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Analysis of the chorological affiliation and conservation status of the vegetation of the Ricote Valley, Murcia (Spain)

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Analysis of the chorological affiliation and conservation status of the vegetation of the Ricote Valley, Murcia (Spain)

ABSTRACT

The Ricote Valley is located in the Autonomous Community of Murcia (Spain). It is a secular landscape with anthropic influences from different cultures, from the Iberians to the Romans, Carthaginians, Arabs, etc. This intense and prolonged occupation and management of the territory has led to a great transformation of the original vegetation cover. A systematic inventory of representative plots of each of the plant landscapes was undertaken in the Spanish XII National Fields Sessions and the IV International Symposium of Biogeography. This article shows the biogeographical characterization of these landscapes, as well as the results of the analysis of the conservation status and the chorological affiliation of the list of species detected. The results show a large number of common species or species with low threats as a result of the enormous transformation and trivialization of the vegetation landscape. On the other hand, Mediterranean component affiliations dominate, although those components with wide territorial ranges are low, which may contradict what was stated above. It is also interesting to note that the Euro-Siberian component is higher than expected.

Keywords: Vegetation. Systematic inventory. Conservation status. Chorological affiliation. Ricote Valley.

Análise da filiação corológica e do estado de conservação da vegetação do Vale do Ricote, Múrcia (Espanha)

RESUMO

O Vale do Ricote está localizado na Comunidade Autônoma de Múrcia (Espanha). Trata-se de uma paisagem secular com influências antrópicas de diferentes culturas, desde os ibéricos até os romanos, cartagineses, árabes, etc. Essa ocupação e gestão intensa e prolongada do território levou a uma grande transformação da cobertura vegetal original. Por ocasião das XII Jornadas Nacionales de Campo e do IV Simposio Internacional de Biogeografía, foi realizado um inventário sistemático de parcelas representativas de cada uma das paisagens vegetais. Este artigo mostra a caracterização biogeográfica dessas paisagens, bem como os resultados da análise do status de conservação e a afiliação corológica da lista de espécies detectadas. Os resultados mostram um grande número de espécies comuns ou espécies com baixa ameaça como resultado da enorme transformação e banalização da paisagem vegetal. Por outro lado, as afiliações de componentes mediterrâneos dominam, embora os componentes com amplas faixas territoriais sejam baixos, o que pode contradizer o que foi dito acima. Também é interessante observar que o componente euro-siberiano é mais alto do que se poderia esperar.

Palavras-chave: Vegetação. Inventário sistemático. Status de conservação. Afiliação corológica. Vale do Ricote.

Análisis de la filiación corológica y el estatus de conservación de la vegetación del Valle de Ricote, Murcia (España)

RESUMEN

El Valle de Ricote se sitúa en la Comunidad Autónoma de Murcia (España). Un paisaje secular con influencias antrópicas de culturas diferentes, desde los íberos hasta los romanos, cartaginenses, árabes, etc. Esta intensa y prolongada ocupación y manejo del territorio ha dado lugar a una gran transformación de la cubierta

vegetal original. Con motivo de la celebración de las XII Jornadas Nacionales de Campo y el IV Simposio Internacional de Biogeografía se abordó el inventariado sistemático de parcelas representativas de cada uno de los paisajes vegetales. En este trabajo se muestra la caracterización biogeográfica de dichos paisajes, así como los resultados del análisis del estatus de conservación y la filiación corológica del listado de especies detectado. Los resultados hablan de un gran número de especies comunes o con amenazas bajas fruto de esa enorme transformación y banalización del paisaje vegetal. Por su parte, dominan las filiaciones de componente mediterráneo siendo bajos, no obstante, aquellos componentes de amplios rangos territoriales, lo que puede contradecir lo afirmado anteriormente. También resulta interesante observar que el componente eurosiberiano es más alto de lo que podría preverse.
Palabras clave: Vegetación, inventario sistemático, estatus de conservación, filiación corológica, Valle de Ricote.

INTRODUTION

This paper presents the results of the analysis of the status and chorological affiliation of the vegetation of the Ricote Valley, obtained during the Spanish XII National Fields Sessions and the IV International Symposium of Biogeography. Different examples of plant formations and landscapes in this area of Murcia, especially in the municipalities of *Blanca* and *Abarán*, were collected, analyzed and evaluated. Although we will not go into a detailed description of the misology and geographical characteristics of the region, it is important to point out several aspects that give this sector remarkable biogeographical value. Firstly, it is integrated into the Mediterranean region and the Murcian-Almerian sub-province, being located close to the Castilian sub-province (Figure 1). The climate is Mediterranean, relatively dry, with rainfall not exceeding 500 mm, and in many places not even 400 mm. The region

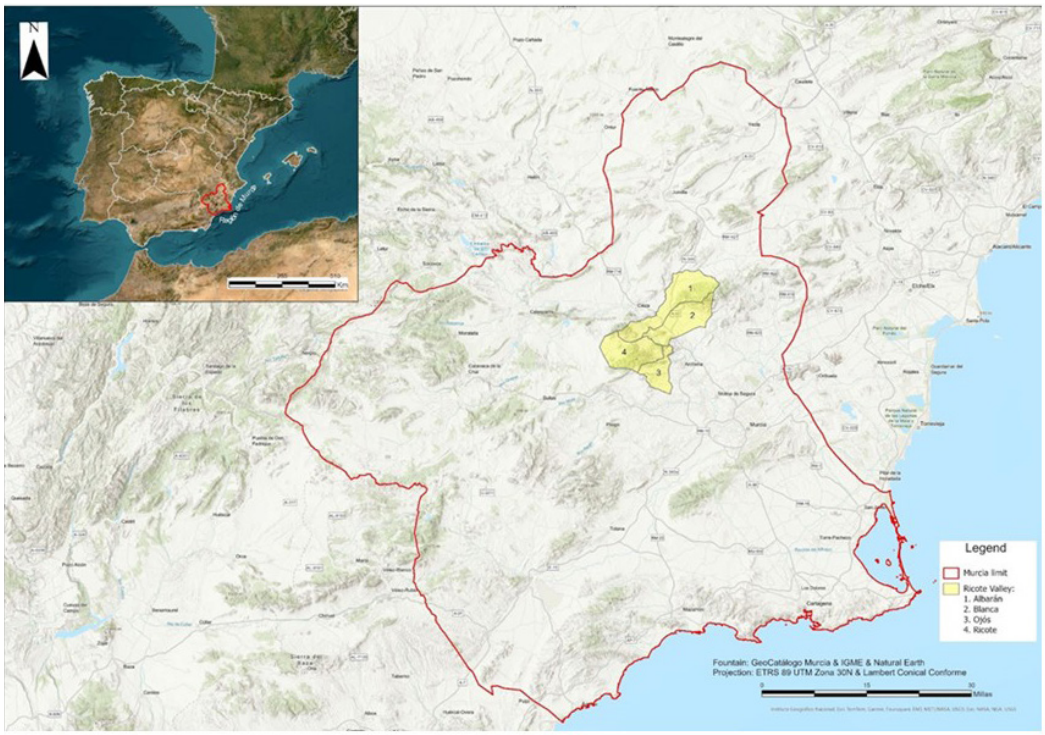

Figure 1 – Location map of the study area.
Source: Prepared by the authors.

experiences a marine influence from the Mediterranean, although it also has continental characteristics. These conditions, with mild winters and hot summers, together with low rainfall and a prolonged period of water stress from late May to mid-October, have resulted in vegetation that is highly adapted to this environment. In addition, the human influence is notable. These fertile lands have been exploited since ancient times. Civilizations such as the Greeks, Carthaginians, Romans and Arabs have left their mark in the form of cultural landscapes, which have been more or less modified over time. In addition to traditional agricultural techniques, new irrigation models, such as the Tajo-Segura water transfer, have allowed the expansion and intensification of irrigated crop areas. This has resulted in a notable alteration of the natural conditions and potential vegetation. Now, there is not a single corner of the Ricote valley where it is possible to speak of a minimally preserved potential vegetation. In their place, the riparian forests that once extended along the broad river terraces and floodplains, as well as the typical kermes oak and strawberry groves of the mountain range and slopes, have been replaced by paraclimactic formations. At best, plant communities that are better adapted to the pressures of human activity predominate, colonizing these landscapes that have centuries of history.

However, although the mesological characteristics (lithology, relief, slope, soils, climate, etc.) are relevant, anthropic influences are even more so. In this sense, we can affirm that all the landscapes of this region are completely cultural, resulting from human intervention that has been carried out over centuries, together with the various activities that have developed in the area. On the other hand, there is a notable duality between the sierras and the plains that form next to the Segura River, characterized by river terraces and flood plains. The mountains are dominated by pine forests of *Pinus halepensis*, which are mostly established in shady areas, facing north, northwest and west. On the other hand, on the solans, pine trees find it more difficult to thrive. This situation, combined with the steep slope and the stunted, often chalky soils, gives rise to a replacement scrubland, which represents a second or third stage of plant regression, manifesting itself in Mediterranean scrubland or esparto grassland.

AREAS AND PLOTS OF STUDY

The sectors chosen to study the vegetation of the Ricote Valley were four, selected by means of orthophotos and reconnaissance fieldwork, trying to carry out a random but stratified inventory of the most faithful representation of the vegetational cortege and the plant landscapes of the Valley, with the inventories being carried out in the spring of 2023 in a very favorable phenological period for the study of the vegetation of these sectors.

The area of the *Sierra de Chinte* was chosen for the study of the pine forests (*Chinte* and *Navela*) within the municipality of *Blanca*; for the *gypsiferous* vegetation the sector of *Las Marañas* in the municipality of *Abarán*, which corresponds to an esparto grassland in the plot facing the sun and a denser and more diverse scrubland in the plot facing the shade. In the same municipality and location, two other inventories were carried out, this time outside the gypsum substrate. One was carried out in a plot of the third stage of substitution, corresponding to the esparto grassland, and the other in the *ontinar-sisallar* area, which represents a somehow less developed Mediterranean scrubland. For the riverside vegetation, the two best examples were selected: one in the *Casas de la Hoya de Don García* and the

other in the *Barranco del Pantano*, both located on the banks of the Segura River; and two other inventories at a more advanced stage of the potential vegetation that develops on old terraces parameterized with dry stone walls that correspond to an agricultural exploitation that was abandoned a few decades ago.

The first location is on the slopes of the *Sierra de Chinte*, a modest mountain range, but with steep slopes and, in fact, the two plots carried out had slopes of 43° and 45° respectively. The dominant lithology is Tortonian and Messinian (Upper Miocene) marls, conglomerates, sandstones and coralline limestones for the first inventory, and Upper Cretaceous and Paleogene marly limestones and pink marls for the second. These are relatively young pine forests (Figure 2a), although intricate due to the development of sub-arboreal, shrub and scandent species. The herbaceous stratum is also well represented. For the second and third stages (Figure 2b) of substitution of the potential vegetation, the sector of *Las Marañas*, within the municipality of *Abarán*, was chosen as it is a very good example of this type of vegetation landscape and, at the same time, concentrates plots of a very different nature in a relatively limited space.

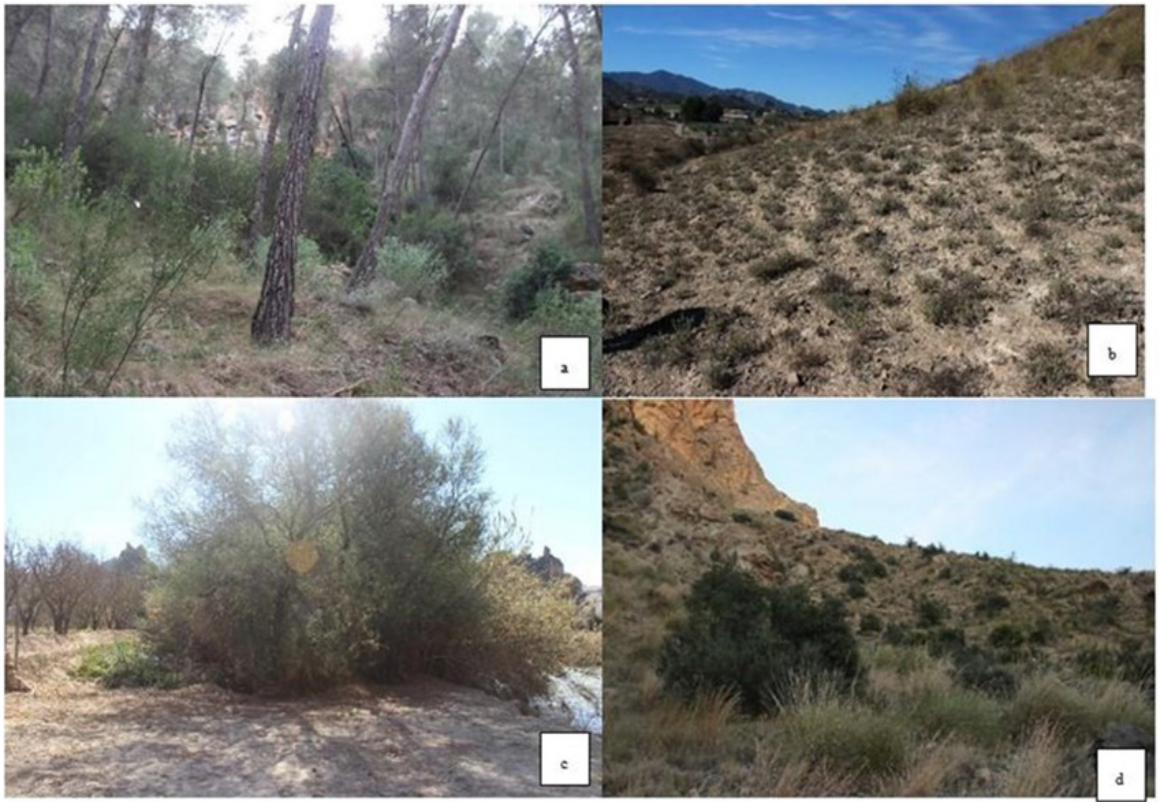

Figure 2 – Examples of structure and vegetation from some inventories. a) pine forests, b) *gypsiferous* scrub, c) riparian vegetation, d) *atochars* and sub-arboreal stages of replacement from abandoned terraces.
Source: Prepared by the authors.

For the study of riparian vegetation (Figure 2c) it was necessary to survey a large part of the banks of the Segura River. The river itself, with its non-intensive and traditional irrigation and market garden systems, as well as fertile soils, made it particularly difficult to find two representative plots. Finally, in order to find a plot where a gradual return to the

most potential situation possible could be observed, we had to focus on the municipality of *Ojós*, where we looked for two plots which, starting from a completely transformed situation, in the form of terraced orchards, the agricultural function had been abandoned and there was a vegetative recovery over the longest possible period of time. Originally, the plot was delimited and protected by dry stone walls. However, abandonment has allowed the watercourse and its geomorphological functioning to cause the disappearance of these walls, leading to the loss of the terrace structure and a good amount of soil substrate (Figure 2d).

OBJETIVES

The landscape of this sector is characterized by vegetation typical of xeric environments, in harmony with the scarcity of rainfall and the intense anthropic pressures that have transformed the environment into a profound and almost integral manner over time. However, the diversity of geotopes in the area makes it a particularly interesting and original place from a landscape point of view, arousing great scientific and social interest. In this sense, the main objective of this work is to analyze, characterize and biogeographically assess the different plant groupings at a regional scale. To carry out an analysis focused on the status of the existing taxa within the grouping, to determine the number of threatened or rare taxa and, logically, their conservation status. On the other hand, an analysis of the chorological affiliation of the taxa that make up the plant cortex by physiognomic groups and of the overall formation is also addressed. All these issues can be taken into account the sectorial scale according to the attributes or questions that are considered appropriate when planning and managing these deeply intervened spaces: natural, cultural, mesological values, threats, and so on so for.

METHODOLOGY

The geographic information provided by the spatial data infrastructure of Murcia and made available by the Geological and Mining Institute of Spain has been used to delimit the study area and define the plots to be inventoried, together with the reconnaissance and characterization fieldwork carried out. To do it so, we considerate the following criteria:

a) The need to complete transects that included all the formations or environments that we had detected through fieldwork and photointerpretation.

b) A necessary mesological diversity, considering the geological-geomorphological, edaphological, hydrological, faunistic, ... conditions.

c) The plots were selected based on the proposed research challenges.

Nevertheless, a total of 10 plots of 20 x 20 m were characterized and assessed (Figure 3), the number is supported by the field experience of numerous investigations showing that the species frequency curve becomes asymptotic after exceeding these values (Mostacedo and Fredericksen , 2000; Lozano-Valencia et al., 2020, 2021).

For each of the inventories carried out, data were obtained on the location and identification of the site (UTM coordinates, toponyms, etc.), general geographical and environmental aspects and features (topographical, lithological, geomorphological, edaphic

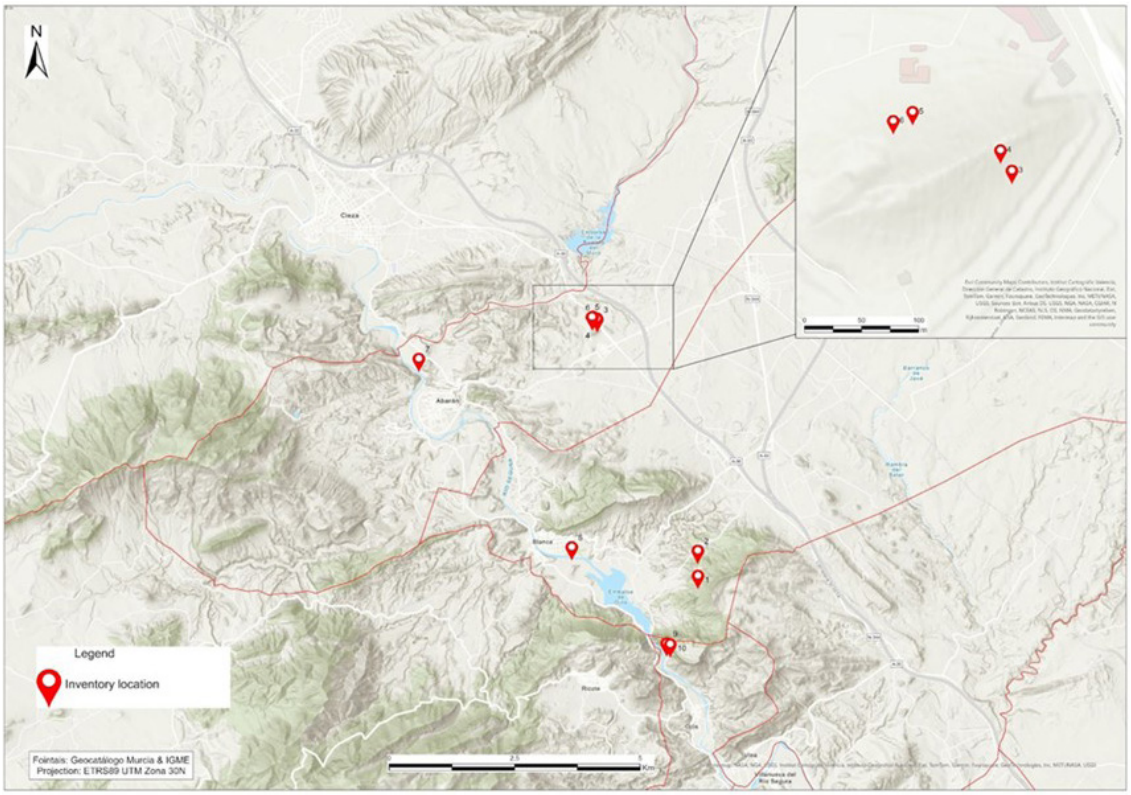

Figure 3 – Location of the plots studied.
Source: Prepared by the authors.

and hydrological), photographs of the plot, etc. Subsequently, the plots were divided by strata (above 5 m; between 1-5 m; between 0.5-1 m and below 0.5 m) and information was collected for each of the taxa present.

Then, not only the usual data on all vascular flora taxa present were taken, but also the fungal and lichen flora (*fungi* and *lichens*) and the cover of the bryophyte species (*stratum muscinalis*), with an indication of the general cover for mosses, lichens, leaf litter and bare soil. Both mosses and lichens and fungi are assessed together and not by collecting the different species present, since these inventories, as mentioned above, focus on the vascular flora.

To determine the cover of each of the vascular species, a classical valuation method was used, derived from the phytosociological methodology, with a scale of 6 classes (6: maximum, r: minimum: r= less than 1% cover, 1 between 1% and 10%, 2 between 10% and 25%, 3 between 25% and 50%, 4 between 50% and 75% and 5 between 75% and 100%), for the sake of greater precision the cover data respond to the final average covers taking into account the different covers granted to each taxon in each inventory.

The presence and density of *bryophytes* (*muscinal stratum*), *lichens* and *fungi* according to the growth substrate, simplified into *epiphytes* (*corticolous and lignicolous*, *trunks and branches*) and *terricolous-saxicolous* (soil and rocks), as well as the cover of leaf litter (with the same system: r,1,2,3,4 and 5), as well as the cover of rock or bare soil, are also indicated using the usual scale of cover. This data will be essential for the calculation of complementary indices that qualify the habitat richness of the corresponding formation.

For the determination of the chorological ascription and status, the Red List of Threatened Species of the (IUCN) Unión Internacional para la Conservación de la Naturaleza (2001)

y, Flora y vegetación del NE de Murcia de Alcaraz (1984); Nueva flora de Murcia: Plantas vasculares de Sánchez-Gómez y Guerra (2003).

DISCUSSION AND RESULTS

As mentioned above, 10 plots of 200 m2 each were inventoried (Table 1), distributed throughout the different study sectors mentioned above. Within the group of trees and shrubs, 26 different species have been recorded, in the group of shrubs and climbers 31 and among the herbaceous species 68, a total of 125 taxa (Table 2). Although we cannot describe the resulting floristic cortege due to lack of space, Table 3 is added for this purpose, where each of the taxa found for each inventory or plot can be checked together with their general coverage.

Table 1 – Formations to which each inventory belongs.

Toponym	Code	Training
Sierra de Chinte	1	Aleppo pine forest
Navela	2	Aleppo pine forest
Las Marañas	3	Low Mediterranean scrubland on gypsum
Las Marañas	4	Sparta on gypsum
Las Marañas	5	Mediterranean scrub on gypsum
Las Marañas	6	Mediterranean scrub
Casas de la Hoya de D. García	7	Riverside vegetation
Barranco del Pantano	8	Riverside vegetation
Casas de Jerónimo	9	Old terraced land with olive trees and Mediterranean shrubs and bushes
Casas de Jerónimo	10	Mediterranean arborescent scrubland

Source: Prepared by the authors.

Tabla 2 – General data from the different inventories carried out.

Toponym	Code	Altitude	Orientation	Coordenates	Trees and Shrubs	S. shrubs and climbing plant	Herbs	Total
Mountain of Chinte	1	303	N	0645317 – 4225982	7	7	8	22
Navela	2	294	N	0645314 – 4226489	11	14	16	41
The Marañas	3	254	E	0643311 – 4231148	1	3	11	15
The Marañas	4	263	E	0643301 – 4231166	1	4	12	17
The Marañas	5	273	W	0643224 – 4231200	4	9	7	20
The Marañas	6	246	AW	0643207 – 4231192	6	5	10	21
Houses of Hoya the D. García	7	157	AW	0639757 – 4230352	4	1	15	20
Swamp ravine	8	138	AW	06422804 – 4226559	5	1	15	21
Jerome´s houses	9	116	W	0644693 – 4224622	12	8	19	39
Jerome´s houses	10	136	W	0644766 – 4224603	10	6	17	33

Source: Prepared by the authors.

Table 3 – Taxons and their coverages within the different inventories carried out.

	TAXA	1	2	3	4	5	6	7	8	9	10	E	FC
TREES AND SHRUBS	*Pinus halepensis*	2	4							r		C	MED
	Rhanumus lycioides	r	3			1				r	r	C	MED-OCC
	Cistus albidus	2	2									C	MED
	Pistacia lentiscus	r	1					r				C	MED
	Cistus clusii	2	r									C	MED-OCC
	Ephedra fragilis	1	r	1	1		3			2	2	C	MED-OCC
	Olea europaea var. *domestica*									3	r	C	MED
	Olea europaea var. *sylvestris*	r	r			1	r			r	r	LC	MED
	Rhamnus alaternus		1									LC	MED-OCC
	Juniperus oxycedrus subsp. *badia*		r							1		VU	MED
	Nerium oleander		r								r	C	PLUR
	Coronilla juncea		r									C	MED
	Juniperus foenicea					1						C	MED
	Retama sphaerocarpa						r					C	MED-OCC
	Ficus carica						r					C	PLUR
	Prunus dulcis						r					C	PLUR
	Tamarix africana							4	5			C	MED-OCC
	Salix hastata							r				C	PLUR
	Populus alba							1	1			C	EUR
	Atriplex halimus								2			C	MED
	Acacia farnesiana								r			Intro	SUBC
	Laurus nobilis								r			C	MED
	Ceratonia siliqua									1		C	MED
	Withania frutescens									r	1	C	MED-OCC
	Anthyllis cytisoides									3	r	C	MED-OCC
	Clinopodium nepeta									1	r	C	PLUR
SMALL SHRUBS AND CLIMBERS	*Osyris quadripartita*									3	3	C	MED-OCC
	Osyris lanceolata										r	C	MED-OCC
	Ulex parvifolius	r										C	MED-OCC
	Asparagus acutifolius	1	1	r	r	r	r			1	1	LC	MED
	Helichrysum italucum	1										C	MED
	Helichrysum stoechas	1	1			1	r			1		C	MED
	Lavandula latifolia	1	r									C	MED-OCC
	Lonicera implexa	r	1									LC	MED
	Asparagus albus		2							2	r	C	MED-OCC
	Senecio linifolius		1									Intro	South Africa
	Lonicera etrusca		1									C	EUR
	Thymus vulgaris subsp. aestivus		1									LC	MED-OCC
	Rubia peregrina sbsp. *longifolia*		1					2	1	r		C	MED
	Limbarda crithmoides						r					C	MED
	Smilax aspera		r									C	PLUR
	Ephedra fragilis		r									C	MED-OCC
	Cheirolophus intybaceus subsp. *inthybaceus*		r									C	MED-OCC
	Convolvulus althaeoides		1				r					C	MED
	Ononis fruticosa		1									C	MED-OCC
	Helianthemum syriacum			2	2	1						C	EUR
	Helianthemum squamatum			3	3							LC	MED-OCC
	Salvia rosmarinus				r	2				1	1	C	MED-OCC
	Macrochloa tenacissima					4						C	MED
	Thymus zygis	r				2						C	PLUR
	Marrunium vulgare					r						C	MED-OCC
	Ruta angustifolia					r					1	C	MED-OCC
	Ruta chalepensis					r						C	MED-OCC
	Fumana ericoides					r						C	MED
	Suaeda vera						r					C	MED-OCC
	Fagonia cretica									1	r	C	MED-OCC
	Helianthemum violaceum									1		VU	CIRCUNMED

Legend: S= status; VU=Vulnerable; LC= Minor concern; Intro=Introduced and C= Common or not threatened. CF= Chorological affiliation: MED=Mediterranean; MED-OCC=Western Mediterranean; CIRCUNMED= Circunmediterranean; IBEROL=Iberolevantine; EUROS= Eurosiberian; PLUR=Plurirregional; SUBC=Subcosmopolitan; Africa; South Africa and HOLO=Holoartic. Source: Prepared by the authors.

Table 3 – Continued...

	TAXA	1	2	3	4	5	6	7	8	9	10	E	FC
HERBS	*Brachypodium retusum*	5	4							4	2	C	MED-OCC
	Lygeum spartum	2	1	r			r					C	MED-OCC
	Elaeoselinum tenuifolium	r										C	IBEROL
	Macrochloa tenacissima	2	1	2	4					1	2	VU	MED
	Asphodelus cerasiferus	2					r			r	r	C	EUR
	Verbascum densiflorum	r	r									C	EUR
	Carlina vulgaris	1	r									C	EUR
	Lactuca virosa	1	r									C	PLUR
	Asphodelus tenuifolius		1		r	1				1	1	LC	PLUR
	Carex halleriana		1									C	MED
	Picris echioides		r									C	SUBC
	Eryngium tricuspidatum		r				r					LC	MED-OCC
	Lapiedra martinezii		r	r	r	1				r		C	MED-OCC
	Brassica napus		r								r	LC	PLUR
	Paronychia suffruticosa		r									LC	MED-OCC
	Hypericum ericoides		r									C	MED-OCC
	Campanula rapunculus		r									C	MED-OCC
	Teucrium pseudochamaepitys		r									C	EUR
	Salsola vermiculata			1			2					VU	CIRCUNMED
	Teucrium libanitis			1	1							C	MED
	Fumana ericoides			1	r							C	MED-OCC
	Bituminaria bituminosa			r						1		C	MED
	Artemisia herba-alba			r	r	r	r			r	1	C	MED-OCC
	Sedum gypsicola			r	r	r						C	MED-OCC
	Diplotaxis viminea			r	r	1						C	PLUR
	Limonium caesium			r			1					C	MED-OCC
	Reseda stricta				r							C	MED
	Dipcadi serotinus				r							LC	PLUR
	Sedum sediforme					1				2	1	C	PLUR
	Gagea lacaitae					r						C	MED-OCC
	Moricandia arvensis						r			r	r	C	MED
	Panicum virgatum						3					C	PLUR
	Euphorbia lagascae						r					C	MED-OCC
	Anagallis arvensis						2				r	C	PLUREG
	Ecballium elaterium						1					C	MED
	Arundo donax							4	2			Intro	PLUR
	Zantedeschia aethiopica							r				Intro	Africa
	Limonium cossonianum							1				C	PLUR
	Paretaria officinalis							1	2			C	PLUR
	Malva multiflora							1	r			C	PLUR
	Hordeum murinum							1				C	PLUR
	Sonchus oleraceus							r				C	PLUR
	Fumaria parviflora							1	2			Intro	HOLO
	Oxalis pes-caprae							r	r			Intro	PLUR
	Poa annua							r	4			C	PLUR
	Juncus acutus							r	1			C	PLUR
	Calendula officinalis							r				C	EUR
	Educastrum nasturtiifolium							r				C	PLUR
	Phragmites australis							r	2			C	PLUR
	Dittrichia graveolens							r	r			C	MED
	Beta singularis								r			C	PLUR
	Solanum nigrum								r			C	PLUR
	Crepis vesicaria								1			C	PLUR
	Euphorbia peplus								r			C	MED
	Crepis capillaris								r			C	PLUR
	Chenopodium murale								r			C	MED-OCC
	Chamaerox humilis									3	3	C	MED
	Phagnalon saxatile									r	r	C	MED
	Urospermum picroides									r	r	C	MED
	Hiparrhenia hirta									3	2	C	MED
	Sedum album									r	r	C	PLUR
	Plantago lagopus									r	r	C	PLUR
	Campanula decumbens									r		VU	MED-OCC
	Avenula bromoides subsp. *bromoides*									r	r	C	MED-OCC

Legend: S= status; VU=Vulnerable; LC= Minor concern; Intro=Introduced and C= Common or not threatened. CF= Chorological affiliation: MED=Mediterranean; MED-OCC=Western Mediterranean; CIRCUNMED= Circunmediterranean; IBEROL=Iberolevantine; EUROS= Eurosiberian; PLUR=Plurirregional; SUBC=Subcosmopolitan; Africa; South Africa and HOLO=Holoartic. Source: Prepared by the authors.

Table 3 – Continued...

	TAXA	1	2	3	4	5	6	7	8	9	10	E	FC
HERBS	*Echium creticum* subsp. *granatense*									1	r	C	MED-OCC
	Stipa offneri									2	2	C	MED-OCC
	Peganum harmala									r		C	MED
	Phoenix dactylifera									r		Intro	CIRCUMB
MOSSES, LICHENS AND FUNGI	Mosses on trunks and branches												
	Mosses in soils and rocks	3	2			1				r			
	Lichens on branches and trunks	r	r			r		r	r	r			
	Lichens on soil and rocks	1	1	r	r	3	r			1	1		
	Fungi								r				
	Leaf litter	1	1	r	r	r	r	3	2	1	1		
	Bare soil and rocks	2	1	4	4	r	2	1	r	2	3		

Legend: S= status; VU=Vulnerable; LC= Minor concern; Intro=Introduced and C= Common or not threatened. CF= Chorological affiliation: MED=Mediterranean; MED-OCC=Western Mediterranean; CIRCUNMED= Circunmediterranean; IBEROL=Iberolevantine; EUROS= Eurosiberian; PLUR=Plurirregional; SUBC=Subcosmopolitan; Africa; South Africa and HOLO=Holoartic. Source: Prepared by the authors.

Firstly, it should be noted that the figures are, in general, higher than those recorded in other territorial areas belonging to the Mediterranean region of the Iberian Peninsula, such as those studied in Alava, Navarra, Valladolid or Ciudad Real. However, in herbaceous plants it would be surpassed by the case of Allepuz, in the *Sierra de Gudar* (Teruel) within the supramediterranean level. In this case, the figures recorded for trees and shrubs are relatively high, but the figures for bushes and climbers, that is, small *camelephytes* which, as we have seen, form a shrub or subshrub stratum present in all the inventories and plots surveyed, are higher. In this case, the number of taxa doubles in comparison with those areas with which we are comparing. For each plot there were 2.8 taxa, whereas in Allepuz there were 1.9; 2.9 taxa in the group of bushes and climbers, whereas in Allepuz there were 1.09 and 6.8 taxa of herbs, whereas in Allepuz there were 9.73 species of herbaceous plants. The difference between inventories is notable and here, unlike in other regions, there is no excessive repetition of plants from one inventory to another, mainly in terms of herbaceous plants and trees. The inventory with the fewest species was plot 3 with 15, while the second one is the most diverse with 41 species. The meaning is 12.5 taxa per plot with a mode between 20 and 22 (Table 3). The differences are notable, with those oriented on the sunny side, on *gypsum* and with great anthropic pressure being the ones with the lowest records, while those higher up, on the mountain ranges or on steeper slopes and oriented towards the most important moisture flows, have the highest number of species. Interestingly, the riparian vegetation, with a guaranteed supply of moisture, is very low compared to other similar formations in other areas. In this case it is the anthropic factor that is most relevant, once again. The riverbank vegetation has been reduced to its maximum expression by agricultural pressure and, as if that were not enough, the highest proportion of introduced and *xenophytic* plants is located in this area. It should also be noted that the low tree and arborescent cover gives rise to a great profusion of shrubs and herbaceous plants in particular. Thus, the existence of a poor and very open tree canopy ensures good diversity in the lower strata.

These data and numbers lead us to a first comparative result. In different Iberian Mediterranean formations, but especially in holm oak forests (*Quercus ilex* subsp. *rotundifolia*), although not as heavily intervened as those present here, the figures are similar for trees and shrubs, although slightly lower. However, where the big difference appears is in the shrub stratum, while the herbaceous stratum is also relatively modest. In this way, and raising a

discussion in this sense, it is logical to think that the absence of large tree cover gives rise to a greater opportunity for other species of lower size such as shrubs. However, studies have also been carried out in certain meadows (Ciudad Real and Valladolid), that is hollow cultural or disturbed woodlands where pasture is sought after, and they have never reached such high numbers of bushes. This is logical since most herbaceous plants are much more palatable to livestock than bushes and/or climbers. It is also curious to some extent how little cover and, in general, how few climbers there are. Species such as *Lonicera implexa*, *L. etrusca* or *Smilax aspera* with good thermal conditions, however, appear in a few inventories, some only in one, and with very low or modest cover. *Rubia peregrina subsp. longifolia* appeared in four of the ten inventories and always with a general cover of no more than 25%.

The largest number of trees and shrubs can be found in the Mediterranean shrubland on the abandoned terraces of the Casas de Jerónimo (Plot 9) with 12 species. It is followed, in this order: the pine forest of Navela (2) with 11, the Mediterranean arborescent scrub of the Casa de Jerónimo (10) with 10 and, at a great distance, the pine forest of the Sierra de Chinte (1) with 7. On the lower part are: the esparto grassland on gypsum at Las Marañas (4) and the low Mediterranean scrub at the same location (3), both with only 1 species, the riverbank vegetation at Las Casas de Don García (7) with 4, as well as the Mediterranean scrub on gypsum at Las Marañas (5) also with 6 taxa (Table 3).

With regard to the bushes and climbers, the ranking is as follows; at the top are: the pine forest of La Navela (2) with 14 species, the Mediterranean scrubland on gypsum at Las Marañas (5) with 9 species, the old terraced land with olive trees and Mediterranean arborescent scrubland (9) with 8 taxa and the pine forest of the Sierra de Chinte (1) with 7. On the other hand, the two plots of riverside vegetation with short scores are located in Las Casas de la Hoya D. García and Barranco del Pantano (7 and 8), both with only one species. Next to them are the low Mediterranean scrubland on gypsum at Las Marañas (3) with 3 taxa and, in the same location, the esparto grassland (4) with 4. Finally, with regard to herbaceous plants by environment, we should highlight, on the upper part, the old terraces with olive trees and Mediterranean shrubs in Las Casas de Jerónimo (9) and, in the same location, plot 10 with 17 taxa. The Navela pine forest (2) has 16 species and two plots that coincide with the riverside vegetation (7 and 8) have 15 species. At the bottom with fewer herbaceous species are the Mediterranean scrubland on gypsum at Las Marañas (5) with 7 species, the pine forest of the Sierra de Chinte (1) with 8, and the Mediterranean scrubland of Las Marañas (6) with 10.

Analysis of the status of the taxa of the Ricote Valley

In the plots analyzed and inventoried, a list of species is obtained that have a degree of protection depending on their status. Those that are threatened will be given a higher level than those that become more common. Figure 4 shows the status of each taxon by physiographic group and in general.

In general, taxa have an uncompromised conservation status and can be classified as common dominate. If we look at the trees and shrubs, it is clear that 84% of the taxa are common compared to 8% that are of lesser concern, i.e. a fairly low degree of threat, while one taxon (4%) would fall into the vulnerable category, *Juniperus oxycedrus* subsp. *badia*, which is the most threatened species in the plots and inventories carried out. Finally, there is one introduced taxon (4%), *Acacia farnesiana*.

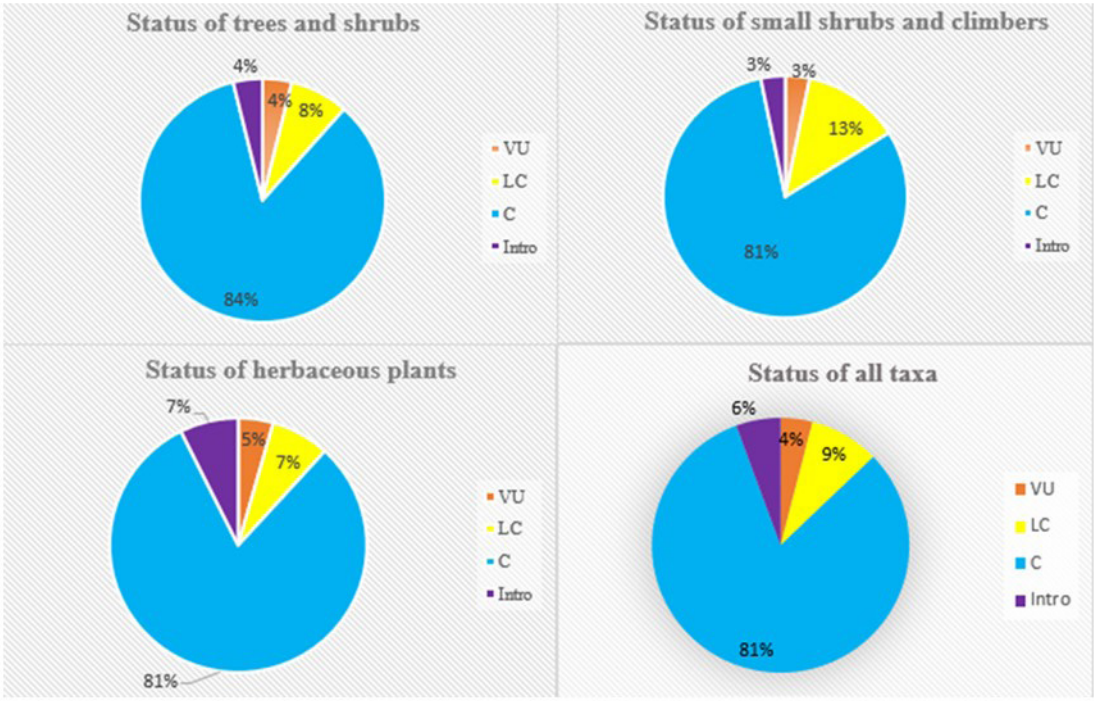

Figure 4 – Status of taxa by physiographic groups and in general. Legend: VU = Vulnerable; LC = Minor concern; C = Common and Intro = Introduced.
Source: Prepared by the authors.

As far as shrubs and climbers are concerned, however, 13% of the taxa have a lower concern and a low degree of threat, while, again, the highest percentages relate to common species (81%) and are therefore not threatened. On the one hand, there is a vulnerable taxon: *Helianthemum violaceum*, while another has been introduced: *Senecio linifolius*.

With regard to herbaceous species, the most numerous groups, 81% of the species are common, 7% are of lesser concern for their survival and conservation, while 3% (*Macrochloa tenacissima*, *Salsola vermiculata* and *Campanula decumbens*) are in the vulnerable category. Introduced species account for 7%.

Finally, taking all taxa into account, 81% would have a common status, followed by 9% of lesser concern and 4% of vulnerable taxa. The introduction taxa would account for 6% and would correspond to 7 taxa.

For the discussion it should be noted that the degree of threat of the taxa inventoried and recorded is very low, in general, except for 5 taxa in the vulnerable category. This is related to the enormous and secular pressure on the vegetation cover. Relatively anthropophilic and nitrophilic taxa, very accustomed to high and incessant pressure, prevail, in fact, none of the inventories or plots worked on can be considered as climactic since, in any case, they represent a second, third or even fourth level of negative succession. Furthermore, one of the aspects to be highlighted is that there is a relatively high number of species introduced.

Analysis of the chorological affiliation of the taxa of the Ricote Valley

As in the previous analysis, we now examine the chorological affiliations of the taxa present in the different plots and inventories. Figure 5 shows the chorological phylineations by physiognomic groups and in general.

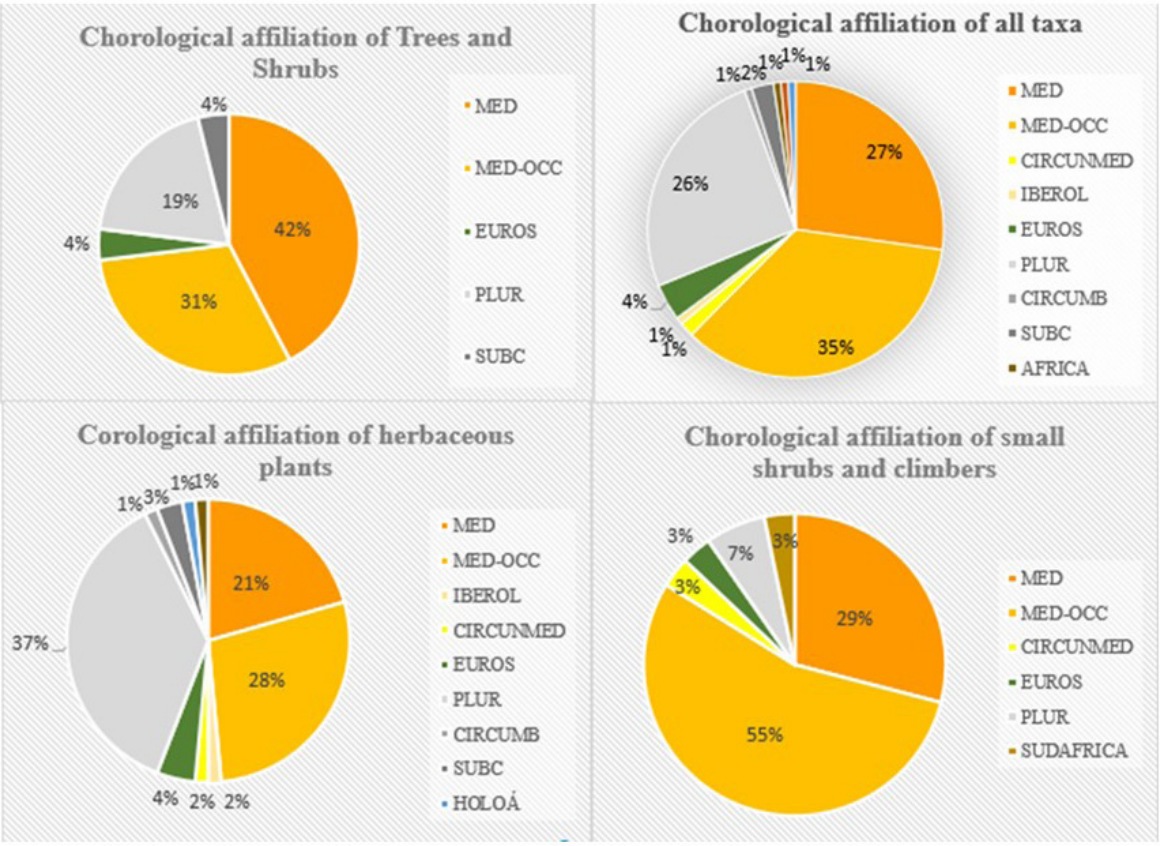

Figure 5 – Chorological phyla of taxa by physiognomic groups and in general.
Source: Prepared by the authors.

As can be seen, the most common affiliation is Mediterranean. However, it should be noted that we have chosen to ungroup, within this large and general Mediterranean affiliation, different sub-affiliations: western (where the Iberian affiliations are also introduced, i.e. the endemism of the Iberian Peninsula), circum-Mediterranean and even an Ibero-Levantine endemism. The starting hypothesis could be based on a large group of taxa grouped around Mediterranean affiliations, but also pluriregional, circumboreal and even subcosmopolitan ones, as they are anthropophilic or nitrophilic species, in any case, highly conditioned and even favored by humans.

In regards of trees and shrubs, the hierarchy is clear, with the majority of taxa showing a Mediterranean (*sensu stricto*) affiliation (42%), followed, with some logic, by the western Mediterranean (31%) and, at a greater distance, by the Eurosiberian (4%). If all the Mediterranean affiliations are added together, the percentage rises to 73%, i.e. almost three quarters of the trees show these Mediterranean affiliations. The most important affiliations are those with a wide territorial spectrum, in this case 19% pluri-regional and 4% sub-cosmopoilite. In this case, the two hypotheses are confirmed: on the one hand, there is a clear Mediterranean dominant, and on the other, a secondary one of relatively ubiquitous species with a wide territorial range.

As for the shrubs and climbers, once again the Mediterranean affiliation is the most abundant with 87% sensu lato, that is grouping all the Mediterranean components. From these, the clearly Mediterranean ones account for 29%, while the Western Mediterranean affiliation accounts for 55%, i.e. the most abundant. The Circum-Mediterranean is the most

abundant, accounting for 3%. At a great distance behind, there are: the multi-regional affiliation (7%), the Euro-Siberian (3%) and the South African, logically through an introduced taxon, with another 3%. In other words, while the first hypothesis is fulfilled, the second is not.

In regards of herbaceous plants, they show more varied affiliations. For the first time, a non-Mediterranean affiliation is in first place, but in second place is the western Mediterranean with 28%, followed by the Mediterranean with 21%. However, other Mediterranean affiliations show much lower percentages: circum-Mediterranean and Ibero-Levantine with 2% each. In total, all the Mediterranean affiliations would account for 53%, that is, slightly more than half. Pluri-regional affiliation would also appear with high percentages, which effectively and for the first time is the dominant affiliation (37%), followed, within these groups of affiliations with a wide territorial range, by sub-cosmopolitan (3%) and circumboreal (1%). In total, these three phyla would account for 41% of all herbaceous phyla, a very high percentage, which means that the second hypothesis is more than fulfilled in this case. At a greater distance, the following phyla appear: Euro-Siberian (3%), Holoarctic (1%) and African (1%).

To sum up, taking the affiliation of all taxa, we would obtain the following results: 35% would correspond to western Mediterranean affiliations, followed by Mediterranean ones (27%). In third place are the multi-regional ones with another 26%, followed by the sub-cosmopolitan (2%) and circumboreal (1%) with more modest percentages. Although small, there is a certain Euro-Siberian influence, as this affiliation accounts for 3%. The rest of the affiliations show figures that in no case exceed 1%: circum-Mediterranean, Ibero-Levantine, African, South African and Holoarctic.

For the discussion, the two starting assumptions are indeed fulfilled: Mediterranean phyla, sensu lato, dominate widely (64%), and, likewise, the number of subcosmopolitan, circumboreal and pluri-regional taxa is also very high (29% in total). The latter is due to the secular, extensive and profound modification that this territory and with it the vegetation has undergone and, therefore, the importance, not only of bioclimatic variables, but also of anthropic and human management of space.

Also noteworthy is the lack of phyla apparently more related to more xeric and southern conditions such as the Saharan or the Irano-Turanian, in this case none of these phyla have appeared in the 125 taxa inventoried.

CONCLUSIONS

The Ricote Valley, Murcia (Spain) has a vegetation landscape characterized by a deep and secular transformation, so that the vegetation cover existing now is very different to the one originally existed before the presence of humans and the different transformations by each of the cultures and human groups that settled in the territory: Iberians, Carthaginians, Romans, Arabs, among others.

There are no tesserae that can be considered as potential vegetation, probably characterized by holm oak and strawberry groves on the plains and mountain ranges and riparian forest on the riverbanks. In its absence and as a result of this great and gradual transformation, today there are pine forests in the shady areas of mountain ranges and serrezuelas, as paraclimate vegetation, or more or less dense and low scrubland in those sectors more exposed to the sun and with scarce soils or dominated by gypsum, as second

and third stages of substitution. When the soil is scarcer and poorer or when anthropic action has been more pressing, atochares appear as the most degraded and poorest stages. On the other hand, the current riverbanks are dominated by sub-arboreal vegetation with tamarisk and Arundo donax reeds.

Within the 10 plots in which all existing vegetation and its cover was inventoried, 26 different species were recorded in the group of trees and shrubs, 31 in the group of bushes and climbers and 68 in the group of herbaceous plants, in total 125 taxa. These are relatively high records, especially for the more modest biological forms: shrubs, climbers and herbs.

With regard to the status of the taxa that appear, it should be noted that 81% are shown to be common, 9% are of lesser concern and 4% are vulnerable. Introduced taxa would account for 6% and would respond. In general, it is possible to speak of a relatively ubiquitous courtship where nitrophilous and anthropophilous taxa and even *xenophytes* and introduced taxa dominate. This is a consequence of what has been described above, the profound transformation and trivialisation (anthropisation) of the vegetation landscape.

There are no major differences between the three physiognomic groups and the taxa as a whole, so that the common species always dominate over 80%.

In terms of chorological ascriptions, 35% correspond to western Mediterranean affiliations, followed by Mediterranean (27%), thirdly, multi-regional, with another 26%, followed by sub-cosmopolitan (2%) and circumboreal (1%) with more modest percentages. Although small, there is a certain Euro-Siberian influence, accounting for 3%. The remaining affiliations: circum-Mediterranean, Ibero-Levantine, African, South African and Holoarctic, have a weight of 1%.

In this case, there are some differences, but the Mediterranean phyla in the sensu lato sense always prevail. While the Mediterranean phyla sensu stricto are dominant in the group of trees and shrubs, the Western Mediterranean phyla dominates in the group of shrubs and climbers and the multi-regional phyla dominate in the group of grasses and herbs. Overall, taking all taxa into account, the western Mediterranean dominate.

The two premises or starting hypotheses are fulfilled. Due to the bioclimatic conditions, the first group of affiliations is represented by the Mediterranean ones, but those of wide territorial ranges (sub-cosmopolitan, circumboreal or pluri-regional) are not far behind, so that the second hypothesis is also fulfilled: given that the human influence and transformation of the territory and the landscape has been so extensive, these ubiquitous affiliations are also quite abundant.

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Author's contribution

María Cristina Díaz-Sanz: Carried out the preliminary field and desk work and the drafting of the first 3 sections of the article, together with the preparation of the graphs and maps.
Pedro José Lozano-Valencia: Has carried out field and desk work and the drafting of the last 3 sections of the article, and the final revision of the article.

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