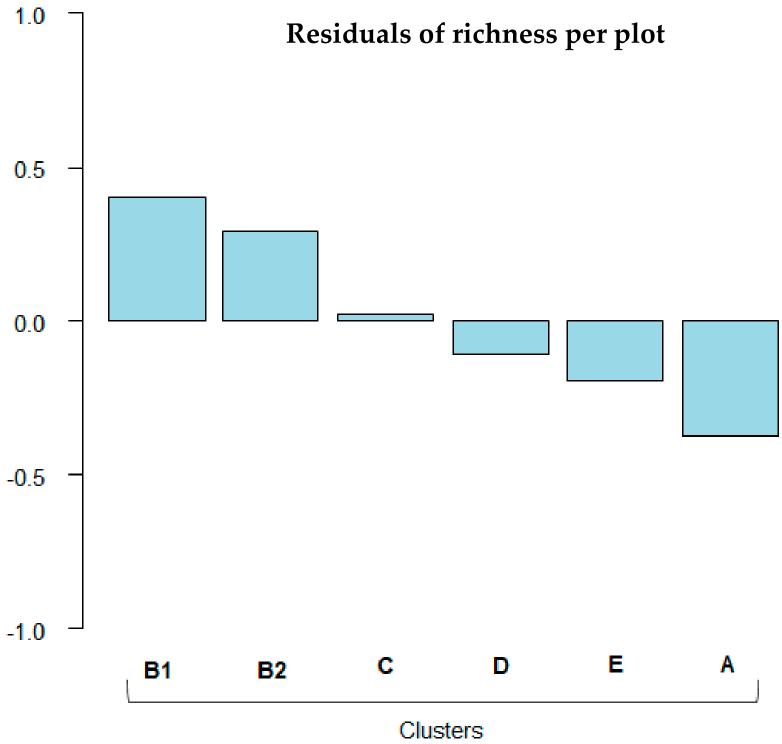

Figure 6. Residuals of species richness in the different vegetation clusters. A—*R. alaternus* communities, B1—therophytic grasslands communities, B2—*A. ramosus* communities, C—grave mounds communities, D—*D. villosum* communities, E—*M. sylvestris* communities.

Species richness and occurrence of species with conservation interest in the Monterozzi site surveys resulted much higher than in the surveys of several Roman archaeological areas with similar vegetation types and sizes and the therophytic grasslands with the dominance of *Teucrium capitatum* show the highest richness (62 species), while the shrublands showed the lower richness (20 species) (Figure 7a). In fact, in the occurring range of the logarithm scale, the increase of one point triplicates the values of plant diversity.

Regarding the occurrence of species with conservation interest (Figure 7b), again, the Monterozzi surveys show much higher values than the regression line. All surveys of Monterozzi have at least one species with conservation interest, while many surveys of Roman archaeological areas have none. Therophytic grasslands of Monterozzi, with the dominance of *T. capitatum*, also contain the highest number of species with conservation interest, such as several orchids.

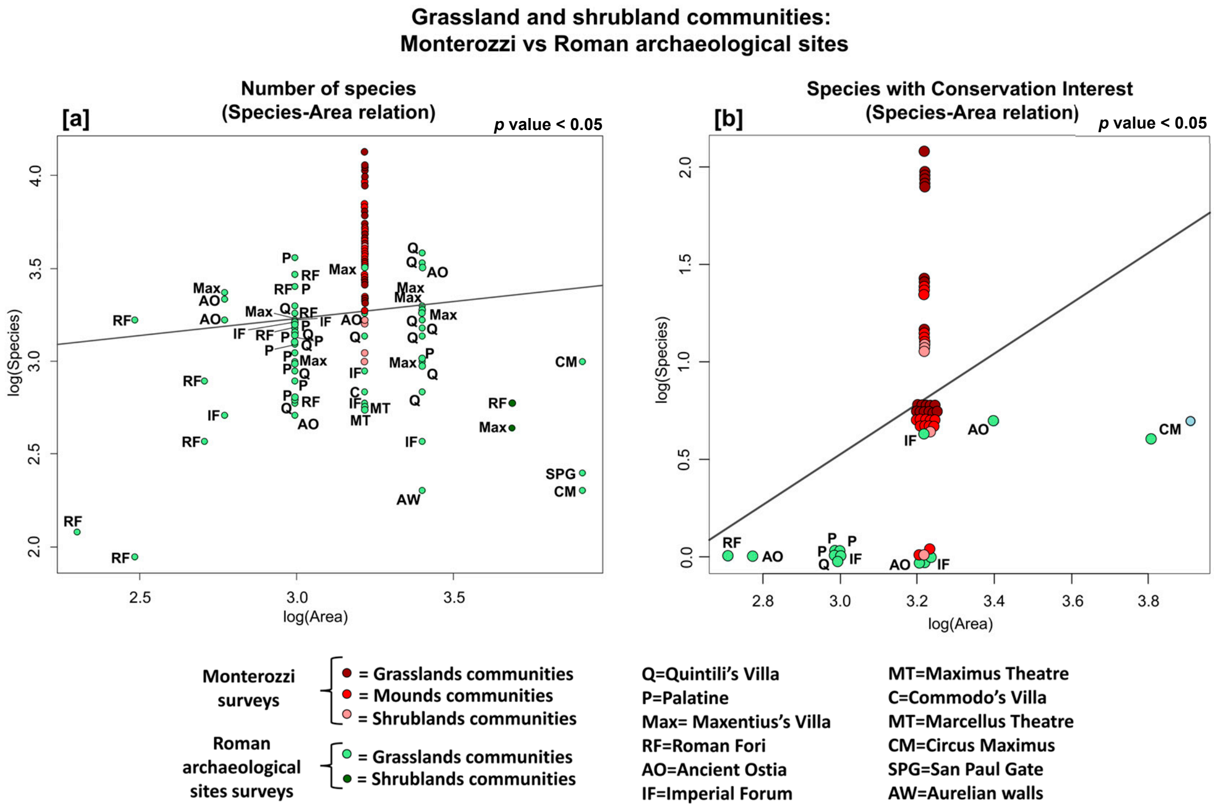

Figure 7. Comparison of species richness (**a**) and occurrence of species with conservation interest (**b**) between the surveys of the Monterozzi site and those of several Roman archaeological areas (the overlapping points were separated and shown close together, and when surveys had no species of conservation interest are not shown in Graph (**b**)).

3.3. The Bioindication Values of the Different Plant Communities

The graph of Ellenberg Indicators Values (Figure 8) showed that, in general, the plant communities describe conditions of high solar radiation (LIGHT 7–9) and values of transition among xeric Mediterranean-mountain and typical xeric Mediterranean ones (TEMP 7–9). It is confirmed by the continentality value (CONT 5), and the xeric conditions of the site were also indicated by the low hydric values (MOIST 3). The average soil preference for pH values (REACT 5–7) and for nutrients (NUTR 3–5) highly vary. The latter two indicators show greater variability. Specifically, regarding reaction, therophytic grasslands (cluster B1) and grave mounds communities (cluster C) show higher pH values, while *A. ramosus* and *D. villosum* communities lower. Regarding nutrition, on the other hand, the more synanthropic grasslands (Clusters B2, C, D and E) show higher values than the more natural therophytic grasslands (Cluster B1).

The ecological characteristics of the dominant species in the vegetation allow using them as bioindicators of the present environmental conditions or also those occurring in the past.

Grasslands dominated by *M. sylvestris* and *H. murinum* subsp. *leporinum* (Cluster E) are indicators of disturbed land subject to trampling, with a certain accumulation of debris [66,86]. Furthermore, when *M. sylvestris* is dominant (as in our case), it indicates a deeper soil, rich in nitrates and subject to frequent trampling [74,93].

Grasslands dominated by *D. villosum* and *A. barbata* (Cluster D) are typical grasslands of the so-called "Campagna Romana" [94–96], and they indicate a Mediterranean xerophilous herbaceous vegetation.

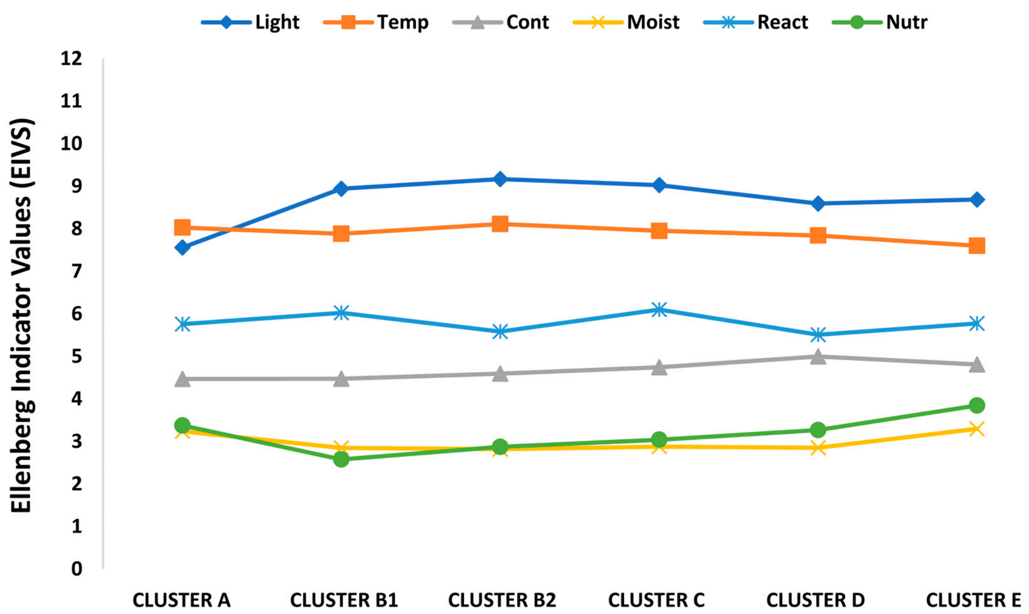

Figure 8. Averages of Ellenberg indicator values of communities weighted to species abundance data collected. Clusters: A—*R. alaternus* communities, B1—therophytic grasslands communities, B2—*A. ramosus* communities, C—grave mounds communities, D—*D. villosum* communities, E—*M. sylvestris* communities.

Grasslands dominated by *A. ramosus* (Cluster B2) are related to grazing and fires, and such Mediterranean geophyte shows a relevant resprouting capacity from the rhizome. This species is favoured by heavy grazing and recurrent fires [74,97]; in fact, it flowers massively in burned areas [98].

Therophytic grasslands hosting high cover of *T. capitatum* and with frequent occurrence of several orchids such as *S. parviflora* and *O. bombyliflora* (Cluster B1) refers to vegetation in hot and arid Mediterranean environments, on stony, embryonic, or decapitated soils [74,85].

The Mediterranean scrub dominated by *R. alaternus* (Cluster A) refers to the scrubland's vegetation of basal and hilly belts, with moderate resilience in fire-disturbed contexts.

4. Discussion

The floristic and vegetational assessment of the Monterozzi site revealed high plant biodiversity, with still remaining naturalness and interesting features of relictuality.

4.1. Floristic Analysis and Evaluation of the Naturalistic Interest

The dominance of therophytes over hemicryptophytes confirmed the character of the present bioclimate of the site, in particular of the lower mesomediterranean thermotype, and the effects of the past and current anthropogenic disturbances [99]. The relevant spread of geophytes (8%) can be justified by the presence of rather evolved soils and the presence of some habitats less affected by human disturbance [100], especially in the north-eastern area of the site, farthest from the entrance and bordering Mediterranean scrub vegetation. In addition, there is a higher percentage (60%) of bulbous geophytes, which are usually more abundant in grassland areas or synanthropic environments, than rhizomatous geophytes, which are associated with wetter areas. Instead, the considerable occurrence of chamaephytes (8%) can be explained by the presence of thin soils and rock emergences in the north-central part of the site due to the remnant fragments of coastal boulder and travertine beds, which were more widely distributed in the past over all the surrounding areas [80].

The marked prevalence of Mediterranean and sub-Mediterranean components and Eurasian ones is due to the bioclimatic conditions, and the high proportion of widely distributed species is due to the anthropic disturbance in the area [101].

Several species of special conservation interest were found within the site. First and foremost, *T. spumosum*, a thermo-xerophilous species mainly found in the arid and uncultivated soils of coastal areas with a very fragmented and declining distribution in Italy, especially in the central regions [102]. In Latium, there are very few findings around Rome and near Gaeta and Tarquinia [103]; in the latter two cases, however, only bibliographic or field data and not herbarium samples are available.

4.2. Ecological and Syntaxonomical Characteristics of Vegetation Types and Their Species Richness

Despite our study not considering the influence of seasonal variations influence, the syntaxonomic analysis showed a certain heterogeneity of the vegetation types, containing small relictual fragments of steppic zones and pastoral grasslands mixed with the expected Mediterranean vegetation types.

These remnant fragments record some natural vegetation types as therophytic grasslands growing on travertine or coastal *macco*. Indeed, in the Tarquinia area, there is a marine terrace at a relatively low altitude, dating from the Upper Pliocene-Lower Pleistocene, which was home to heterogeneous and highly biodiverse vegetation, of which only a few fragments remain today [80]. The flora found in these environments are very similar to that of the travertines, with many steppic species adapted to higher elevation environments, such as some chamaephytes present in site *H. apenninum*, *H. salicifolium*, *T. capitatum* and *O. echioides*, which are relicts of vegetation that managed to be preserved following the last glaciation. In a large portion of the site, therophytic grasslands with *T. capitatum* are bioindicators of thin soils and superficial bedrocks. They are mixed in a patchy distribution with *A. ramosus* grasslands, which are a consequence of the past pastoral activities showing a long-time permanence. After that, due to the resilience of several therophytic species of calcareous soils, especially in the areas with higher outcrops of coastal *macco* and stony soils, therophytic vegetation with *T. capitatum* can become dominant again. This would also explain the similarity in species composition between clusters B1 and B2. As observed by several authors, when grazing is managed in a non-intensive way, it can favour greater biodiversity, and the effects of such activities can remain for a long time (in this case, for several decades) [104–106]. Furthermore, the higher richness of clusters B1 and B2, shown in Figure 6, can be related to microhabitats created by the variability of bedrocks and erosion phenomena, which favours a great amount of therophitic species requiring lower nutrient and water availability [107,108]. The separation between the mounds of the Leonesse and the Fiore di Loto tombs (Cluster C1) with respect to the other tombs (Cluster C2) is mainly due to the artificialisation of the vegetation cover to which these two tombs have recently been subject.

In general, the resulting species richness is very relevant not only when considering the archaeological areas in the Roman context (the double) [32] but also other grasslands in a wider Euro-Mediterranean context [109]. Furthermore, the occurrence of species with conservation interest found within the single plots seems mainly due to the high naturalness of this area and its high value in terms of the conservation status of floristic and vegetation elements. These results are in line with a preliminary study of flora on this site [67] and other data from other similar situations, like those collected in the near necropolis "La Banditaccia", located a few kilometres away in Cerveteri, and included in the same UNESCO World Heritage Site [22,92].

Based on the floristic results, it is recommended that the site management would support the conservation of the species of conservation interest occurring in the site.

4.3. The Bioindication Values of the Different Plant Communities

Although the study did not explore the historical human activities and historical land use practices in the site, since we found such information not easy to retrieve, the bioindication value can replace this lack of providing important information.

On the other hand, grasslands dominated by *M. sylvestris* and *H. murinum* subsp. *Leporinum*, according to [32,33], are common in the Roman archaeological areas, where they grow along the margins of paths and on soils where pedogenesis is embryonic and anthropogenic disturbance is high. These communities are bioindicators of herbaceous formations that grow on abandoned lands where pedogenesis is embryonic and anthropic disturbance has a certain incidence [43].

This vegetation type has often been found in spatial contact with grasslands dominated by *D. villosum* and *A. barbata*, similar to other archaeological areas [17,33], where, if trampling disturbance decreases, grasslands dominated by *M. sylvestris* and *H. murinum* subsp. *leporini* tend to evolve towards *D. villosum* and *A. barbata* grasslands. Bibliographic data report that it develops in rather poor soil often reworked and made up of heterogeneous materials [33]. Thus, this vegetation type is typical of abandoned fields and uncultivated areas growing, so are witness that several zones in the area were cultivated in the past. Such as the therophytic grasslands witnesses of arid soils abandoned after (non-intensive) cultivation or extensive grazing [74,85].

The shrub formations dominated by *R. alaternus*, located furthest from the graves and the visitor's path, indicate a higher naturality. These communities are, in fact, intermediate stages of vegetation series culminating in mature sclerophyllous evergreen forest stages linked to slight natural or anthropogenic disturbance [76]. This vegetation represents an intermediate stage of the vegetation series culminating in mature forest stages of *Q. ilex* forests, affected by natural and anthropogenic disturbances [85].

The analysis of the Ellenberg indicator values (Figure 8) properly describes the ecological pattern of the site, and usually, the values do not vary considerably among the different communities. Instead, the greater variability of soil reaction and nutrient values better explain some differences between the communities. In particular, the unpredicted lower nutrients requirement of the detected *A. ramosus* communities (Cluster B2), compared to the other synanthropic grasslands (Clusters C, D and E), seems due to the high bearing in such communities of species belonging to the therophitic grasslands (Cluster B1), which have a significantly lower nutrient requirement.

4.4. Management and Conservation Strategies

Valorisation of the presence of this natural heritage on the site is important, as well as making the tourists aware of it. To achieve this aim, it could be worthwhile to install signage that informs visitors about the naturalistic value of the site and communities with conservation interests they may encounter in order to encourage visitors not to damage them. Furthermore, it can be recommended the delimitation of areas where such species are mostly found, highlighting their presence and their value. In this way, the limited access of visitors in these areas would not cause an issue but rather a stop-off point where the visitors can understand both the beauty of cultural and natural heritage of the site.

In the management plan and in the conservation strategies, it should be important to find a balance between the protection of monuments and the conservation of the natural environment. In this respect, it is important to have a coherent management plan with limited weeding activities in areas that contain the most valuable natural elements and to schedule them after their processes of dissemination do not obstruct their reproduction. Moreover, the weeding activities must be selective to the plant species that in the concrete have a biodeteriogen activity against the building heritage.

5. Conclusions

This work enhancing the natural heritage in a cultural place showed how a detailed analysis of the ecological characteristics of the plant species and of their bioindication values gives useful information for reconstructing past and present activities and for supporting a sustainable management plan. The latter should consider the safeguarding of natural richness in the planning of weeding and maintenance activities and in the modalities in which sites are made accessible to visitors. As the first analysis on this site to consider changes in vegetation and use bioindication values, we encourage for future research.

Furthermore, we underline the importance in protecting and promoting the sustainability and conservation of natural and cultural heritages.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su152316469/s1. Table S1: Indicator species of the different groups calculated using the IndVal index; Table S2: Analytic table of the grassland plant community: communities dominated by *Malva sylvestris* and *Hordeum murinum* (Cluster E; n. 1–5) dominated by *Dasypyrum villosum* and *Avena barbata* (Cluster D; n. 6–10), dominated by *Asphodelus ramosus* and therophytic grasslands with high cover of *Teucrium capitatum* (Cluster B; n. 12–15, 22–26); Table S3: Analytic table of shrub formations of Mediterranean scrub dominated by *Rhamnus alaternus* (Cluster A); Table S4: Analytic table of the plant community growing on grave mounds (Cluster C).

Author Contributions: Conceptualization, G.C.; methodology, G.Z. and G.C.; investigation, G.Z., F.L. and G.C.; data curation, G.Z. and F.B.; writing—review and editing, G.Z., F.B., F.L. and G.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was conducted as part of a PhD study and funded as a PhD scholarship by the University Roma Tre, Science Department. The Grant of Excellence Departments, MIUR, Italy (Art. 1, commi 314–337 legge 232/2016), is gratefully acknowledged.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data present in this study are available within the text and in the Supplementary Materials.

Acknowledgments: The authors wish to thank the Direzione Regionale Musei Lazio (Vincenzo Belelli, Director of the Cerveteri and Tarquinia UNESCO Site) and the Soprintendenza Archeologia, Belle Arti e Paesaggio per la Provincia di Viterbo e per l'Etruria Meridionale (Rossella Zaccagnini).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Corbetta, F.; Pavone, P.; Spampinato, G.; Tomaselli, V.; Trigilia, A. Studio della vegetazione dell'area archeologica della Neapolis (Siracusa, Sicilia) finalizzato alla conservazione dei manufatti architettonici. *Fitosociologia* **2002**, *39*, 3–24.
2. Celesti-Grapow, L.; Blasi, C. The role of alien and native weeds in the deterioration of archaeological remains in Italy. *Weed Technol.* **2004**, *18*, 1508–1513. [CrossRef]
3. Guglielmo, A.; Pavone, P.; Tomaselli, V. Studio della vegetazione infestante e del verde ornamentale nel Parco Archeologico di Akrai (Palazzolo Acreide, SR) finalizzato alla conservazione e alla valorizzazione dei manufatti architettonici. *Fitosociologia* **2006**, *43*, 39–53.
4. Caneva, G.; Nugari, M.P.; Salvadori, O. *Plant Biology for Cultural Heritage: Biodeterioration and Conservation*; Getty Publications: Los Angeles, CA, USA, 2008.
5. Bartoli, F.; Romiti, F.; Caneva, G. Aggressiveness of Hedera helix L. growing on monuments: Evaluation in Roman archaeological sites and guidelines for a general methodological approach. *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2017**, *151*, 866–877. [CrossRef]
6. Trotta, G.; Savo, V.; Cicinelli, E.; Carboni, M.; Caneva, G. Colonization and damages of Ailanthus altissima (Mill) Swingle on archaeological structures: Evidence from the Aurelian Walls in Rome (Italy). *Int. Biodeterior. Biodegrad.* **2020**, *153*, 105054. [CrossRef]
7. Hosseini, Z.; Caneva, G. Evaluating hazard conditions of plant colonization in Pasargadae World Heritage Site (Iran) as a tool of biodeterioration assessment. *Int. Biodeterior. Biodegrad.* **2021**, *160*, 105216. [CrossRef]
8. Dalimi, M.; Baghdad, B.; Zakarya, D.; Taleb, A.; Iñigo, A.C. Vegetations as biodeterioration agents on archaeological stones: Comparative study of plant species found on the walls of some Moroccan historical monuments. *J. Res. Agric.* **2014**, *3*, 193–204.
9. Cozzolino, A.; Adamo, P.; Bonanomi, G.; Motti, R. The Role of Lichens, Mosses, and Vascular Plants in the Biodeterioration of Historic Buildings: A Review. *Plants* **2022**, *11*, 3429. [CrossRef] [PubMed]
10. Isola, D.; Bartoli, F.; Langone, S.; Ceschin, S.; Zucconi, L.; Caneva, G. Plant DNA barcode as a tool for root identification in hypogea: The Case of the Etruscan Tombs of Tarquinia (Central Italy). *Plants* **2021**, *10*, 1138. [CrossRef] [PubMed]
11. Bruno, L.; Rugnini, L.; Spizzichino, V.; Caneve, L.; Canini, A.; Ellwood, N.T.W. Biodeterioration of Roman hypogea: The case study of the Catacombs of SS. Marcellino and Pietro (Rome, Italy). *Ann. Microbiol.* **2019**, *69*, 1023–1032. [CrossRef]
12. Elgohary, Y.M.; Mansour, M.M.; Salem, M.Z. Assessment of the potential effects of plants with their secreted biochemicals on the biodeterioration of archaeological stones. *Biomass Convers. Biorefinery* **2022**, 1–15. [CrossRef]

13. Caneva, G. A botanical approach to the planning of archaeological parks in Italy. *Conserv. Manag. Archaeol. Sites* **1999**, *3*, 127–134. [CrossRef]
14. Caneva, G.; Langone, S.; Bartoli, F.; Cecchini, A.; Meneghini, C. Vegetation Cover and Tumuli's Shape as Affecting Factors of Microclimate and Biodeterioration Risk for the Conservation of Etruscan Tombs (Tarquinia, Italy). *Sustainability* **2021**, *13*, 3393. [CrossRef]
15. Carrari, E.; Aglietti, C.; Bellandi, A.; Dibari, C.; Ferrini, F.; Fineschi, S.; Galeotti, P.; Giuntoli, A.; Manganelli Del Fa, R.; Moriondo, M.; et al. The management of plants and their impact on monuments in historic gardens: Current threats and solutions. *Urban For. Urban Green.* **2022**, *76*, 127727. [CrossRef]
16. Celesti-Grapow, L.; Caneva, G.; Pacini, A. La flora del Colosseo (Roma). *Webbia* **2001**, *56*, 321–342. [CrossRef]
17. Ceschin, S.; Cutini, M.; Caneva, G. La vegetazione ruderale dell'area archeologica del Palatino (Roma). *Fitosociologia* **2003**, *40*, 73–96.
18. Gao, H.; Ouyang, Z.; Chen, S.; Van Koppen, C.S.A. Role of culturally protected forests in biodiversity conservation in Southeast China. *Biodivers. Conserv.* **2013**, *22*, 531–544. [CrossRef]
19. Ceschin, S.; Bartoli, F.; Salerno, G.; Zuccarello, V.; Caneva, G. Natural habitats of typical plants growing on ruins of Roman archaeological sites (Rome, Italy). *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2016**, *150*, 866–875. [CrossRef]
20. Minissale, P.; Sciandrello, S. The wild vascular flora of the Archaeological Park of Neapolis in Syracuse and surrounding areas (Sicily, Italy). *Biodivers. J.* **2017**, *8*, 87–104.
21. Domina, G. The floristic research in Italian archaeological sites. *Flora Mediterr.* **2018**, *28*, 377–383.
22. Caneva, G.; Benelli, F.; Bartoli, F.; Cicinelli, E. Safeguarding natural and cultural heritage on Etruscan tombs (La Banditaccia, Cerveteri, Italy). *Rend Lincei-Sci. Fis.* **2018**, *29*, 891–907. [CrossRef]
23. Celesti-Grapow, L.; Ricotta, C. Plant invasion as an emerging challenge for the conservation of heritage sites: The spread of ornamental trees on ancient monuments in Rome, Italy. *Biol. Invasions* **2021**, *23*, 1191–1206. [CrossRef]
24. Albani Rocchetti, G.; Bartoli, F.; Cicinelli, E.; Lucchese, F.; Caneva, G. Linking Man and Nature: Relictual Forest Coenosis with Laurus nobilis L. and Celtis australis L. in Antica Lavinium, Italy. *Sustainability* **2021**, *14*, 56. [CrossRef]
25. Heneidy, S.Z.; Al-Sodany, Y.M.; Bidak, L.M.; Fakhry, A.M.; Hamouda, S.K.; Halmy, M.W.; Toto, S.M. Archeological Sites and Relict Landscapes as Refuge for Biodiversity: Case Study of Alexandria City, Egypt. *Sustainability* **2022**, *14*, 2416. [CrossRef]
26. Hosseini, Z.; Bartoli, F.; Cicinelli, E.; Lucchese, F. First floristic investigation in archaeological sites of Iran: Features and plant richness of Pasargadae world heritage site. *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2022**, *157*, 605–621. [CrossRef]
27. Panitsa, M.; Trigas, P.; Kontakos, D.; Valli, A.T.; Iatrou, G. Natural and cultural heritage interaction: Aspects of plant diversity in three East Peloponnesian castles (Greece) and conservation evaluation. *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2022**, *156*, 538–552. [CrossRef]
28. Alanís-Méndez, J.L.; Martínez-Castillo, I.A.; Viveros-Valencia, J.; Sosa-Constantino, F.G.; Limón-Salvador, F. Archaeological Sites as a Safeguard for Orchid Diversity: A Study in El Tajin, Veracruz, Mexico. *Nat. Areas J.* **2023**, *43*, 179–184. [CrossRef]
29. Rotherham, I.D. Bio-cultural heritage and biodiversity: Emerging paradigms in conservation and planning. *Biodivers. Conserv.* **2015**, *24*, 3405–3429. [CrossRef]
30. Keramitsoglou, K.M.; Koudoumakis, P.; Akrivopoulou, S.; Papaevaggelou, R.; Protopapas, A.L. Biodiversity as an Outstanding Universal Value for Integrated Management of Natural and Cultural Heritage. *Sustainability* **2023**, *15*, 8540. [CrossRef]
31. Papafotiou, M.; Marco Martínez, G.; Petrocheilou, A.; Kanellou, E. Design proposal to increase functionality and enhance the landscape by native plants at the archaeological site of Kolona, Aegina Island, Greece. In Proceedings of the VI International Conference on Landscape and Urban Horticulture, Athens, Greece, 20–25 June 2016; Volume 1189, pp. 93–96. [CrossRef]
32. Lucchese, F.; Pignatti, E. La vegetazione nelle aree archeologiche di Roma e della Campagna Romana. *Quad. Bot. Ambient. E Appl.* **2009**, *20*, 3–89.
33. Ceschin, S.; Cutini, M.; Caneva, G. Contributo alla conoscenza della vegetazione delle aree archeologiche romane (Roma). *Fitosociologia* **2006**, *43*, 97–139.
34. Capotorti, G.; Del Vico, E.; Lattanzi, E.; Tilia, A.; Celesti-Grapow, L. Exploring biodiversity in a metropolitan area in the Mediterranean region: The urban and suburban flora of Rome (Italy). *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2013**, *147*, 174–185. [CrossRef]
35. Deák, B.; Tóthmérész, B.; Valkó, O.; Sudnik-Wójcikowska, B.; Moysiyenko, I.I.; Bragina, T.M.; Török, P. Cultural monuments and nature conservation: A review of the role of kurgans in the conservation and restoration of steppe vegetation. *Biodivers. Conserv.* **2016**, *25*, 2473–2490. [CrossRef]
36. Hosseini, Z.; Zangari, G.; Carboni, M.; Caneva, G. Substrate Preferences of Ruderal Plants in Colonizing Stone Monuments of the Pasargadae. World Heritage Site, Iran. *Sustainability* **2021**, *13*, 9381. [CrossRef]
37. Katz, O. The ecosystem services framework in archaeology (and vice versa). *People Nat.* **2022**, *4*, 1450–1460. [CrossRef]
38. Frasca, F.; Verticchio, E.; Caratelli, A.; Bertolin, C.; Camuffo, D.; Siani, A.M. A comprehensive study of the microclimate-induced conservation risks in hypogeal sites: The mithraeum of the baths of Caracalla (Rome). *Sensors* **2020**, *20*, 3310. [CrossRef] [PubMed]
39. Caneva, G.; Bartoli, F.; Ceschin, S.; Salvadori, O.; Futagami, Y.; Salvati, L. Exploring ecological relationships in the biodeterioration patterns of Angkor temples (Cambodia) along a forest canopy gradient. *J. Cult. Herit.* **2015**, *16*, 728–735. [CrossRef]
40. André, M.F.; Voldoire, O.; Roussel, E.; Vautier, F.; Phalip, B.; Peou, H. Contrasting weathering and climate regimes in forested and cleared sandstone temples of the Angkor region. *Earth Surf. Process. Landf.* **2012**, *37*, 519–532. [CrossRef]

41. Godefroid, S. Temporal analysis of the Brussels flora as indicator for changing environmental quality. *Landsc. Urban Plan.* **2001**, *52*, 203–224. [CrossRef]
42. Celesti-Grapow, L.; Blasi, C. I siti archeologici nella conservazione della biodiversità in ambito urbano: La flora vascolare spontanea delle Terme di Caracalla a Roma. *Webbia* **2003**, *58*, 77–102. [CrossRef]
43. Ceschin, S.; Salerno, G.; Caneva, G. Multitemporal floristic analysis on a humid area in Rome's archaeological site as indicator for environmental change. *Environ. Monit. Assess.* **2009**, *149*, 29–42. [CrossRef] [PubMed]
44. Ceschin, S.; Salerno, G.; Bisceglie, S.; Kumbaric, A. Temporal floristic variations as indicator of environmental changes in the Tiber River in Rome. *Aquat. Ecol.* **2010**, *44*, 93–100. [CrossRef]
45. Ellenberg, H. *Vegetation Ecology of Central Europe Cambridge*; Cambridge University Press: Cambridge, UK, 1988.
46. Blasi, C.; Bruno, F. Botanica e territorio. In *100 Anni di Ricerche Botaniche in Italia (1888–1988)*; Società Botanica Italiana: Firenze, Italy, 1988; pp. 1003–1012.
47. Caneva, G.; Pacini, A.; Cutini, M.; Merante, A. The Colosseum floras as bio-indicators of the climatic changes in Rome. *Clim. Chang.* **2005**, *70*, 431–443. [CrossRef]
48. Daily, G.C. Introduction: What are ecosystem services? In *Nature's Services: Societal Dependence on Natural Ecosystems*; Daily, G.C., Ed.; Island Press: Washington, DC, USA, 1997; pp. 1–10.
49. Dambrine, E.; Dupouey, J.L.; Laüt, L.; Humbert, L.; Thinon, M.; Beaufils, T.; Richard, H. Present forest biodiversity patterns in France related to former Roman agriculture. *Ecology* **2007**, *88*, 1430–1439. [CrossRef] [PubMed]
50. Bhattacharya, S. Forest and biodiversity conservation in ancient Indian culture: A review based on old texts and archaeological evidences. *Int. Lett. Soc. Humanist. Sci.* **2014**, *19*, 35–46. [CrossRef]
51. Gamfeldt, L.; Hillebrand, H.; Jonsson, P.R. Multiple functions increase the importance of biodiversity for overall ecosystem functioning. *Ecology* **2008**, *89*, 1223–1231. [CrossRef]
52. Dupouey, J.L.; Dambrine, E.; Laffite, J.D.; Moares, C. Irreversible impact of past land use on forest soils and biodiversity. *Ecology* **2002**, *83*, 2978–2984. [CrossRef]
53. Amici, V.; Landi, S.; Frascaroli, F.; Rocchini, D.; Santi, E.; Chiarucci, A. Anthropogenic drivers for plant diversity: Prospective on land use change in a dynamic cultural landscape. *Biodivers. Conserv.* **2015**, *24*, 3185–3199. [CrossRef]
54. Agnoletti, M.; Rotherham, I.D. Landscape and biocultural diversity. *Biodivers. Conserv.* **2015**, *24*, 3155–3165. [CrossRef]
55. Baiamonte, G.; Domina, G.; Raimondo, F.M.; Bazan, G. Agricultural landscapes and biodiversity conservation: A case study in Sicily (Italy). *Biodivers. Conserv.* **2015**, *24*, 3201–3216. [CrossRef]
56. Nilon, C.H.; Aronson, M.F.; Cilliers, S.S.; Dobbs, C.; Frazee, L.J.; Goddard, M.A.; Yocom, K.P. Planning for the future of urban biodiversity: A global review of city-scale initiatives. *BioScience* **2017**, *67*, 332–342. [CrossRef]
57. Sirakaya, A.; Cliquet, A.; Harris, J. Ecosystem services in cities: Towards the international legal protection of ecosystem services in urban environments. *Ecosyst. Serv.* **2018**, *29*, 205–212. [CrossRef]
58. Kowarik, I.; Fischer, L.K.; Kendal, D. Biodiversity conservation and sustainable urban development. *Sustainability* **2020**, *12*, 4964. [CrossRef]
59. Blasco López, M.F.; Recuero Virto, N.; Aldas Manzano, J.; Garcia-Madariaga, J. Tourism sustainability in archaeological sites. *J. Cult. Herit. Manag. Sustain. Dev.* **2018**, *8*, 276–292. [CrossRef]
60. Minissale, P.; Trigilia, A.; Brogna, F.; Sciandrello, S. Plants and vegetation in the archaeological park of Neapolis of Syracuse (Sicily, Italy): A management effort and also an opportunity for better enjoyment of the site. *Conserv. Manag. Archaeol. Sites* **2015**, *17*, 340–369. [CrossRef]
61. Hancock, A. El Caño Archaeological Park: Biodiversity Past and Present. Ph.D. Thesis, Worcester Polytechnic Institute, Worcester, MA, USA, 2019.
62. Damhoureyeh, S.; Disi, A.; Al-Khader, I.; Abu-Dieyeh, M.H. Development of a zoning management plan for Petra Archaeological Park (PAP), Jordan. *Nat. Sci.* **2011**, *3*, 1040. [CrossRef]
63. Motti, R.; Bonanomi, G.; Stinca, A. Deteriogenic flora of the Phlegraean Fields Archaeological Park: Ecological analysis and management guidelines. *Nord. J. Bot.* **2020**, *38*, 1–11. [CrossRef]
64. Pisa, P.R.; Bitelli, G.; Bittelli, M.; Speranza, M.; Ferroni, L.; Catizone, P.; Vignudelli, M. Environmental assessment of an archaeological site for the development of an archaeological park. In *ARCHAIA: Case Studies on Research Planning, Characterisation, Conservation and Management in Archaeological Sites*; BAR Publishing: Oxford, UK, 2008; p. 1877.
65. Speranza, M.; Çakan, H.; Ferroni, L. A Safe Hotspot. Plant Biodiversity and the Natural and Cultural Heritage at Tilmen Höyük. In *An Integrated Approach for an Archaeological and Environmental Park in South-Eastern Turkey: Tilmen Höyük*; Springer: Cham, Switzerland, 2020; pp. 209–217. [CrossRef]
66. UNESCO—Nomination of the Site "Etruscan Necropolises of Cerveteri and Tarquinia". World Heritage List. 2004. Available online: https://whc.unesco.org/uploads/nominations/1158.pdf (accessed on 9 June 2023).
67. Cicinelli, E.; Zangari, G.; Bartoli, F.; Isola, D.; Lucchese, F.; Caneva, G. Protecting monuments and plant biodiversity in archaeological sites: The case of the Etruscan necropolis of "Monterozzi" (Tarquinia, central Italy). In Proceedings of the VIII International Conference on Landscape and Urban Horticulture, Catania, Italy, 28 September 2022; pp. 123–128. [CrossRef]
68. Caneva, G.; Isola, D.; Lee, H.J.; Chung, Y.J. Biological risk for hypogea: Shared data from Etruscan tombs in Italy and ancient tombs of the Baekje dynasty in Republic of Korea. *Appl. Sci.* **2020**, *10*, 6104. [CrossRef]

69. Rivas-Martinez, S. Bioclimatic Map of Europe. In *Geobotanica y Climatologia*; Rivas-Martinez, S., Ed.; Universidad de Granada: Granada, Spain, 1996; pp. 25–98.
70. Mitrakos, K. A theory for Mediterranean plant life. *Acta Oecologica-Oecologia Plant.* **1980**, *1*, 245–252.
71. Savo, V.; De Zuliani, E.; Salvati, L.; Perini, L.; Caneva, G. Long-term changes in precipitation and temperature patterns and their possible impacts on vegetation (Tolfa–Cerite Area, Central Italy). *Appl. Ecol. Environ. Res.* **2012**, *10*, 243–266. [CrossRef]
72. Geoportale Nazionale—Ministero dell'Ambiente e Della Tutela del Territorio e del Mare. 2009. Available online: http://www.pcn.minambiente.it (accessed on 16 May 2023).
73. Mattias, P.P.; Ventriglia, U. *La Regione Vulcanica dei Monti Sabatini e Cimini*; Arti Grafiche Pacini Mariotti: Pisa, Italy, 1970.
74. Pignatti, S.; Guarino, R.; La Rosa, M. *Flora d'Italia*, 2nd ed.; Edagricole di New Business Media: Milan, Italy, 2017.
75. WFO. World Flora Online. 2020. Available online: http://www.worldfloraonline.org (accessed on 5 July 2022).
76. Portal to the Flora of Italy. Version 20212. 2021. Available online: https://dryades.units.it/floritaly/ (accessed on 9 November 2022).
77. Cicinelli, E.; Salerno, G.; Caneva, G. An assessment methodology to combine the preservation of biodiversity and cultural heritage: The San Vincenzo al Volturno historical site (Molise, Italy). *Biodivers. Conserv.* **2018**, *27*, 1073–1093. [CrossRef]
78. Orsenigo, S.; Fenu, G.; Gargano, D.; Montagnani, C.; Abeli, T.; Alessandrini, A.; Bacchetta, G.; Bartolucci, F.; Carta, A.; Castello, M.; et al. Red list of threatened vascular plants in Italy. *Plant Biosyst.* **2021**, *155*, 310–335. [CrossRef]
79. Anzalone, B.; Iberite, M.; Lattanzi, E. La flora vascolare del Lazio. *Inf. Bot. Ital.* **2010**, *42*, 187–317.
80. Lucchese, F. *Atlante Della Flora Vascolare del Lazio: Cartografia, Ecologia E Biogeografia. Le Specie di Maggiore Interesse Conservazionistico*; Regione Lazio, Direzione Capitale Naturale, Parchi e Aree Protette: Lazio, Rome, 2018.
81. Braun-Blanquet, J. Plant sociology. In *The Study of Plant Communities*; McGraw-Hill: New York, NY, USA; London, UK, 1932.
82. Rousseeuw, P.J. Silhouettes: A graphical aid to the interpretation and validation of cluster analysis. *J. Comput. Appl. Math.* **1987**, *20*, 53–65. [CrossRef]
83. De Cáceres, M.; Legendre, P. Associations between species and groups of sites: Indices and statistical inference. *Ecology* **2009**, *90*, 3566–3574. [CrossRef]
84. De Cáceres, M.; Legendre, P.; Moretti, M. Improving indicator species analysis by combining groups of sites. *Oikos* **2010**, *119*, 1674–1684. [CrossRef]
85. Biondi, E.; Blasi, C.; Allegrezza, M.; Anzellotti, I.; Azzella, M.M.; Carli, E.; Casavecchia, S.; Copiz, R.; Del Vico, E.; Facioni, L.; et al. Plant communities of Italy: The vegetation prodrome. *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2014**, *148*, 728–814. [CrossRef]
86. Mucina, L.; Bültmann, H.; Dierßen, K.; Theurillat, J.P.; Raus, T.; Čarni, A.; Sumberová, K.; Willner, W.; Dengler, J.; Gavilán García, R.; et al. Vegetation of Europe: Hierarchical foristic classifcation system of vascular plant, bryophyte, lichen, and algal communities. *Appl. Veg. Sci.* **2016**, *19*, 3–264. [CrossRef]
87. Biondi, E.; Pesaresi, S.; Galdenzi, D.; Gasparri, R.; Biscotti, N.; Del Viscio, G.; Casavecchia, S. Post-abandonment dynamic on Mediterranean and sub-Mediterranean perennial grasslands: The edge vegetation of the new class Charybdido pancratii-Asphodeletea ramosi. *Plant Sociol.* **2016**, *53*, 3–18. [CrossRef]
88. MacArthur, R.H.; Wilson, E.O. *The Theory of Island Biogeography*; Princeton University Press: Princeton, NJ, USA, 1967.
89. R Development Core Team. *R: A Language and Environment for Statistical Computing*; R Foundation for Statistical Computing: Vienna, Austria, 2020.
90. Ellenberg, H.; Weber, H.E.; Düll, R.; Wirth, V.; Werner, W. *Zeigerwerte von Pflanzen in Mitteleuropa*; Goltze: Göttingen, Germany, 2001.
91. Pignatti, S.; Menegoni, P.; Pietrosanti, S. Valori di bioindicazione delle piante vascolari della flora d'Italia. *Braun-Blanquetia* **2005**, *39*, 1–97.
92. Cicinelli, E.; Benelli, F.; Bartoli, F.; Traversetti, L.; Caneva, G. Trends of plant communities growing on the Etruscan tombs (Cerveteri, Italy) related to different management practices. *Plant Biosyst. Int. J. Deal. All Asp. Plant Biol.* **2020**, *154*, 158–164. [CrossRef]
93. Güler, B. Plant species diversity and vegetation in urban grasslands depending on disturbance levels. *Biologia* **2020**, *75*, 1231–1240. [CrossRef]
94. Pignatti, E.; Giomi Visentin, M. Ostia Antica and its vegetation. *Braun-Blanquetia* **1989**, *3*, 271–278.
95. Fanelli, G. Analisi fitosociologica dell'area metropolitana di Roma. *Braun-Blanquetia* **2002**, *27*, 1–269.
96. Pignatti, S.; Bianco, P.; Tescarollo, P.; Scarascia Mugnozza, G. *La Vegetazione Della Tenuta Presidenziale di Castelporziano*; Accademia Nazionale delle Scienze detta dei XL, Scritti e Documenti: Rome, Italy, 2001; Volume 26, pp. 441–708.
97. Pantis, J.D.; Margaris, N.S. Can systems dominated by asphodels be considered as semi-deserts? *Int. J. Biometeorol.* **1988**, *32*, 87–91. [CrossRef]
98. García, Y.; Castellanos, M.C.; Pausas, J.G. Fires can benefit plants by disrupting antagonistic interactions. *Oecologia* **2016**, *182*, 1165–1173. [CrossRef] [PubMed]
99. Fanelli, G. Dasypyrum villosum vegetation in the territory of Rome. *Rend. Lincei* **1998**, *9*, 149–170. [CrossRef]
100. Bonari, G.; Selvi, F.; Minniti, F.; Frignani, F.; Angiolini, C. Contribution to the vascular flora of Castelvecchio Reserve (Central Tuscany, Italy). *Atti Della Soc. Toscana Sci. Nat. Pisa* **2018**, *125*, 77–86. [CrossRef]

101. Cannucci, S.; Angiolini, C.; Anselmi, B.; Banfi, E.; Biagioli, M.; Castagnini, P.; Centi, C.; Fiaschi, T.; Foggi, B.; Gabellini, A.; et al. Contribution to the knowledge of the vascular flora of Miniera di Murlo area (southern Tuscany, Italy). *Ital. Bot.* **2019**, *7*, 51–67. [CrossRef]
102. Scoppola, A.; Lattanzi, E.; Bernardo, L. Distribution and taxonomy of the Italian clovers belonging to Trifolium sect vesicastrum subsect mystillus (Fabaceae). *Ital. Bot.* **2016**, *2*, 7–27. [CrossRef]
103. Conti, F.; Abbate, G.; Alessandrini, A.; Blasi, C. An annotated checklist of the Italian vascular flora: First data. *Bocconea* **2005**, *21*, 147–153.
104. Marini, L.; Scotton, M.; Klimek, S.; Isselstein, J.; Pecile, A. Effects of local factors on plant species richness and composition of Alpine grasslands. *Agric. Ecosyst. Environ.* **2007**, *119*, 281–288. [CrossRef]
105. Marini, L.; Fontana, P.; Scotton, M.; Klimek, S. Vascular plant and Orthoptera diversity in relation to grassland management and landscape composition in the European Alps. *J. Appl. Ecol.* **2008**, *45*, 361–370. [CrossRef]
106. Orlandi, S.; Probo, M.; Sitzia, T.; Trentanovi, G.; Garbarino, M.; Lombardi, G.; Lonati, M. Environmental and land use determinants of grassland patch diversity in the western and eastern Alps under agro-pastoral abandonment. *Biodivers. Conserv.* **2016**, *25*, 275–293. [CrossRef]
107. Grace, B.J. The factors controlling species density in herbaceous plant communities: An assessment. *Urban Fisch. Verl.* **1999**, *2*, 1–28. [CrossRef]
108. Wellstein, C.; Campetella, G.; Spada, F.; Chelli, S.; Mucina, L.; Canullo, R.; Bartha, S. Context-dependent assembly rules and the role of dominating grasses in semi-natural abandoned sub-Mediterranean grasslands. *Agric. Ecosyst. Environ.* **2014**, *182*, 113–122. [CrossRef]
109. Dengler, J.; Biurrun, I.; Apostolova, I.; Baumann, E.; Becker, T.; Berastegi, A.; Weiser, F. Scale-dependent plant diversity in Palaearctic grasslands: A comparative overview. *Bull. Eurasian Dry Grassl. Group* **2016**, *31*, 12–26.