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A new winter deciduous forest and its associated Eurosiberian flora and vegetation in a Mediterranean mountain climatic refuge (Sierra Nevada, Spain)

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Key words: mediterranean mountain, southern Europe, threatened species, new syntaxa, protected habitats

Ključne besede: sredozemsko gorovje, južna Evropa, ogrožene vrste, novi sintaksoni, zaščiteni habitati

Abstract

Sierra Nevada (south of the Iberian Peninsula) is an isolated mountain range (3481 m), a climatic and geographic island with vegetation refuges, including the Eurosiberian-type deciduous forest on its northern slope selected for this study. In this paper, we present the floristic and phytocoenological diversity, focusing on the deciduous forest, its associated vegetation and their value as protected habitats. We publish a new floristic catalogue with 440 taxa (19% of Sierra Nevada flora), of which 20 species are strictly endemic, 19 protected and 31 critically endangered. We publish also 75 new relevés recorded from all altitudinal ecosystems. We describe a new type of climatophilic forest (*Poo nemoralis-Prunetum avium* ass. nova), distinct from the only previously recognized biogeographically type *Adenocarpo-Quercetum pyrenaicae*, one hydrophytic mountain community (*Montio fontanae-Ranunculetum omiophylli* ass. nova) and two sub-associations and one community with Eurosiberian floristic influences (*Genisto versicoloris-Juniperetum nanae rosetosum villosae* subass. nova, *Lonicero arboreae-Crataegetum granatensis ribetosum austroeuropaei* subass. nova and *Fraxinus excelsior* community).

Izvleček

Sierra Nevada (na jugu Iberskega polotoka) je osamljeno gorsko gorovje (3.481 m), klimatski in geografski otok z vegetacijskimi refugiji, med katerimi je tudi evrosibirski tip listopadnega gozda na severnem pobočju, ki smo ga izbrali za to raziskavo. V tem prispevku predstavljamo floristično in fitocenološko raznolikost s poudarkom na listopadnem gozdu, z njim povezani vegetaciji ter njuni vrednosti v kontekstu zavarovanih habitatov. Objavljamo nov floristični katalog s 440 taksoni (19 % flore Sierra Nevade), od katerih je 20 vrst ozko endemičnih, 19 zavarovanih in 31 kritično ogroženih. Poleg tega objavljamo 75 novih vegetacijskih popisov, narejenih v vseh višinskih ekosistemih. Opisujemo nov tip klimatofilnega gozda (*Poo nemoralis–Prunetum avium* ass. nov.), ki se biogeografsko razlikuje od edinega doslej poznanega tipa *Adenocarpo–Quercetum pyrenaicae*, eno hidrofitsko gorsko združbo (*Montio fontanae–Ranunculetum omiophylli* ass. nov.) ter dve subasociaciji in eno asociacijo z evrosibirskimi floističnimi vplivi (*Genisto versicoloris–Juniperetum nanae rosetosum villosae* subass. nov., *Lonicero arboreae–Crataegetum granatensis ribetosum austroeuropaei* subass. nov. in združba s *Fraxinus excelsior*).

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Introduction

Mountain ecosystems constitute climatic and geographic islands that reflect ecological conditions different from those of their surroundings, constituting shelter for certain types of vegetation (Quézel, 1996; Blanca et al., 2019). Due to these conditions, the existence of unique ecosystems that are not found in neighbouring areas and even at great distances is possible (Blanca & Algarra, 2011). These types of vegetation in refuge spaces (Blanca et al., 2002) constitute models to understand the adaptations to special ecological conditions and to study changes in flora composition or vegetation structure due to changes in the ecological conditions. Mountain Mediterranean areas offer small refuge spaces where ecological conditions resemble those that disappeared along the climatic history. The flora and vegetation living in these spaces provide basic information about the ecological characteristics of the ecosystem they inhabit (Blanca et al., 2001).

The mountains of southeastern Iberian Peninsula, and Sierra Nevada in particular, were of great importance as a cold climatic refuge for flora and vegetation during the successive climatic changes that occurred from the late Tertiary to the present Quaternary (Fernández et al., 2007; Manzano et al., 2017). It is especially a climatic refuge for several paleoendemics with boreal, temperate, or arctic-alpine affinities (Molina-Venegas et al., 2017) due to its latitude, E-W orientation and, above all, because it is the highest (3481 m) and most extensive mountain range in the south of the Iberian Peninsula. As a crossroad of migratory routes supplying floristic contingents of diverse origins (Blanca et al., 2019), it also acts as a "museum" for these relict, rare and endemic species (Peñas et al., 2019) that today constitute relevant biogeographical disjunctions.

Sierra Nevada (Andalusia, Spain), with a total of 2350 taxa in a territory of about 2000 km^2 (Lorite, 2016, 2020), represents 33% of the Iberian flora and 20% of the European flora (Aedo et al., 2017). 95 species out of the total are endemic (Peñas et al., 2019), 138 species are threatened into different categories: 17 'critically endangered' (CR), 18 'endangered' (EN) and 103 'vulnerable' (VU) (Salazar & Valle, 2019) and 31 protected (Decree 23/2012). It is considered an important hotspot of plant diversity in the western Mediterranean region (Médail & Quézel, 1999; Blanca et al., 2002; Lorite, 2016).

The northern face of Sierra Nevada represents an exceptional enclave because it is home to flora and vegetation in an acceptable state of conservation which is very scarce in the south of the Iberian Peninsula and Western Europe (Losa-Quintana et al., 1986). It is necessary to study the plant communities (Lorite et al., 2003; Rivas-Martínez, 2007; Rivas-Martínez, 2007, 2011) and its high floristic richness (Blanca et al., 1999, 2000, 2011; Lorite, 2016, 2020; Pavón-Núñez et al., 2020a) through basic studies to be able to carry out conservation and management tasks. The importance of knowing in depth the vegetation of Sierra Nevada lies also in the fact that it is included in the European Union's Natura 2000 Network as a Special Area of Conservation (SAC) and because it contains habitats and species of Community Interest. 37 habitats of Directive 92/43 EEC are present in Sierra Nevada of which 22 HCI (Habitat of Community Interest) contain 95% of its threatened flora taking part in a wide diversity of plant communities (Salazar & Valle, 2019). Although the flora and vegetation of Sierra Nevada has been extensively studied, certain refuge enclaves on its northern face merit further study, above all because of the possible existence of deciduous forests (beyond those traditionally identified) and their associated dynamic and catenal vegetation. On the northern face of the Sierra Nevada, certain areas have been identified that form refuge areas for important types of vegetation that are no longer present today in the southeast of the Iberian Peninsula (Blanca et al., 2019). The upper basins of the rivers Alhama de Lugros, Genil, Dúrcal and Dílar, located in the north-west of Sierra Nevada, are very important forest areas surrounded by peaks exceding 3,000 metres in elevation, with ravines in moist siliceous soils and temporary flooding in the sub-humid supramediterranean thermotype (Losa-Quintana et al., 1986). The western basins of the Dúrcal and Dílar rivers maintain, even today, the most important relict and more southern Eurosiberian populations of *Betula pendula* subsp. *fontqueri* (Rothm.) G. Moreno & Peinado in the whole mountain range and in the southern Iberian Peninsula (Martínez-Labarga et al., 1990; Girela et al., 2001). The upper Northwestern basin of the Genil River is noted for its relict forests of the oak *Quercus pyrenaica* Willd. in its mesophytic faciation with *Acer opalus* Mill. subsp. *granatense* (Boiss.) Font Quer & Rothm. and *Sorbus aria* (L.) Crantz, as well as old *Castanea sativa* Mill. plantations (Losa Quintana et al., 1986). Among these places, the upper basin of the Alhama de Lugros River (Dehesa del Camarate) on the center-northern slope of Sierra Nevada contains well-preserved winter-deciduous forests. At the bottoms of ravines and shady supra-mediterranean slopes with humid ombrotype and temporo-hygrophilous soils between 1500 and 2000 m, mixed winter-deciduous forests of multispecific composition are found with *Prunus avium* L., *Fraxinus excelsior* L. and its hybrid (*F. excelsior* x *F. angustifolia*), *Acer opalus* subsp. *granatense, Sorbus aria, Taxus baccata* L., *Malus sylvestris* (L.) Mill. and *Pyrus cordata* Desv. This type of forest has

not been described and catalogued yet and so deserves its phytosociological study. In sunnier areas and somewhat drier but equally deep soils, marcescent forests of *Quercus pyrenaica* oaks appear, which, depending on the gradients of humidity, can be monospecific or accompanied by other mesophilic species such as *Acer opalus* subsp. *granatense* or *Sorbus aria* (Molero & Marfil, 2017).

These northern slopes of Sierra Nevada could be considered suitable sites for studying the existence of climatic refuges, threatened flora and plant communities, which are key elements to be preserved. To contribute to a more detailed study of the mixed winter-deciduous forest and its associated vegetation, the first objective was to identify the diversity of vascular plants and to obtain a floristic catalogue, highlighting endemic, threatened, rare, chorologically interesting or legally protected taxa. The second objective was to characterise and identify the diversity of plant associations and communities, focusing on deciduous forests and their associated vegetation, identifying those included in the Habitats Directive 92/43/EEC.

Materials and Methods

Study area

The study area (Figure 1) corresponds to the northern face of Sierra Nevada, upper basin of the Alhama river in the province of Granada, in the south of the Iberian Peninsula (Andalusia, Spain). The area is included in the municipality of Lugros and to a lesser extent (the highest part) in the municipalities of Jerez del Marquesado and Güejar-Sierra. It is included in the Sierra Nevada National Park and in the Special Area of Conservation (SAC) with Site code ES6140009. It occupies a total of 20.79 km^2 state-owned land of which about 150 ha correspond to the Reserve Zone (21.4%). Altitudes reach between 1350 and 3088 m in the highest peak) above sea level. The lithology comprises a continuum of rocks derived from quartzite and micaschist (Martín et al., 2008; IGME, 2019), and the soils correspond to eutric and dystric cambisols (Balsera, 1989; FAO, 2009; Martín-Peinado et al., 2019).

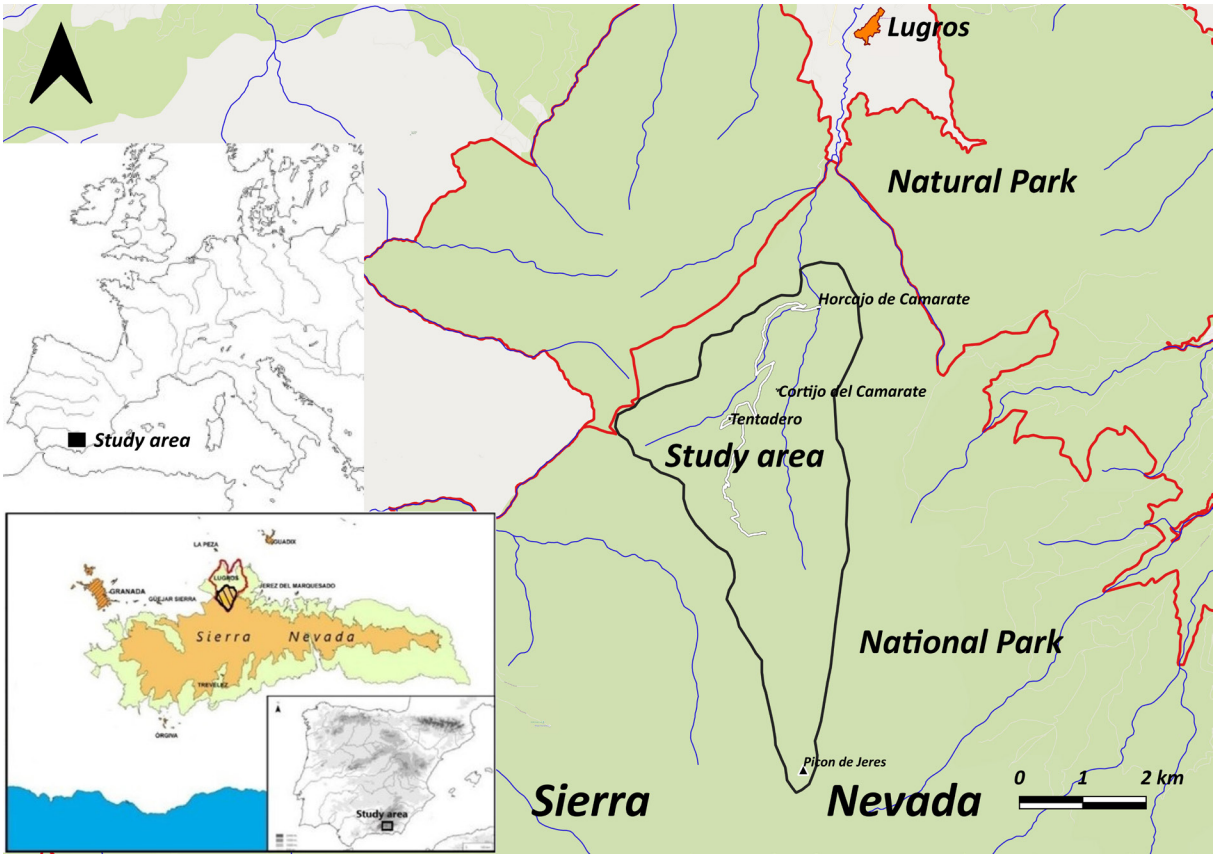

Figure1: Geographical location of the study area (Sierra Nevada, Granada, Spain) in the National Park of Sierra Nevada. Source: own elaboration using the coverage available in DERA (2019).

Slika 1: Geografska lega območja raziskave (Sierra Nevada, Granada, Španija) v narodnem parku Sierra Nevada. Vir: lastna izdelava na podlagi podatkov, ki so na voljo v DERA (2019).

Table 1: Bioclimatic data of the study site (upper basin of the Alhama de Lugros river). T: Annual Average Temperature; Tp: Annual Positive Temperature; Ts: Summer temperature; P: Annual precipitation; Pp: Annual Positive Precipitation; Itc: Compensated Thermicity Index; Ic: Continentality Index; Io: Ombrothermic Index; Io6 (June); Io7 (July); Io8 (August): Monthly Ombrothermic Index (Marfil et al. 2016).
Tabela 1: Bioklimatski podatki območja študije (zgornji bazen reke Alhama de Lugros). T: letna povprečna temperatura; Tp: letna pozitivna temperatura; Ts: poletna temperatura; P: letne padavine; Pp: letne pozitivne padavine; Itc: kompenzirani indeks toplotne energije; Ic: indeks kontinentalnosti; Io: ombrotermični indeks; Io6 (junij); Io7 (julij); Io8 (avgust): mesečni ombrotermični indeks (Marfil et al. 2016).

Study site (meteorological station)	Lat. Long.	Alt. (m)	Years	T	Tp	Ts	P	Pp	Itc	Ic	Io	Io6	Io7	Io8	Isobioclimates
Embarcadero	37º 11'N 3º 15'W	1517	2008-2019	12.1	1448.3	657.3	544.8	540.2	219.7	20.7	3.4	0.7	0.3	0.3	Lower Supramediterranean-Lower Subhumid
Piedra de los Soldados	37º 9'N 3º 15'W	2155	2008-2019	7.9	899.7	509.9	509.2	444.6	82	20	4.6	1.2	0.3	0.4	Lower Oromediterranean-Lower Subhumid.

Table 2: Submediterraneity Index (Isbm). Isbm = sum of the submediterraneity values of the summer monthly ombrothermic indexes Ios1, Ios2, Ios3 and Ios4 provided they are positive and not including negatives (Rivas-Martínez et al., 2017).
Tabela 2: Indeks submediteranosti (Isbm). Isbm = vsota vrednosti submediteranskosti poletnih mesečnih ombrotermičnih indeksov Ios1, Ios2, Ios3 in Ios4, če so pozitivni in ne vključujejo negativnih vrednosti (Rivas-Martínez et al., 2017).

Study site (meteorological station)	Lat. Long.	Alt. (m)	Years	Ios1	Ios2	Ios3	Ios4	Isbm	Type of submediterraneity
Embarcadero	37º 11'N 3º 15'W	1517	2008-2019	-40.03	-58.84	-57.44	-24.42	0	Genuine Mediterranean
Piedra de los Soldados	37º 9'N 3º 15'W	2155	2008-2019	-23.64	-47.94	-43.74	0.71	0.71	Extremely Weak Submediterranean (Isbm 1-30)

Based on the available data collected at the two meteorological stations present in the study area, bioclimatic parameters and indexes were calculated (Table 1). In addition, the Submediterraneity Index (Rivas-Martínez et al., 2011b) was determined for the two stations mentioned above (Table 2). The Embarcadero station at 1517 m obtained a sub-Mediterranean index (Isbm) of 0 (all Ios values were negative) which is interpreted as a water deficit extending throughout the summer season, i.e. zero sub-Mediterraneanity, and therefore a genuine Mediterranean climate with intense summer drought. For the Piedra de los Soldados station at 2155 m, all Ios reached negative values except in September (Ios4 = +0.71), which was decisive in the Isbm value of + 0.71. This resulted in very weak sub-Mediterraneanity, insufficient as a water supply to compensate for the central months of summer.

Bioclimatic diagrams have also been represented from the data of the two meteorological stations (Figure 2a, Figure 2b), showing a dry period coinciding with the summer months, generally from mid-late May to the end-middle of September, more accentuated at medium altitudes (1517 m) than at higher altitudes (2155 m).

The bioclimatic indexes, based on the bioclimatic classification of Rivas-Martínez (1996–2009) and Rivas-Martínez et al. (2017) were calculated for the two meteorological stations present at the study site:

Embarcadero station (1517 m): the site was classified as belonging to the lower supramediterranean thermotype (Mean annual temperature, T=12.38 ºC; Compensated thermal index, Itc=219) and the lower subhumid ombrotype (Average annual rainfall, P=540.15 mm; Annual ombrothermic index, Io=4.89).

Piedra de los Soldados station (2155 m): the site was classified as belonging to the lower oromediterranean thermotype (Mean annual temperature, T=7.94 ºC; Compensated thermal index, Itc=82.04) and the lower subhumid ombrotype (Average annual rainfall, P=477.01 mm; Annual ombrothermic index; Io=4.60).

Biogeographically, the area is classified into the Holarctic Kingdom, Mediterranean Region, Western Mediterranean Subregion, Iberian-Moroccan-Atlantic Superprovince, Baetic Province, Nevadensian Sector and Nevadensian Subsector (Galán de Mera et al., 2003; Marfil et al., 2016).

Methodology

Botanical surveys (transects) of flora and vegetation have been carried out in this territory from August 2018 to July 2023, and are depicted in Figure 3.

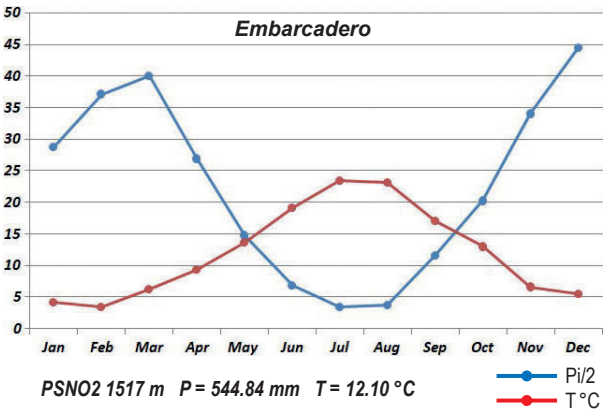

Figure 2a: Climatic diagram of the study site (meteorological station: "Embarcadero" *PSN02*, 1517 m).

Slika 2a: Klimatski diagram območja raziskave (meteorološka postaja: "Embarcadero"*PSN02*, 1517 m).

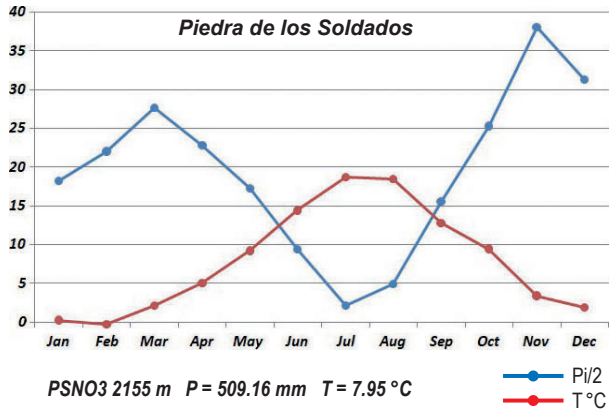

Figure 2b: Climatic diagram of the study site (meteorological station: "Piedra de los Soldados" *PSN03*, 2155 m).

Slika 2b: Klimatski diagram območja raziskave (meteorološka postaja: "Piedra de los Soldados" *PSN03*, 2155 m).

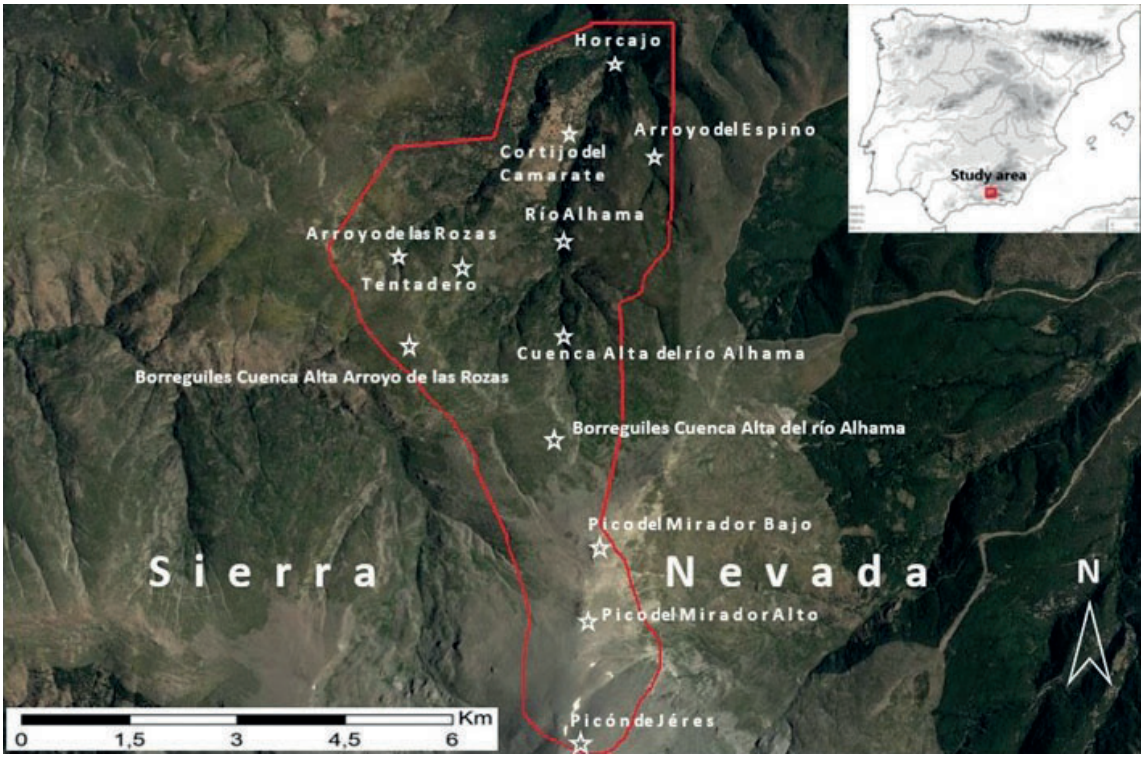

Figure 3: Study area indicating surveyed localities (spelled in white):1. Horcajo (30S477803/4116010), 2. Cortijo del Camarate (30S477176/4114766), 3. Arroyo del Espino (30S 478422/4115337), 4. Río Alhama (30S477299/4113777), 5. Arroyo de las Rozas (30S 476774/4115046), 6. Tentadero (30S476384/4114341), 7. Cuenca Alta del río Alhama (30S477527/4113543), 8. Borreguiles Cuenca Alta Arroyo de las Rozas (30S475619/4113874), 9. Borreguiles Cuenca Alta del río Alhama (30S477216/4110557), 10. Pico del Mirador Bajo (30S477729/4110335), 11. Pico del Mirador Alto (30S477565/4112170), 12. Picón de Jeres (30S477520/4108619). Source: Own elaboration using the coverage available in Google Earth.

Slika 3: Lokacija območja študije z označenimi raziskanimi območji (belo): 1. Horcajo (30S477803/4116010), 2. Cortijo del Camarate (30S477176/4114766), 3. Arroyo del Espino (30S 478422/4115337), 4. Río Alhama (30S477299/4113777), 5. Arroyo de las Rozas (30S 476774/4115046), 6. Tentadero (30S476384/4114341), 7. Cuenca Alta del río Alhama (30S477527/4113543), 8. Borreguiles Cuenca Alta Arroyo de las Rozas (30S475619/4113874), 9. Borreguiles Cuenca Alta del río Alhama (30S477216/4110557), 10. Pico del Mirador Bajo (30S477729/4110335), 11. Pico del Mirador Alto (30S477565/4112170), 12. Picón de Jeres (30S477520/4108619). Vir: Lastna izdelava na podlagi podatkov, ki so na voljo v Google Earth.

Floristic study

The collection of plant specimens was done between August 2018 and July 2023 in the three main parts of the study area (Figure 2: low area -Horcajo de Camarate and Zona de Reserva Baja-, middle area -Arroyo de las Rozas and Tentadero- and high area -Zona de Reserva Alta and northern slope of Pico Mirador Bajo/Mirador Alto and Picón de Jeres). The samplings were carried out in two periods: spring-summer, and autumn, coinciding with the phenological development of flora and vegetation, and following altitudinal transects from 1350 m to 3088 m. All the possible ecosystems and micro-ecosystems (e.g. peat bogs) and altitudinal belts were visited. The works "Flora Vascular de Andalucía Oriental" (Blanca et al., 2011) and "Flora iberica" (Castroviejo et al., 1986–2021) have been used for the identification of vascular flora. Because of their importance, some bryophytes were also collected both in deciduous forests and in plant communities where they could be characteristic taxa (e–. hydrophytic vegetation). Identification has been made following Flora Briofitica Iberica (Guerra et al., 2006–2018) by the University of Murcia personnel (Dr. J. Guerra).

Taxa from GBIF.org recorded in the study area were also included. In order to determine the degree of threat for the catalogued flora, we have consulted the Spanish and Andalusian red books (Blanca et al., 1999, 2000; Bañares et al., 2004, 2010), the Spanish red list (Moreno, 2008) and the Andalusian red list (Cabezudo et al., 2005). The legal protection status of the catalogued species was included according to the Andalusian legislation (D 23/2012). For legally protected species we indicated: scientific name, family, protection status (according to Andalusian catalogue and list of wild species under special protection)(D 23/2012); PEC: Plant species of European Community interest in need of strict protection), threat degree in Red Lists of Spain -RLS- and/or Andalusia -RLA-; (Blanca et al., 1999, 2000; Bañares et al., 2004; Bañares et al., 2010; Moreno, 2008), ecology (Blanca et al., 2011), phytosociological class in the study site (Rivas-Martínez et al., 2011a), local endemism (Blanca et al., 2011) and for invasive alien species, Royal Decree 630/2013 and Sanz-Elorza et al. (2004) have been followed. Voucher specimens are deposited in the MGC Herbarium (University of Málaga) (Thiers, continuously updated).

For those taxa of greatest relevance, the percentages of threatened, protected and endemic flora were calculated based on the catalogue of flora collected, inventoried and initially cited in the databases GBIF (2023).

Vegetation study

For the description of the vegetation units, we applied the phytosociological methodology of Braun-Blanquet (1979), complemented by Gehú & Rivas-Martínez (1981) and Schuhwerk (1990). The most interesting forest vegetation for this study, such as winter-deciduous and marcescent forests, as well as their dynamic stages and catenal contact vegetation, have been inventoried. Phytosociological relevés (75) have been carried out between August 2018 and July 2023 in ecologically homogeneous plots, georeferenced, distributed throughout the study area. Plot size was estimated by the minimum area calculation procedure (Braun-Blanquet, 1979; Rivas-Martínez, 2007, 2011a). The recorded ecological parameters for each phytosociological relevés included: slope (º), plot size (m^2), lithological composition, altitude (m a.s.l.), vegetation height (m or cm) and vegetation cover (%). All the relevés have been georeferenced in UTM coordinates using satellite data measured on the ground in the inventoried plot using a handheld GPS receiver. The phytosociological synthetic tables methodology has been applied to differentiate between the new associations proposed and other similar ones published previously. This methodology has not been used for subassociations but a complete description and differential species are given. The new syntaxonomical proposals follow the International Code of Phytosociological Nomenclature (Theurillat et al., 2021).

The syntaxonomical scheme shows the associations identified during this work as well as those of other authors that appear in the bibliography obtained for the studied area (Martínez-Parras et al., 1985; Losa-Quintana et al., 1986; Martínez-Parras et al., 1987; Lorite, 2001; Salazar et al. 2001a; Lorite et al., 2003; Rivas-Martínez et al., 2011). The phytosociological database SIVIM (Iberian and Macaronesian Vegetation Information System) was also consulted for the elaboration of the syntaxonomic scheme.

The proposal of Rivas-Martínez et al. (2011) was followed to identify the vegetation series, the characteristic species of the syntaxa and the most precise geo-ecological nomenclature. We follow Pérez-Latorre et al. (2004, 2008) to describe the zone-potential vegetation, using the data from the phytosociological tables and inventories. Soil types follow the FAO classification (2009) and were obtained from De Pedraza (1996). The development of the altitudinal catenas (geosigmetum) follows Rivas-Martínez (2007).

To identify the habitat types included in the Habitats Directive (Council Directive 92/43/EEC), Annex I was consulted, as well as the Atlas and Manual of Habitats of Spain (Rivas-Martínez et al., 2003) and the Andalusian habitat guide (REDIAM, 2020).

Results and Discussion

Flora

A total of 629 herbarium sheets were collected. The catalogue of vascular flora resulting from our study (Supplementary material) comprises a total of 440 taxa (species and subspecies), 370 from our floristic recording, 58 from our vegetation records and 12 initially from GBIF, belonging to 248 genera in 78 families. This represents almost 19% of the total number of species catalogued in Sierra Nevada (Lorite, 2016, 2020) and nearly 12% when compared to the flora of Eastern Andalusia (Cueto et al., 2014). In the catalogue, 20 taxa (4.5%) are endemic to Sierra Nevada and represent 23.8% of the known 84 endemic species for the whole of Sierra Nevada (Lorite, 2016, 2020). The distribution of species according to large taxonomic groups is as follows: pteridophytes 2.35%, gymnosperms 0.85% and angiosperms 96.8%. In the study area, the predominant floristic element was the Mediterranean (60 taxa; 13.6%), followed by the Iberian-North African (49; 11.13%), European (40; 9.1%), Nevadensian (36; 8.18%), Eurasian (34; 7.72), Holartic (31; 7.05%), Iberian (30; 6.81%), Paleotemperate (25; 5.68%) and Eurosiberian element (17; 3.86%).

Legally Protected and Threatened Species

The total number of threatened species according to the Red List of Andalusia (Cabezudo et al., 2005) in the study area is 25, of which 17 species are protected by andalusian legislation (Decree 23/2012 and Law 8/2003). The following threat categories are represented: 1 (EX); 1 (CR); 2(EN) and 21 (VU) (Table 3). In Sierra Nevada, with 2348 catalogued species (Lorite et al. 2016, 2020), 123 (5.24%) species of vascular plants are threatened (Cabezudo et al. 2005) of which 61 (2.6%) are legally protected (Decree 23/2012 and Law 8/2003). In the study area, with a total of 440 species and subspecies that make up the floristic catalogue, 25 are threatened (5.68 %) and 17 are protected (3.86%).

The protected/threatened flora is shown in Table 3.

Alien taxa

Only one taxon in the study area, *Datura stramonium* L. (Solanaceae) can be considered exotic/invasive, which represents 0.2% of the floristic catalogue. It is considered a methaphyte, epecophyte-hemiagryophyte (Sanz-Elorza et al. 2004). It occurs in ruderal and road vegetation.

Species of chorological and biogeographical interest

Hereafter, we briefly highlight other species of interest due to their rarity and/or scarcity or for their biogeographic value, which are present in the study area and/or have been highlighted in previous works (Pavón-Núñez et al., 2020a, 2020b). This group of species is scarcely present in Sierra Nevada and is always associated with the refuge ecosystems inventoried in this work, such as the edges of streams with rising water, deciduous and prostrate gymnosperm undergrowth, mixed deciduous forests, sheltered rocky areas, ditches and wet sheepfolds, thorny-deciduous edges of wet soils and *Sphagnum* peat bogs. Furthermore, according to their distribution, most of them correspond to disjunctions with their centre of origin in territories located in the Euro-Siberian region and are very uncommon in the south of the Iberian Peninsula (Guerra et al., 2004; Blanca et al., 2011; Pavón-Núñez et al., 2020a).

Information provided for each taxon is as follows: family, ecology, thermotype, phytosociological affinity (Rivas-Martínez et al., 2002; Blanca et al., 2011) and herbarium sheet collected. They also reveal those taxa that are first herbarium citations for Sierra Nevada, Andalusia, and southern Iberian Peninsula.

Epilobium lanceolatum Sebast. & Mauri. (*Onagraceae*). Moist grasslands and stony mountain slopes. Supra-oromediterranean (*Androsacetalia alpinae*). MGC 91717.

New for Sierra Nevada and Granada with GBIF herbarium sheet (Pavón-Núñez et al., 2020a).

Fraxinus excelsior L. (*Oleaceae*). Riparian forests and deciduous rainforests. Meso-supramediterranean (*Fagetalia*). MGC90704. Second record for Sierra Nevada with herbarium specimen (GBIF, MA 751674) (Pavón-Núñez et al., 2020a).

Geranium divaricatum Ehrh. (*Geraniaceae*). Ruderal and mountain roadside vegetation. Supra-oromediterranean (*Berberidion vulgaris*). MGC 90732. Second record for Sierra Nevada as the first record with herbarium specimen (GBIF, MA 01-00614256) comes from Aedo et al. (1998).

Geranium sylvaticum L. (*Geraniaceae*). Deciduous thorny scrub, cushion and creeping vegetation of high mountains. Supra-oromediterranean (*Trifolion medii/Triseto-Polygonion bistortae*). MGC 93795. New for Sierra Nevada with herbarium sheet (GBIF)(Pavón-Núñez et al., 2020a).

Moehringia trinervia (L.) Clairv. (*Caryophyllaceae*). Herbaceous vegetation in mesophilic and humid forest clearings. Thermo-supramediterranean (*Fagetalia syl-*

Table 3: Protected/threatened flora, Phytosociological affinity and Habitats of Community Interest. (*) Priority habitat. Threat category IUCN (2001): EX = Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable.

Taxa	Phytosociological affinity
Aconitum burnatii Gáyer (Ranunculaceae)	*Cirsion flavispinae*
Agrostis canina L. subsp. *granatensis* Romero García, Blanca & C. Morales. (Gramineae)	*Festucion frigidae*
Androsace vitaliana (L.) Lapeyr. subsp. *nevadensis* (Chiarugi) Luceño (Primulaceae)	*Nevadension purpureae*
Andryala agardhii DC. (Compositae)	*Andryalion agardhii*
Aquilegia vulgaris L. subsp. *nevadensis* (Boiss. & Reut.) T. E. Díaz (Ranunculaceae)	*Cirsion flavispinae*
Armeria filicaulis (Boiss.) Boiss. subsp. *nevadensis* Nieto Fel., Roselló & Fuertes (Plumbaginaceae)	–
Botrychium lunaria (L.) Swartz (Botrychiaceae)	*Nardetalia strictae*
Carex camposii Boiss. & Reut. (Cyperaceae)	*Magnocaricion elatae*
Dryopteris filix–mas (L.) Schott (Aspidiaceae)	*Querco-Fagetea*
Festuca clementei Boiss. (Gramineae)	*Nevadension purpureae*
Festuca elegans Boiss. (Gramineae)	*Festucion merinoi*
Gentiana alpina Vill. (Gentianaceae)	*Caricetea-Curvulae*
Gentiana sierrae Briq. (Gentianaceae)	*Plantaginion nivalis*
Leontodon boryi Boiss. ex DC. (Compositae)	*Nevadension purpureae*
Ophioglossum vulgatum L. (Ophioglossaceae)	*Molinion caeruleae*
Phleum brachystachyum (Salisb.) Gamisans, Romero García & C. Morales subsp. *abbreviatum* (Boiss.) Gamisans, Romero García & C. Morales (Gramineae)	*Plantaginion nivalis*
Pinguicula nevadensis (H. Lindb.) Casper. (Lentibulariaceae)	*Festucion frigidae*
Prangos trifida (Mill.) Herrnst. & Heyn (Umbelliferae)	–
Primula elatior (L.) L. subsp. *lofthousei* (Hesl.–Harr.) W. W. Sm. & Fletcher. (Primulaceae)	*Nardetalia strictae*
Prunus avium L. (Rosaceae)	*Fagetalia sylvaticae*
Prunus ramburii Boiss. (Rosaceae)	*Lonicero arboreae-Berberidion hispanicae*
Rhamnus cathartica L. (Rhamnaceae)	*Prunetalia spinosae*
Ribes uva–crispa L. subsp. *austro-europaeum* (Bornm.) Bech. (Grossulariaceae)	*Berberidion vulgaris*
Salix caprea L. (Salicaceae)	*Betulo-Populetalia tremulae*
Sarcocapnos speciosa Boiss.(Papaveraceae)	*Sarcocapnion pulcherrimae*
Scorzoneroides microcephala (Boiss.) Holub. (Compositae)	*Festucion frigidae*
Sorbus aria (L.) Crantz (Rosaceae)	*Quercetalia pubescentis*
Sorbus aucuparia L. (Rosaceae)	*Betulo-Populetalia tremulae*
Taxus baccata L. (Taxaceae)	*Querco-Fagetea*

vaticae). MGC 91702. Second record for the south of the Iberian Peninsula with herbarium specimen (GBIF, MGC 72188-1) (Pavón-Núñez et al., 2020a).

Ophioglossum vulgatum L. (*Ophioglossaceae*). Hygrophilous mountain grasslands. Meso-supramediterranean (*Molinion caeruleae*). MGC 89223. Second record for Sierra Nevada as herbarium specimen (GBIF, ABH 13660) (Pavón-Núñez et al., 2020a).

Pyrus cordata Desv. (*Rosaceae*). Cultivated and naturalised within its natural range in mountain areas. Meso-supramediterranean (*Frangulo alni-Pyrion cordatae*). MGC 95312. New for Andalusia, it had been excluded from the Andalusian catalogue (Cueto et al., 2025).

Quercus* x *trabutii Hy (*Fagaceae*). Deciduous forests on acid soils. Meso-supramediterranean (*Ilici-Fagion*). MGC 90706. New to the south of the Iberian Peninsula (Pavón-Núñez et al., 2020b)

Ranunculus omiophyllus Ten. (*Ranunculaceae*). Helophytic vegetation along water courses. Supra-oromediterranean (*Ranunculion omiophyllo-hederacei*). MGC 92482. New to the southern Iberian Peninsula with a herbarium specimen (GBIF).

Ribes uva-crispa L. subsp. ***austroeuropaeum*** (Bornm.) Bech. (*Grossulariaceae*). Deciduous thorny scrub, climatophilous deciduous forests. Supra-oromediterranean (*Berberidion vulgaris*). MGC 90327.

Rosa dumalis Bechst. (*Rosaceae*). Deciduous thorny scrub, undergrowth, hedgerows and forest edges. Su-

Tabela 3: Zaščitena/ogrožena flora, fitosociološka pripadnost in habitati v interesu skupnosti. (*) Prednostni habitat. Kategorija ogroženosti IUCN (2001): EX = izumrl, CR = kritično ogrožen, EN = ogrožen, VU = ranljiv.

HIC	Threat category (Red List of Andalusia)	Protection Level (Andalusian Legislation)	Endemicity	MGC
6430	VU	Special protection regime	Local endemic	95095
6230	VU	Special protection regime	Local endemic	93771
–	VU	–	Local endemic	93821
4090	VU	–	Local endemic	93835
–	VU	–	–	91684
–	VU	–	–	93789
6230	VU	–	–	93750; 95087
–	NT	Special protection regime	Local endemic	93869
–	VU	–	–	90745
6160	VU	Special protection regime	Local endemic	93834; 93841
–	–	Special protection regime	–	
6230	VU	–	–	93752
6230	VU	Special protection regime	Subendemic	93777
–	NT	Special protection regime	Local endemic	92465
6410	CR	–	–	89223
6230	VU	–	Local endemic	93774;95106
6230	VU	Vulnerable	Local endemic	93757
–	VU	–	–	93862
6420	VU	Special protection regime	Local endemic	93772
9180	VU	Special protection regime	–	90322
	VU	–	Subendemic	90740
–	EN	Vulnerable	Subendemic	93861
–	VU	–	–	90327; 92468; 95379
9180	EN	Special protection regime	–	91733
8220	VU	Endangered	Local endemic	90730
6230	VU	Special protection regime	Local endemic	93766
9180	NT	Special protection regime	–	91735; 92321; 93739; 93740; 93742; 95089
9180	EX	Special protection regime	–	92305
9580	VU	Special protection regime	–	90753; 93744

pra-oromediterranean (*Berberidion vulgaris*). MGC 89226 A very rare Euro-Siberian taxon in the south of the Iberian Peninsula (Blanca et al., 2011).

Rosa villosa L. (*Rosaceae*). Deciduous thorny scrub, undergrowth, hedgerows and forest edges. Supra-oromediterranean (*Berberidion vulgaris*). MGC 91728. New for Sierra Nevada with herbarium sheet (GBIF).

Rubus canescens DC. (*Rosaceae*). Deciduous thorny scrub, climatophilous deciduous forests. Supra-oromediterranean (*Prunetalia spinosae*). MGC 93860. New for Sierra Nevada and the province of Granada as a herbarium specimen (GBIF).

Sorbus aucuparia L. (*Rosaceae*). Edges of deciduous forests on siliceous substrate. Supra-oromediterranean (*Betulo pendulae-Populetalia tremulae*). MGC 92305. It has been cited previously but without a herbarium sheet. First citation for Sierra Nevada with an herbarium specimen (GBIF) (Pavón-Núñez et al., 2020a).

Sphagnum subnitens Russow &Warnst. (*Bryaceae*). Peatbogs. Supra-oromediterranean (*Erico tetralicis-Sphagnetalia papillosi*). MGC5192. Very uncommon in the south of the Iberian Peninsula (Guerra et al., 2004).

Sphagnum auriculatum Schimp. (*Bryaceae*). Peatsbogs. Supra-oromediterranean (*Oxycocco-Sphagnetea*). MGC 2097. Very uncommon in the south of the Iberian Peninsula (Guerra et al., 2004).

Vegetation

Of a total of almost 200 plant communities present in the Sierra Nevada natural area (Molero & Marfil, 2017; Muñoz & Molero, 2019) 35 syntaxa are present in the study area. They consitute 17.5% of phytocoenological richness. In the study area, 18 Habitats of Community Interest (HCIs) are present out of 37 catalogued for the whole Sierra Nevada (Salazar & Valle, 2019), representing 48.6% of the areas HCI richness. These records highlight the value of this territory of just over 20 km^2 in the Sierra Nevada National Park. Of these 35 syntaxa, 25 are associations, seven sub-associations, two communities and one variant. We describe five new syntaxa: two new associations, two new subassociations and one new community. In this work, nine syntaxa have been identified for the first time for the studied territory, of which seven are associations, one is a sub-association and another is a variant. Prior to this publication, 21 syntaxa had already been identified in the area by other authors (Quézel, 1953; Arnáiz, 1979; Martínez-Parras & Molero, 1982; Martínez-Parras et al., 1987; Rivas-Martínez, 1987, 2002; Lorite, 2001; Salazar et al., 2001; Lorite et al., 2003). In relation to the first objective of the work, we have described a new type of deciduous forest with Eurosiberian floristic-chorological relationships, placed in the *Querco-Fagetea* class. It is floristically and ecologically differentiated from the marcescent forests of *Quercus pyrenaica*, which was, until now, the only climatophilic deciduous forests considered to exist in the entire Sierra Nevada in its Nevadense sector (Martínez-Parras & Molero, 1982; Martínez-Parras et al., 1985; Molero & Marfil, 2017). The other new association constitutes a complete disjunction for the southern Iberian Peninsula of the hydrophytic communities with *Ranunculus omiophyllus* (Braun-Blanquet & Tüxen, 1952; Rivas-Martínez et al., 2002). Regarding the two new sub-associations, they constitute southward radiations of deciduous shrub and thorny vegetation characterised by species of a more northern optimum (Blanca et al., 2011; Castroviejo, 2021) and also constitutes the border and upper catenal contact of the new deciduous forest association. Regarding the new communities, the ash groves with *Fraxinus excelsior* and its hybrid with *Fraxinus angustifolia* subsp. *angustifolia* could be the southernmost localities on the European continent together with those located in Sierra Tejeda (Cabezudo et al., 2011). The ash hybrids were taxonomically differentiated from the parent species by the dark brown colour of the dormant buds, the large size of the leaflets, and the fact that they had more teeth than secondary veins. The second community is a majadal with *Poa bulbosa*, a type of grazed grassland, whose existence was unknown in the siliceous Sierra Nevada (Pérez-Raya, 1987).

New records on plant associations and communities

Five plant associations and communities have been identified for the first time in the study area:

Montio fontanae-Ranunculetum omiophylli Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana ass. nova (Table 4).

Table 4: (Tabela 4): *Montio fontanae-Ranunculetum omiophylli* ass. nova.

N. relevé	1	2	3	4	5	6	7	8
Slope face	N	W	–	NE	–	–	N	–
Area (m^2)	1	1	1	2	1	4	1	2
Lithology	Mica Cuar	Mica Cuar	Mica Cuar	Mica Cuar	Mica Cuar	Mica Cuar	Mica Cuar	Mica Cuar
Altitude (1=10 m asl)	225	157	201	178	202	216	210	214
N. species	11	6	6	8	4	7	5	10
Characteristics and differentials of association								
Ranunculus omiophyllus	2	3	3	3	3	3	.	3
Montia fontana subsp. *fontana*	1	3	2	2	1	4	3	1
Saxifraga stellaris subsp. *robusta*	+	.	.	.	.	.	.	.
Philonotis seriata	.	.	.	.	.	x	.	.
Stellaria alsine								
Philonotis fontana	.	.	.	.	.	.	x	.
Callitriche stagnalis	.	.	.	.	3	.	.	.
Brachythecium rivulare	.	.	.	.	.	.	.	x

N. relevé	1	2	3	4	5	6	7	8
Companions								
Agrostis stolonifera	.	.	.	1	.	1	+	1
Hypericum tetrapterum	+	.	.	+	.	.	1	+
Veronica anagallis–aquatica	.	+	1	1	.	.	.	.
Apium nodiflorum	.	.	.	+	.	.	.	.
Epilobium lanceolatum	.	.	.	.	.	.	1	+
Fontinalis antipyretica	.	.	.	.	.	+	.	+
Reophilic moss	2	.	.	.	.	.	.	+
Carex camposii	.	.	.	1	.	.	.	.
Carex nevadensis	5	.	.	.	.	.	.	.
Festuca nevadensis	+	.	.	.	.	.	.	.
Isolepis setacea	.	+	.	.	.	.	.	.
Juncus acutiflorus	.	.	.	.	.	.	.	+
Juncus alpino-articulatus subsp. *alpino-articulatus*	+	.	.	.	.	.	.	.
Juncus bufonius	.	+	.	.	.	.	.	.
Juncus tenageia	.	.	.	.	.	+	.	.
Scorzoneroides microcephala	+	.	.	.	.	.	.	.
Mentha aquatica	.	.	+	.	.	.	.	.
Mentha suaveolens	.	+	.	.	.	.	.	.
Rock moss	.	.	.	.	.	+	.	.
Myosotis decumbens subsp. *teresiana*	.	.	.	.	.	+	.	.
Poa supina	.	.	.	.	+	.	.	.
Phleum brachystachyum subsp. *abbreviatum*	+	.	.	.	.	.	.	.
Rumex pulcher	.	.	+	.	.	.	.	.
Sagina saginoides subsp. *nevadensis*	.	.	.	.	.	.	.	+
Trifolium repens	.	.	+	.	.	.	.	.
Viola palustris	+	.	.	.	.	.	.	.
Ranunculus repens	.	.	.	+	.	.	.	.

Localities:

1. Granada. Lugros. Dehesa del Camarate. Borreguil de la Fuente de las Ortigas. 30S477240/4112467.
2. Granada. Lugros. Dehesa del Camarate. Arroyo del Espino. Surgencia de agua. 30S478649/4115574.
3. Granada. Lugros. Dehesa del Camarate. Parte Alta Arroyo de las Rozas. 30S475876/4113902.
4. Granada. Lugros. Dehesa del Camarate. Arroyo de las Rozas, abedular bajo el tentadero.30S476306/4114334.
5. Granada. Lugros. Dehesa del Camarate. Cuenca alta del arroyo de las Rozas. 30S475619/4113874.
6. Granada. Lugros. Dehesa del Camarate. Borreguiles de la Cuenca Alta del río Alhama de Lugros. 30S477565/4112170.
7. Granada. Lugros. Dehesa del Camarate. Cascada de la Cuenca Alta del río Alhama de Lugros. 30S477493/4112331.
8. Granada. Lugros. Dehesa del Camarate. Acequia de la Cuenca Alta del río Alhama de Lugros. 30S477823/4112404.

Holotypus ass.: Table 4, relevé 8. Granada, Dehesa del Camarate, Cuenca Alta del río Alhama de Lugros. Date: 27.07.2023. UTM: 30S477823/4112404.

Characteristic species: *Ranunculus omiophyllus* and *Montia fontana* subsp. *fontana*.

Diagnosis: association dominated by *Ranunculus omiophyllus*, which grows in small shallow pools connected to permanent streams with cold, oligotrophic water and with spring and summer phenology. It is a southern vicariant (reaching Sierra Nevada) of the *Myosotido stoloniferae-Ranunculetum omiophylli* Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero in Rivas-Martínez et al. 2002, association described by Rivas-Martínez et al. (2002) for the Carpetano-Ibérico-Leonesa and Luso-Extremadurensean subprovinces in the centre of the Iberian Peninsula.

It has its optimum in the supra- and oromediterranean thermotypes of the Nevadensian sector although relict because of its scarcity. Another association with similar ecology (little ponds and streams) was included in *Ranunculetum hederacei* (R. Tüxen & Diemont 1936) Libbert 1940 by Lorite et al. (2003), but it differs from the new association by the presence of *Ranunculus hederaceus* and the absence of *R. omiophyllus*. Association of great environmental importance, as it develops in streams and irrigation channels, very characteristic and threatened ecosystems in Sierra Nevada (Salazar & Valle, 2019).

The different floristic composition (Table 5) of both associations is statistically reflected at the alliance level; in *Montio fontanae-Ranunculetum omiophylli* ass. nova, the characteristic species belong to the *Cardamino-Montion* typical of cold water streams poor in bases in Eurosiberian environments (Rivas-Martinez et al., 2011). On the contrary, in *Myosotido stoloniferae-Ranunculetum omiophylli* Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero 2002, it belongs to *Myosotidion stoloniferae* of cold oligotrophic waters in Oroiberian Carpetan-Leonese and Western Orocantabric territories (Rivas-Martinez et al., 2011).

Table 5: Synthetic table of *Montio fontanae-Ranunculetum omiophylli* ass. nova and *Myosotido stoloniferae-Ranunculetum omiophylli* Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero 2002.

Tabela 5: Sintetska tabela *Montio fontanae-Ranunculetum omiophylli* ass. nova in *Myosotido stoloniferae-Ranunculetum omiophylli* Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero 2002.

Group nº	**1**	**2**
Nº relevés	8	4
Characteristics of *Ranunculion omiophyllo-hederacei*		
Ranunculus omiophyllus	V	4
Characteristics of *Cardamino-Montion*		
Montia fontana subsp. *fontana*	V	.
Saxifraga stellaris subsp. *robusta*	I	.
Philonotis seriata	I	.
Characteristics of *Myosotidion stoloniferae*		
Myosotis stolonifera	.	4
Characteristics of *Montio-Cardaminetalia*		
Montia fontana subsp. *amporitana*	.	3
Stellaria alsine	.	1
Philonotis fontana	I	.
Callitriche stagnalis	I	2
Brachythecium rivulare	I	.
Companions		
Agrostis stolonifera	III	1
Hypericum elodes	.	1
Hypericum tetrapterum	III	.
Veronica anagallis-aquatica	III	.
Apium nodiflorum	I	1
Epilobium lanceolatum	III	.
Fontinalis antipyretica	I	.
Reophilic moss	III	.
Carex camposii	I	.
Carex nevadensis	I	.
Festuca nevadensis	I	.
Holcus reuteri	.	1
Isolepis setacea	I	.
Juncus acutiflorus	I	.
Juncus alpino-articulatus subsp. *alpino-articulatus*	I	.
Juncus bufonius	I	1
Juncus tenageia	I	.
Scorzoneroides microcephala	I	.
Mentha aquatica	I	.
Mentha suaveolens	I	.
Potamogeton polygonifolius	.	2
Rock moss	I	.
Myosotis decumbens subsp. *teresiana*	I	.
Poa supina	I	.
Phleum brachystachyum subsp. *abbreviatum*	I	.
Rumex pulcher	I	.
Sagina saginoides subsp. *nevadensis*	I	.
Trifolium repens	I	.
Viola palustris	I	.
Ranunculus repens	I	.
Glyceria declinata	.	4

Source of the relevés:

1. *Montio fontanae-Ranunculetum omiophyllii* ass. nova

2. *Myosotido stoloniferae-Ranunculetum omiophyllii* Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero 2002

Community of *Poa bulbosa* (Table 6)

Diagnosis: grassland of hemicryptophytes, therophytes and geophytes dominated by *Poa bulbosa* growing on deep siliceous soils derived from micaschists and quartzites, subjected to grazing. They are preferably located in the supramediterranean thermotype with at least a sub-humid ombrotype. Synsuccessionally, they evolve from a nutrient-rich and green grass pasture from the beginning of autumn and winter to a dry pasture of therophytes and preferably nitrophilous Compositae especies from late spring to early summer (Rivas-Martínez et al., 2011). This type of grazed grassland on siliceous soils was unknown in Sierra Nevada, although a basophilous community was described by Pérez-Raya (1987).

Table 6: Community of *Poa bulbosa*.
Tabela 6: Združba z vrsto *Poa bulbosa*.

Relevé	1	2
Slope face	E	-
Slope (º)	15	0
Area (m²)	100	50
Lithology	Micaesq	Micaesq
Altitude (m)	1830	1830
Vegetation height (cm)	0,5	5
Cover (%)	80	80
Characteristics of *Poetalia bulbosae*		
Poa bulbosa	4	2
Herniaria hirsuta	.	1
Taraxacum obovatum	+	.
Companions	.	.
Anthemis pedunculata	1	.
Alyssum granatense	+	1
Alyssum minutum	.	+
Arabis verna	4	4
Anagallis arvensis	+	.
Erodium cicutarium	1	.
Gagea reverchonii	1	.
Herniaria hirsuta	.	1
Pilosella argyrocoma	.	+
Pilosella pseudopilosella	+	.
Plantago holosteum	.	+
Hyoseris radiata	1	.
Leontodon longirrostris	1	.
Rumex angiocarpus	3	3
Spergularia segetalis	1	.
Thlaspi arvense	+	.

Localities:
1. Granada. Lugros. Dehesa del Camarate. Camino hacia el Tentadero. 476841/4114283.
2. Granada. Lugros. Dehesa del Camarate. Tentadero. 476319/4114206.

Lonicero arboreae-Crataegetum granatensis Bolós 1954 corr. Rivas-Martínez, T. E. Díaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002 nom. invers. propos in Cabezudo et al., (2016).
ribetosum austroeuropaei Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova (Table 7).
Holotypus subass.: Table 7, relevé 3. Granada, Dehesa del Camarate, El Tentadero. Date: 16.06.2022. UTM: 30S476359/4114282.
Characteristic and differential species: *Ribes uva-crispa* subsp. *austro-europaeum, Rosa villosa, Rosa dumalis, Rosa sicula* and *Geranium divaricatum*.
Diagnosis: microphanaerophytic (2–5 m), chionophilous deciduous thorny shrubland, typical of the upper supramediterranean and lower oromediterranean thermotypes of the Nevadensian sector, developing on deep temporo-hygrophilous soils derived from micaschists and quartzites. The association is characterized by *Lonicera arborea* and *Crataegus granatense*, which generate the greatest biomass. The sub-association *ribetosum austroeuropaei* is endemic and microtopographic, occurring in localised areas on the northern slopes of Sierra Nevada and is characterised by the frequent presence of characteristic and differentiating taxa of *Berberidion vulgaris* Br.-Bl. 1950 such as *Ribes uva-crispa* subsp. *austro-europaeum, Rosa villosa, Rosa dumalis, Rosa sicula* or *Geranium divaricatum*. It would be a phytocenological singularity due to its rarity and its relict situation that would connect these southern deciduous thorny shrublands of *Lonicero arboreae-Berberidion hispanicae* O. Bolòs 1954 with those existing in the Eurosiberian mountains of the central and northern Iberian Peninsula (*Berberidion vulgaris*) (Rivas-Martínez et al., 2011). As the characteristic species are also located in other northern, upper parts of several basins of Sierra Nevada (rivers Genil, Monachil, Maitena, see GBIF), the presence of this new subassociation is possible there. It constitutes the seral preforest mantle of the higher altitude forest of the association *Poo nemoralis-Prunetum avium* ass. nova.

Genisto versicoloris-Juniperetum nanae Quézel 1953 corr. Rivas-Martínez, Fernández-González & Loidi 1999 ***rosetosum villosae*** Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova (Table 8).
Holotypus subass.: Table 8, relevé 2. Granada, Dehesa del Camarate, Cuenca Alta del río Alhama, scrubland bordering hygromorphic grassland. Date: 2.07.2023. UTM: 30S477695/4112133
Characteristic and differential species: *Rosa villosa*, *Rosa dumalis, Geranium sylvaticum*, *Aquilegia vulgaris* subsp. *nevadensis* and *Primula elatior* subsp. *lofthousei.*
Diagnosis: the typical subassociation (*juniperetosum hemisphaericae*) is an oromediterranean sub-humid siliceous xerophytic shrubland, dominated by *Juniperus sabina* and *Juniperus hemisphaerica* in the Nevadensian sector, well adapted to the summer dryness, intense winter cold, snow and strong winds, at the altitude where it grows (Losa-Quintana et al., 1986). The *rosetosum villosae* subass. nova would represent a mesophilic subassociation of the high mountain juniper

Table 7 (Tabela 7): *Lonicero arboreae-Crataegetum granatensis* Bolós 1954 *ribetosum austroeuropaei* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova.

Relevé	1	2	3	4
Slope face	NW	N	NW	NE
Slope (º)	20	30	5	35
Area (m²)	50	100	100	100
Lithology	MicaesqCuar	MicaesqCuar	MicaesqCuar	MicaesqCuar
Altitude (m)	2020	2000	1870	1879
Vegetation height (cm)	4	6	2	5
Cover (%)	80	100	100	100
Characteristics and differentials of association				
Lonicera arborea	1	2	1	3
Crataegus granatensis	+	1	2	.
Berberis hispanica	2	2	+	2
Cotoneaster granatensis	.	.	.	+
Characterstics and differentials of subassociation				
Ribes uva–crispa	2	1	1	2
Rosa villosa	2	4	.	2
Rosa dumalis	1	+	2	.
Rosa sicula	.	.	+	.
Geranium divaricatum	.	.	+	.
Characterstics of *Prunetalia spinosae*				
Rosa corymbifera	.	.	.	+
Rubus canescens	.	.	.	+
Companions of *Querco-Fagetea*				
Acer opalus subsp. *granatense*	.	.	.	+
Poa nemoralis	.	+	.	.
Companions				
Urtica dioica	1	1	.	2
Sorbus aria	+	1	+	.
Geum heterocarpum	1	+	.	.
Alliaria petiolata	.	+	.	+
Cirsium acaule subsp. *gregarium*	+	+	.	
Primula elatior subsp. *lofthousei*	.	1	.	.
Acinos alpinus	+	.	.	.
Alchemilla filicaulis	.	+	.	.
Aquilegia nevadensis	.	+	.	.
Artemisia absinthium	.	.	.	+
Cerastium fontanum subsp. *vulgare*	.	+	.	.
Cuscuta triumvirati	.	.	+	.
Cystopteris fragilis	.	.	.	+
Cytisus galianoi	.	.	+	.
Digitalis purpurea subsp. *purpurea*	+	.	.	.
Genista versicolor	.	.	+	.
Geranium lucidum	.	+	.	.
Helianthemum apenninum subsp. *suffruticosum*	.	.	+	.
Heracleum sphondylium subsp. *granatense*	.	+	.	.
Lapsana communis	+	.	.	.
Marrubium supinum	.	.	+	.
Pilosella argyrocoma	.	.	+	.
Prunella vulgaris	.	+	.	.
Senecio jacobaea	.	+	.	.
Vicia benghalensis	.	.	+	.

Localities:
1 and **2**. Granada. Lugros. Dehesa del Camarate. Cuenca Alta Arroyo Rozas. 30S475730/41138433 and 30S475737/4113883.
3. Granada. Lugros. Dehesa del Camarate. El Tentadero. 30S476359/4114282.
4. Granada. Lugros. Dehesa del Camarate. Arroyo del tejo milenario afluente del arroyo de las Rozas. 30S476302/4114203.

shrubland, frequently in ecotone with hygromorphic grasslands "borreguiles", on humid siliceous substrates of oro-mediterranean microclimatic zones. It may also be considered as the preforest mantle of a hypothetic relict but exinct forest of *Betula pendula* subsp. *fontqueri* (*Salici capreae-Betuletum fontqueri* Molero & Rivas-Martínez in Rivas-Martínez et al., 2002), nowadays represented by isolated individuals in this ecosystem (Ruiz-Girela et al., 2001). The presence of rare, relict or endemic taxa of eurosiberian optimum within the creeping juniper shrub, such as *Geranium sylvaticum*, *Primula elatior* subsp. *lofthousei* or *Pedicularis comosa* subsp. *comosa* together with thorny shrub species such as *Rosa villosa* and *Rosa dumalis* (*Berberidion vulgaris* Br.-Bl. 1950) clearly differentiates this ecosystem from the typical, which thrives in more extreme environmental conditions and includes xerophytic species such as *Festuca indigesta* and *Thymus serpylloides*. As some of the characteristic species are also located in other northern basins of Sierra Nevada (Genil, Monachil, see GBIF), the presence of this new subassociation is possible there.

Table 8 (Tabela 8): *Genisto versicoloris-Juniperetum nanae* Quezel 1953 corr. Rivas-Martínez, Fernández-González & Loidi 1999 *rosetosum villosae* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova.

Relevé	1	2	3	4	5	6
Slope face	N	NW	N	S	W	W
Slope (º)	25	15	25	20	30	15
Area (m²)	100	100	75	100	100	100
Lithology	MicaCuar	MicaCuar	MicaCuar	MicaCuar	MicaCuar	MicaCuar
Altitude (m)	2244	2190	2208	2641	2526	2257
Vegetation height (cm)	150	120	100	50	30	70
Cover (%)	90	100	100	90	70	90
Characteristics of association and upper syntaxonomical units						
Juniperus communis subsp. *hemisphaerica*	4	2	2	3	3	5
Juniperus sabina	3	3	1	.	.	.
Cytisus galianoi	+	1	.	.	.	1
Genista versicolor	.	.	.	.	.	4
Avenella flexuosa subsp. *iberica*	.	.	.	.	1	.
Characteristics and differentials of subassociation						
Rosa villosa	+	2	2	.	.	.
Aquilegia vulgaris subsp. *nevadensis*	+	+	+	.	.	.
Primula elatior subsp. *lofthousei*	+	+	1	.	.	.
Geranium sylvaticum	.	1	1	.	.	.
Rosa dumalis	1	.	.	.	.	.
Characteristics of *Rhamno-Prunetea*						.
Berberis hispanica	2	3	4	.	.	.
Lonicera arborea	.	+	+	.	.	.
Companions						
Festuca indigesta	.	.	.	3	1	2
Aconitum vulparia subsp. *neapolitanum*	+	.	+	.	.	.
Agrostis stolonifera	.	+	.	.	.	+
Astragalus nevadensis subsp. *nevadensis*	.	.	.	1	+	.
Eryngium bourgatii	+	.	+	.	.	.
Geum heterocarpum	.	+	+	.	.	.
Senecio pyrenaicus subsp. *granatensis*	1	.	1		.	.
Thymus serpylloides subsp. *serpylloides*	.	.	.	1	.	1
Vicia pyrenaica	.	+	1	.	.	.
Aconitum burnatii	.	1	.	.	.	.
Armeria filicaulis subsp. *nevadensis*	.	.	.	.	1	.
Arenaria tetraquetra subsp. *amabilis*	.	.	.	+	.	.

Relevé	1	2	3	4	5	6
Cerastium alpinum var. *nevadense*	.	.	.	+	.	
Cirsium acaule	+	.	.	.	.	.
Dactylis glomerata subsp. *hispanica*	.	+	.	.	.	.
Dianthus brachyanthus	.	.	.	.	+	.
Festuca elegans	.	+	.	.	.	.
Hypericum tetrapterum	.	.	+	.	.	.
Lathyrus pratensis	+	.	.	.	.	.
Vaccinium uliginosum var. *nana*	+	.	.	.	.	.
Viola crassiuscula	1	.	.		.	

Localities:
1. Granada. Lugros. Dehesa del Camarate. Cuenca Alta del río Alhama. Sabinar próximo a la Fuente de las Ortigas. 30S476925/4111918.
2. Granada. Lugros. Dehesa del Camarate. Cuenca Alta del río Alhama. Matorral borde de borreguil. 30S477695/4112133.
3. Granada. Lugros. Dehesa del Camarate. Cuenca Alta del río Alhama. Sabinar de alta montaña. 30S477685/4112085.
4. Granada. Lugros. Pico del Mirador Alto. 30S 477779/4110626.
5 and **6**. Granada. Lugros. Ladera oeste del Pico del Mirador Alto. 30S477543/4110791 and 30S476788/4111857.

Poo nemoralis-Prunetum avium Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana ass. nova (Table 9). (*Berberido hispanicae-Aceretum granatensis sensu* Molero & Marfil 2017 *nomen nudum,* art. 2)

Holotypus ass.: Table 9, relevé 4. Granada, Dehesa del Camarate, Horcajo de Camarate. Date: 17.07.2019. UTM: 30S477724/4115971.

Characteristic species: *Prunus avium, Fraxinus excelsior, Moehringia trinervia, Epilobium montanum* and *Poa nemoralis*.

Diagnosis: deciduous, mixed climatophilic and temporihygrophilic forests growing in shady ravines and canyon bottoms with deep eutrophic soils close to neutral pH derived from micaschists and quartzites, with an optimum in the supramediterranean subhumid thermotype of the Nevadense sector. The tree layer is dominated by *Prunus avium* and/or sometimes by *Sorbus aria* and *Acer opalus* subsp. *granatense*, with noteworthy presence of *Taxus baccata, Fraxinus excelsior* and *Quercus* x *trabutti* (*Ilici-Fagion* Br.-Bl. 1967). It is a sub-Mediterranean relict association, with a notable presence of taxa characteristic for *Quercetalia pubescentis* Klika 1933, where it was initially included. In protected and well-preserved areas, in addition to the dominant species (*Prunus avium*), several relict and rare species characteristic for *Fagetalia sylvaticae*, such as *Fraxinus excelsior*, *Moehringia trinervia* or *Epilobium montanum* are present, together with some differential nemoral plants, such as *Poa nemoralis* or *Polygonatum odoratum*. The rare presence of some *Prunetalia spinosae* species is remarkable, e.g. *Rhamnus cathartica* or *Rosa dumalis*. *Homalothecium meridionale* is a noteworthy bryophyte epiphyte on the base of trunks. This forest could be interpreted as an impoverished, relict, southern irradiation of the *Betulo-Populetalia tremulae*, which would occasionally reach, from the Eurosiberian Region, the microclimatic zones of the northern slope of Sierra Nevada. An ecological similar situation shows the *Geo urbani-Coryletum avellanae ulmetosum glabrae* Pavón-Núñez & Pérez-Latorre 2010 subassociation, endemic to the Alcaracensian subsector, Subbaetic sector, Baetic province. The adjacent catenal marcescent forests of *Quercus pyrenaica* (*Adenocarpo-Quercetum pyrenaicae aceretosum granatensis*) develop in a lower altitudinal position or in zonal climatic soils compared to *Poo nemoralis-Prunetum avium* ass. nova. The name *Berberido hispanicae-Aceretum granatensis* was proposed by Molero & Marfil (2017), without a table of inventories, for *Acer opalus* subsp. *granatensis* woodlands occupying similar habitats in Sierra Nevada.

The synthetic table (Table 10) shows comparison between the new association (*Poo nemoralis-Prunetum avium*) and the two similar plant communities previously described in the literature (*Adenocarpo decorticanti-Quercetum pyrenaicae* and *Aceri granatensis-Fraxinetum angustifoliae*). In the new association elements characterisic for the *Fagetalia* order dominate, which is unique, as mentioned in the previous paragraph, and clearly separates it from the *Adenocarpo decorticanti-Quercetum pyrenaicae* association, where the majority of species are characeristic for *Quercetalia pubescentis* or *Quercetalia roboris*. With regard to *Aceri granatensis-Fraxinetum angustifoliae*, the differences are notable, characterised by a dominant number of *Populetalia albae* species. In summary, the table reflects three distinct phytosociological orders, which differentiate each of the three associations.

Table 9 (Tabela 9): *Poo nemoralis-Prunetum avium* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana ass. nova.

Relevé	1	2	3	4	5	6	7	8	9	10
Slope face	N	NW	N	NW	N	NW	NE	NE	W	N
Slope (º)	20	15	35	40	30	35	30	45	35	45
Area (m²)	100	100	400	400	400	400	200	200	200	150
Lithology	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar	Micasc Cuar
Altitude (m)	1895	1750	1475	1465	1860	1840	1860	1805	1595	1984
Vegetation height (cm)	800	1500	600	800	1200	1500	1500	1500	1000	1200
Cover (%)	100	100	70	90	80	100	90	100	100	100
Characteristics and differentials of association										
Prunus avium	4	1	2	4	.	2	.	4	5	.
Poa nemoralis	+	1	.	1	.	+	.	+	.	+
Fraxinus excelsior	.	.	1	1	.	.	.	.	.	.
Moehringia trinervia	.	+	.	+	.	.	.	.	.	.
Epilobium montanum	.	+	.	.	.	.	.	.	.	.
Characteristics of *Quercetalia roboris*										
Quercus pyrenaica	.	.	+	+	.	.	.	.	.	.
Quercus x trabutii	.	.	.	.	+	.	+	.	.	.
Characteristics of *Quercetalia pubescentis*										
Sorbus aria	2	3	+	.	1	.	3	2	.	3
Acer granatense	.	3	3	+	+	4	1	.	.	3
Characteristics of *Betulo pendulae-Populetalia tremulae*										
Salix caprea	.	.	.	.	.	1	.	1	.	.
Sorbus aucuparia	.	.	.	+	+	.	.	.	.	.
Betula fontqueri	+	.	.	.	.	.	.	.	.	.
Companions of *Querco-Fagetea*										
Berberis hispanica	3	2	+	+	2	1	2	.	+	3
Helleborus foetidus	.	1	+	+	+	2	.	1	+	1
Taxus baccata	1	1	.	+	.	.	.	.	.	.
Polygonatum odoratum	.	.	.	+	.	.	.	.	.	.
Companions of *Prunetalia spinosae*										
Crataegus granatensis	+	.	+	1	+	1	.	+	1	2
Lonicera arborea	2	.	+	+	+	.	1	.	+	3
Rhamnus cathartica	.	1	1	3	.	.	.	.	+	.
Rosa corymbifera	.	+	1	+	.	.	1	.	.	.
Rubus canescens	.	.	.	.	.	.	.	+	+	.
Rosa dumalis	.	.	.	.	+	.	+	1	.	.
Rubus ulmifolius	.	.	+	+	.	.	.	.	1	+
Cotoneaster granatense	.	.	+	+	.	.	.	.	.	.
Rosa villosa	.	.	.	.	.	.	.	.	.	2
Rosa sicula	2	.	.	.	.	.	.	.	.	.
Pyrus cordata	.	.	.	.	.	1	.	.	.	.
Malus sylvestris	.	.	.	1	.	.	.	.	.	.
Lonicera periclymenum subsp. *hispanica*	.	.	.	.	.	.	.	.	+	.
Geranium divaricatum	.	.	.	.	.	.	+	.	.	.
Ribes uva-crispa	+	.	.	.	.	.	.	.	.	.
Companions										
Alliaria petiolata	1	2	.	.	1	+	1	3	.	1
Lapsana communis	+	1	.	+	+	+	.	+	.	.
Cystopteris fragilis	.	+	.	.	+	+	+	+	.	.
Urtica dioica	+	2	.	.	.	.	.	2	.	1
Silene latifolia	.	.	.	.	.	+	+	+	.	+
Galium aparine	.	.	.	.	1	2	1	.	.	.
Paeonia coriacea	.	.	.	2	.	.	+	+	.	.
Bunium macuca	.	.	.	.	1	+	+	.	.	

Relevé	1	2	3	4	5	6	7	8	9	10
Geum urbanum	.	.	.	+	.	1	.	+	.	.
Vicia benghalensis	.	.	.	.	.	+	+	+	.	.
Cynosurus echinatus	.	.	.	.	3	.	3	.	.	.
Bromus sterilis	.	.	.	.	.	2	1	.	.	.
Adenocarpus decorticans	.	.	1	+	.	.	.	.	.	.
Digitalis purpurea subsp. *purpurea*	.	+	.	.	.	.	.	1	.	.
Festuca patula	.	.	.	.	.	.	+	1	.	.
Myrrhoides nodosa	.	.	.	.	.	+	.	1	.	.
Cotta triumfetti	.	.	+	+	.	.	.	.	.	.
Doronicum plantagineum	.	.	.	.	.	+	.	+	.	.
Elymus hispanicus	.	+	.	+	.	.	.	.	.	.
Silene vulgaris	.	.	.	+	+	.	.	.	.	
Aquilegia vulgaris subsp. *nevadensis*	.	+	.	.	.	.	.	.	.	+
Carex camposii	.	+	.	.	.	.	.	.	.	+
Cytisus reverchonii	.	.	+	.	.	.	.	+	.	.
Vicia cracca	.	.	+	+	.	.	.	.	.	.
Homalotheciom meridionale	.	.	.	.	x	x	.	x	.	.
Dactylis hispanica subsp. *hispanica*	+	.	.	.	.	.	.	.	.	+
Lewinskya rupestris	.	.	.	.	x	.	.	x	.	.
Syntrichia ruralis	.	.	.	.	x	.	.	x	.	.
Arum cylindraceum	.	.	.	.	.	.	.	+	.	.
Calepina irregularis	.	.	.	.	+	.	.	.	.	.
Campanula rapunculus	.	.	.	.	.	.	.	+	.	.
Clematis flammula	.	.	.	+	.	.	.	.	.	.
Clinopodium vulgare	.	.	.	+	.	.	.	.	.	.
Delphinium pentagynum	.	.	.	+	.	.	.	.	.	.
Festuca capillifolia	.	.	.	.	.	.	.	.	1	.
Geum heterocarpum	+	.	.	.	.	.	.	.	.	.
Geranium lucidum	.	.	.	.	.	+	.	.	.	.
Hypericum perforatum	.	.	.	+	.	.	.	.	.	.
Lonicera etrusca	.	.	.	.	.	.	.	.	+	.
Marrubium supinum	.	.	.	.	.	.	+	.	.	.
Potentilla hirta	.	.	.	.	.	.	.	.	.	+
Pteridium aquilinum	.	.	.	+	.	.	.	.	.	.
Pyrus cordata	.	.	.	.	.	1	.	.	.	.
Ranunculus monspeliacus	.	.	.	.	.	+	.	.	.	.
Salix atrocinerea	.	.	.	.	.	.	.	.	+	.
Saxifraga carpetana	.	.	.	.	+	.	.	.	.	.
Scrophularia lyrata	.	.	.	.	.	.	.	1	.	.
Trifolium ochroleucon	.	.	.	.	.	+	.	.	.	.
Trifolium pratense	.	.	.	.	.	+	.	.	.	.
Verbascum nevadense	.	.	.	.	.	.	.	+	.	.
Orthotrichum lyelii	.	.	.	.	.	x	.	.	.	.
Pterigynandrum filiforme	.	.	.	.	.	x	.	.	.	.
Orthotrichum affine	.	.	.	.	.	x	.	.	.	.

Localities:
1. Granada. Lugros. Dehesa del Camarate. Cercanías al Tentadero. 30S 476359/4114282.
2. Granada. Lugros. Dehesa del Camarate.Arroyo de las Rozas. 30S475658/4113791.
3 and **4.** Granada. Lugros. Dehesa del Camarate. Horcajo de Camarate. 30S477724/4115971.
5. Granada. Lugros. Dehesa del Camarate. Por debajo del Tentadero. 30S476384/4114341.
6. Granada. Lugros. Dehesa del Camarate. Cuenca alta arroyo de las Rozas. 30S476406/4114378.
7. Granada. Lugros. Dehesa del Camarate. Ladera bajo Puntal de la Cunilla. 30S476229/4114634.
8. Granada. Lugros. Dehesa del Camarate. Bosque mixto de la cascada. 30S476401/4114757.
9. Granada. Lugros. Dehesa del Camarate. Arroyo del Espino. 30S478422/4115337.
10. Granada. Lugros. Dehesa del Camarate. Bosque mixto de la Reserva Alta. 30S476424/4113305.

Table 10: Synthetic table of *Poo nemoralis-Prunetum avium* ass. nova, *Adenocarpo decorticanti-Quercetum pyrenaicae* Martínez-Parras & Molero-Mesa 1982 *aceretosum granatensis* Martínez-Parras & Molero-Mesa 1982 and *Aceri granatensis-Fraxinetum angustifoliae* Molero & Pérez Raya in J. M. Losa, Molero, Casares & Pérez Raya 1986.
Tabela 10: Sintetska tabela *Poo nemoralis-Prunetum avium* ass. nova, *Adenocarpo decorticanti-Quercetum pyrenaicae* Martínez-Parras & Molero-Mesa 1982 *aceretosum granatensis* Martínez-Parras & Molero-Mesa 1982 in *Aceri granatensis-Fraxinetum angustifoliae* Molero & Pérez Raya in J. M. Losa, Molero, Casares & Pérez Raya 1986.

Group nº	1	2	3
Nº relevés	10	5	5
Characteristics of *Fagetalia*			
Prunus avium	**IV**	II	.
Fraxinus excelsior	**I**	.	.
Moehringia trinervia	**I**	.	.
Epilobium montanum	**I**	.	.
Characteristics of *Quercetalia roboris*			
Quercus pyrenaica	I	V	III
Quercus x trabutii	I	.	.
Characteristics of *Quercetalia pubescentis*			
Sorbus aria	IV	**III**	.
Acer granatensis	IV	**V**	III
Acer monspessulanum	.	**.**	III
Sorbus torminalis	.	**II**	I
Quercus faginea	.	**.**	I
Characteristics of *Betulo pendulae-Populetalia tremulae*			
Salix caprea	I	I	I
Sorbus aucuparia	I	.	.
Betula fontqueri	I	.	.
Characteristics of *Querco-Fagetea*			
Poa nemoralis	III	.	.
Helleborus foetidus	IV	I	.
Taxus baccata	II	.	.
Hedera helix	.	.	III
Tamus communis	.	.	IV
Luzula forsteri	.	I	.
Polygonatum odoratum	I	I	.
Characteristics of *Populetalia albae*			
Fraxinus angustifolia	.	.	**V**
Salix atrocinerea	.	.	**IV**
Malus sylvestris	I	.	**I**
Arum cylindraceum	I	.	.
Characteristics of *Salicetalia purpurea*			
Salix alba	.	.	I
Salix fragilis	.	.	I
Characteristics of *Salici purpureae-Populetea nigrae*			
Brachypodium sylvaticum	.	.	V
Characteristics of *Rhamno-Prunetea*			
Berberis hispanica	V	II	.
Crataegus granatensis	IV	.	.
Crataegus laciniata	.	.	III
Crataegus monogyna	.	IV	II
Lonicera arborea	IV	IV	II
Rhamnus cathartica	II	.	.
Rosa corymbifera	II	.	.
Rubus canescens	II	.	.
Rosa dumalis	II	.	.
Rubus ulmifolius	II	.	V
Cotoneaster granatense	I	.	.
Rosa villosa	I	.	.
Rosa sicula	I	.	.
Pyrus cordata	I	.	.
Lonicera periclymenum subsp. *hispanica*	I	.	.
Geranium divaricatum	I	.	.
Ribes uva-crispa	I	.	.
Companions			
Alliaria petiolata	IV	I	.
Lapsana communis	III	III	.
Cystopteris fragilis	III	I	.
Urtica dioica	II	.	.
Silene latifolia	II	.	.
Bryonia cretica subsp. *dioica*	.	.	III
Delphinium nevadense	.	.	III
Galium aparine	II	.	.
Paeonia coriacea	II	II	.
Bunium macuca	II	.	.
Geum urbanum	II	.	.
Ruscus aculeatus	.	.	III
Vicia benghalensis	II	.	.
Cynosurus echinatus	II	.	.
Bromus sterilis	II	.	.
Adenocarpus decorticans	I	IV	I
Digitalis purpurea subsp. *purpurea*	I	I	.
Festuca patula	I	.	.
Myrrhoides nodosa	I	V	III
Euphorbia characias	I	.	III
Campanula rapunculus	I	V	III
Cotta triumfetti	I	.	.
Doronicum plantagineum	I	IV	.
Elymus hispanicus	I	.	.
Silene vulgaris	I	.	.
Aquilegia vulgaris subsp. *nevadensis*	I	.	.
Carex camposii	I	.	.
Cytisus reverchonii	I	.	.
Vicia cracca	I	IV	.
Homalotheciom meridionale	II	.	.
Dactylis hispanica subsp. *hispanica*	I	.	.
Smyrnium perfoliatum	.	I	II

Group nº	1	2	3
Nº relevés	10	5	5
Lewinskya rupestris	I	.	.
Syntrichia ruralis	I	.	.
Origanum virens	.	.	I
Calepina irregularis	I	.	.
Clematis flammula	I	.	.
Clinopodium vulgare	I	IV	I
Delphinium pentagynum	I	.	.
Festuca capillifolia	I	.	.
Geum heterocarpum	I	.	.
Geranium lucidum	I	.	.
Hypericum perforatum	I	.	.
Lonicera etrusca	I	.	.
Marrubium supinum	I	.	.
Potentilla hirta	I	.	.
Pteridium aquilinum	I	.	.
Ranunculus monspeliacus	I	.	.
Saxifraga carpetana	I	.	.
Scrophularia lyrata	I	.	.
Trifolium ochroleucon	I	III	.
Trifolium pratense	I	.	.
Verbascum nevadense	I	.	.
Orthotrichum lyelii	I	.	.
Pterigynandrum filiforme	I	.	.
Orthotrichum affine	I	.	.

Source of the relevés:

1. *Poo nemoralis-Prunetum avii* ass. nova

2. *Adenocarpo decorticanti-Quercetum pyrenaicae* Martínez-Parras & Molero 1982 *aceretosum granatensis* Martínez-Parras & Molero-Mesa 1982

3. *Aceri granatensis-Fraxinetum angustifoliae* Molero & Pérez Raya in J. M. Losa, Molero, Casares & Pérez Raya 1986

Community of *Fraxinus excelsior* (Table 11)

Diagnosis: woody mesophilic and edaphohygrophilous winter deciduous community, dominated mainly by ash trees (*Fraxinus excelsior*, *Fraxinus angustifolia* and their hybrid *F. excelsior* x *angustifolia*), occasionally accompanied by wild cherry trees (*Prunus avium*) or willows (*Salix atrocinerea*). *Rubus ulmifolius* is abundant in the thorny fringe, *Rubus canescens* and *Rhamnus cathartica* may be present, as well as *Berberis hispanica*. The herbaceous layer contains very rare and scarce nemoral species in Sierra Nevada. Characteristic species of *Fagetalia* such as *Moehringia trinervia* are concentrated in small, well-preserved areas and, where ferns such as *Athyrium filix-foemina* are also frequent. This habitat is always found in the vicinity of permanent watercourses in very localised areas of protected and shady valley bottoms, on fluvisols, soils close to neutral pH in the supramediterranean subhumid thermotype of the Nevadense sector. This community could be derived by altitude and more mesic conditions from the *Aceri granatensis-Fraxinetum angustifoliae* Molero & Pérez-Raya in J. M. Losa, Molero, Casares & Pérez-Raya 1986.

Table 11: Community of *Fraxinus excelsior*.
Tabela 11: Združba z vrsto *Fraxinus excelsior*.

Relevé	1
Slope face	W
Slope (º)	5
Area (m²)	200
Lithology	Micaesqcuar
Altitude (m)	1436
Vegetation height (m)	25
Cover (%)	100
Characteristics of *Fagetalia*	
Fraxinus excelsior	5
Fraxinus excelsior x angustifolia	1
Prunus avium	+
Moehringia trinervia	+
Athyrium filix–foemina	+
Characteristics of *Querco-Fagetea*	
Helleborus foetidus	+
Characteristics of *Populetea alba*	
Salix atrocinerea	+
Characteristics of *Prunetalia spinosae*	
Rubus ulmifolius	3
Rhamnus cathartica	+
Berberis hispanica	+
Rubus canescens	+
Characteristics of upper syntaxonomical units	
Alliaria petiolata	2
Urtica dioica	2
Sambucus ebulus	1
Anthriscus sylvestris	+
Galium aparine	+
Lapsana communis	+
Arctium minus	+
Companions	
Angelica major	+
Geranium lucidum	3
Peucedanum hispanicum	+
Sonchus oleraceus	+
Saxifraga granulata	+
Torilis arvensis	+

Localities:

1. Granada. Lugros. Dehesa del Camarate. Horcajo de Camarate. Arroyo Alhama de Lugros. 30S477737/4115968.

Syntaxonomical scheme

The syntaxonomical scheme presents the complete catalogue of vegetation types of the studied area and the novelties that are underlined (associations, subassociations, communities, and, where suitable, variants). A short description of the syntaxa with physiognomic and ecological data, and synchorology is provided. Associations that were identified for the first time in this work in the studied area are marked with in bold and underlined. The code for habitats of community interest listed in the Annex I of Directive 92/43/EEC is indicated in bold in brackets following the syntaxon name.

I. Amphibious vegetation of freshwaters, springs and fens

Ia. Vegetation of lakes, springs, fens and bogs

MONTIO-CARDAMINETEA Br.-Bl. & Tüxen ex Br.-Bl. 1948

Montio-Cardaminetalia Pawłowski in Pawłowski, Sokołowski & Wallisch 1928

Ranunculion omiophyllo-hederacei Rivas-Martínez, Fernández-González, Pizarro, Sánchez-Mata & Sardinero 2002

1. *Montio fontanae-Ranunculetum omiophylli* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana ass. nova **(3110_0)** [Hidrophytic vegetation of cold oligotrofic water]

Myosotidion stoloniferae Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984

2. Community of ***Cratoneuron commutatum*** and ***Anagallis tenella*** [Oligotrophic cormophytic bryophytic community of waterlogged or water-splashed rock-covered areas.]

PHRAGMITO-MAGNOCARICETEA Klika in Klika & Novák 1941

Nasturtio-Glycerietalia Pignatti 1954

Glycerio-Sparganion Br.-Bl. & Sissingh in Boer 1942

Glycerienion fluitantis (Géhu & Géhu-Franck 1987) Molina 1996

3. *Glycerio declinatae-Eleocharidetum palustris* Rivas-Martínez & Costa in Rivas-Martínez, Costa, Castroviejo & Valdés 1980 [Vegetation consisting of small helophytes in oligotrophic waters.]

Nasturtion officinalis Géhu & Géhu-Franck 1987

4. *Glycerio declinatae-Apietum nodiflori* Molina 1996 [Association of crassiphilous helophytes of oligotrophic fresh waters with little source]

Magnocaricetalia Pignatti 1954

Caricion broterianae (Rivas-Martínez, Fernández-González & Sánchez-Mata 1986) Molina 1996

5. *Caricetum camposii-cuprinae* Salazar, Lorite, Cano & F. Valle in Salazar, Lorite, A. García, J. Torres, Cano & F. Valle 2001 [Association dominated by caespitose hemicryptophytes of considerable size occupying the centre of streams and rivers]

SCHEUCHZERIO PALUSTRIS-CARICETEA NIGRAE Tüxen 1937

Caricetalia nigrae Koch 1926

Caricion nigrae Koch 1926

6. *Ranunculo alismoidis-Caricetum intricatae* Martínez-Parras, Peinado & Alcaraz 1987 [Hygro-turbated grassland with permanent hydromorphic soils and standing waters]

– *caricetosum intricatae*

II. Chasmophyte, epiphyte and scree vegetation

IIa. Chasmophyte vegetation of rock crevices

ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl. 1934) Oberdorfer 1977

Androsacetalia vandellii Br.-Bl. in Meier & Br.-Bl. 1934

Saxifragion nevadensis Rivas-Goday & Rivas-Martínez 1971

7. *Sarcocapnetum speciosae* J. Lorite 2001 [Outcropping siliceous rock crevice communities]

III. Synanthropic, fringe and megaphorbic vegetation

IIIa. Synanthropic vegetation

ARTEMISIETEA VULGARIS Lohmeyer, Preising & Tüxen ex von Rochow 1951

– *Onopordenea acanthii* Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 2002

Carthametalia lanati Brullo in Brullo & Marcenò 1985

Urtico piluliferae-Silybion mariani Sissingh ex Br.-Bl. & O. Bolòs 1958

8. Community of ***Silybum marianum*** and ***Carduus tenuiflorus*** sensu Aguiar 2000 [Thistle and tall grasses communities]

IIIb. Fringe and megaphorbic vegetation

GALIO-URTICETEA Passarge ex Kopecký 1969

Galio aparines-Alliarietalia petiolatae Görs & Müller 1969

Galio-Alliarion petiolatae Oberdorfer & Lohmeyer in Oberdorfer, Görs, Korneck, Lohmeyer, Müller, Philippi & Seibert 1967

9. *Myrrhoidi nodosae-Alliarietum petiolatae* Rivas-Martínez & Mayor ex Fuente 1986 **(6430)** [Megaphorbs in shady, humid and nitrogenous forest edge environments]

– ***nepetosum granatensis*** Salazar, Lorite, A. García, Torres, Cano & F. Valle 2001

Balloto-Conion maculati Brullo in Brullo & Marcenó 1985

10. *Heracleo granatensis-Urticetum dioicae* Ríos & Alcaraz in Ríos 1996 [Scionitrophilous megaphorbic riparian community with deep soils]

Calystegietalia sepium Tüxen ex Mucina 1993

Filipendulion ulmariae Segal 1966

11. *Aquilegio nevadensis-Ranunculetum granatensis* Martínez-Parras, Peinado & Alcaraz 1987 **(6430)** [Megaphorbs in shady, humid and nitrogenous forest edge environments]

12. *Ranunculo granatensis-Cochlearietum megalospermae* Salazar, Lorite, Cano & F. Valle 2001 [Megaphorbic dense grassland, growing on siliceous rocks and oligotrophic waters with strong currents]

MULGEDIO-ACONITETEA Hadač & Klika in Klika 1948

Adenostyletalia Br.-Bl. 1930

Cirsion flavispinae Quézel 1953

13. *Aconito nevadensis-Senecietum elodis* Quézel 1953 [Summer phenological megaphorbic communities in cool, organic-rich soils surrounding streams]

TRIFOLIO-GERANIETEA Müller 1962

Origanetalia vulgaris Müller 1962

Origanion virentis Rivas-Martínez & O. Bolòs in Rivas-Martínez, T. E. Díaz, F. Prieto, Loidi & Penas 1984

14. *Elymo hispanici-Brachypodietum sylvatici* Gómez-Mercado & F. Valle 1991 [Hemicryptophytic scyophyllous grassland of deciduous forests]

VI. Supratimberline climactical zonal vegetation on cryophilous geliturbated soils

VIa. West-mediterranean orophilous siliceous vegetation

FESTUCETEA INDIGESTAE Rivas Goday & Rivas-Martínez 1971

Festucetalia indigestae Rivas Goday & Rivas-Martínez in Rivas-Martínez 1964

Nevadension purpureae Quézel 1953

15. *Erigeronto frigidi-Festucetum clementei* Quézel 1953 **(6160)** [Mediterranean orophyllous grasslands]

16. *Sideritido glacialis-Arenarietum pungentis* Quézel 1953 **(6160)** [Mediterranean orophyllous cushion scrublands]

VII. Grassland and meadow vegetation

VIIb. Perennial xerophytic grassland

FESTUCO-BROMETEA Br.-Bl. & Tüxen ex Br.-Bl. 1949

Agrostietalia castellanae Rivas Goday in Rivas-Martínez, Costa, Castroviejo & E. Valdés 1980

Agrostion castellanae Rivas-Goday 1958 corr. Rivas-Goday & Rivas-Martínez 1963

17. *Euphrasio willkommii-Festucetum amplae* Martínez-Parras, Peinado & Alcaraz 1987 **(6510_1)** [Siliceous perennial grasslands]

POETEA BULBOSAE Rivas-Goday & Rivas-Martínez in Rivas-Martínez 1978

Poetalia bulbosae Rivas-Goday & Rivas-Martínez in Rivas-Goday & Ladero 1970

Periballio-Trifolion subterranei Rivas-Goday 1964

18. Community of ***Poa bulbosa*** (**6220_2**) [Mediterranean siliceous grazed grasslands of perennial and annual species]

VIIc. Meadow and chionophilous grassland vegetation

MOLINIO-ARRHENATHERETEA Tüxen 1937

Holoschoenetalia vulgaris Br.-Bl. ex Tchou 1948

Molinio-Holoschoenion vulgaris Br.-Bl. ex Tchou 1948

19. *Cirsio micranthi-Scirpetum holoschoeni* Lorite, Salazar, Cano & F. Valle in Salazar & al. 2001 [Brushy pastures]

NARDETEA STRICTAE Rivas Goday in Rivas Goday & Rivas-Martínez 1963

Campanulo herminii-Nardenalia Rivas-Martínez, Fernández-González & Sánchez-Mata 1986

Plantaginion nivalis Quézel 1953

20. *Nardo strictae-Festucetum ibericae* Quézel 1953 **(6230_1)** [High mountain siliceous meadows with moist soils all year round]

21. *Ranunculo acetosellifolii-Vaccinietum uliginosi* Quézel 1953 **(6230_1)** [Microland on stony soils with permanent summer humidity]

22. *Armerio splendentis-Agrostietum nevadensis* Quézel 1953 **(6230_1)**

– *agrostietosum nevadensis*

– *plantaginetosum nivalis* Martínez-Parras, Peinado & Alcaraz 1987 [High mountain siliceous grasslands with temporarily wet soils in summer]

VIII. Heathland, dwarf scrub and scrub vegetation

VIIIa. Heathland and dwarf scrub vegetation

CISTO-LAVANDULETEA Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

Lavanduletalia stoechadis Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

Cistion laurifolii Rivas-Goday in Rivas-Goday, Borja, Monasterio, Galiano & Rivas-Martínez 1956

23. *Halimio viscosi-Cistetum laurifolii* Martínez-Parras & Molero-Mesa 1982 **(4030_2)** [Semi-continental siliceous *Cistus laurifolius* shrublands]

VIIIb. Seral and mantle shrublands

CYTISETEA SCOPARIO-STRIATI Rivas-Martínez 1975

Cytisetalia scopario-striati Rivas-Martínez 1975

Adenocarpion decorticantis (Rivas-Martínez & F. Valle ex F. Valle 1985) Rivas-Martínez, Fernández-González & Loidi 1999

24. *Cytiso scoparii-Adenocarpetum decorticantis* Valle 1981 [Large sized broom on deep siliceous soils]

RHAMNO-PRUNETEA Rivas-Goday & Borja ex Tüxen 1962

Prunetalia spinosae Tüxen 1952

Pruno-Rubion ulmifolii O. Bolòs 1954

25. *Rubo ulmifolii-Rosetum corymbiferae* Rivas-Martínez & Arnáiz in Arnáiz 1979

– *rosetosum corymbiferae*

var. with ***Adenocarpus decorticans*** [Prickly scrubby with brooms]

Lonicero arboreae-Berberidion hispanicae O. Bolòs 1954

26. *Lonicero arboreae-Rhamnetum cathartici-cae* Martínez-Parras & Molero 1983 [Serial high thorny scrub of mixed deciduous forests]

27. *Lonicero arboreae-Crataegetum granatensis* Bolós 1954 nom. inv. propos in Cabezudo, B., Casimiro Soriguer-Solanas, C., García-Sánchez, J., & Pérez-Latorre, A. V. (2016) **(5110_1)** [Hawthorn and wet fringes]

– *loniceretosum arboreae*

– *ribetosum austroeuropaei* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova [Deciduous prickly scrubby on wet and shady soils]

IX. Forest, woodland, potential natural vegetation

IXa. Marshy, chionophilous, pioneer and climactic riparian shrublands and woodlands

SALICI PURPUREAE-POPULETEA NIGRAE (Rivas-Martínez & Cantó ex Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991) Rivas-Martínez, Fernández-González, Loidi, Lousa & Penas 2001

Populetalia albae Br.-Bl. ex Tchou 1948

Osmundo-Alnion (Br.-Bl., P. Silva & Rozeira 1956) Dierschke & Rivas-Martínez *in* Rivas-Martínez 1975

28. *Carici camposii-Salicetum atrocinereae* Salazar, Lorite, Cano & F. Valle *in* Salazar, Lorite, A. García, J. Torres, Cano & F. Valle 2001 **(92A0_2)** [Supramediterranean willows riparian forests]

– *salicetosum atrocinereae*

– *salicetosum capreae* Salazar, Lorite, Cano & F. Valle *in* Salazar, Lorite, A. García, J. Torres, Cano & F. Valle 2001

29. *Carici camposii-Alnetum glutinosae* (Salazar, Lorite, Cano & Valle in Salazar, Lorite, García-Fuentes, Torres, Cano & Valle 2001) Pérez-Latorre, Pavón-Núñez & Hidalgo-Triana 2011 [Supramediterranean alder riparian forests] (identified by the authors as an observation near the border of the studied area)

IXb. Eurosiberian and mediterranean climactic zonal and potential natural vegetation

JUNIPERO SABINAE-PINETEA SYLVESTRIS Rivas-Martínez 1965 nom. invers. propos. Mucina et al. 2016

Juniperetalia hemisphaericae Rivas-Martínez & J.A. Molina in Rivas-Martínez, Fernández-González & Loidi 1999

Genisto versicoloris-Juniperion hemisphaericae Rivas-Martínez & J.A. Molina in Rivas-Martínez, Fernández-González & Loidi 1999

30. *Genisto versicoloris-Juniperetum nanae* Quezel 1953 corr. Rivas-Martínez, Fernández-González & Loidi 1999 **(5120)** [High mountain juniper prostrate forest]

– *juniperetosum nanae*

– *rosetosum villosae* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana subass. nova [Mesophilic faciation of the high mountain juniper prostrate forest]

31. *Genisto versicoloris-Cytisetum nevadensis* Rivas-Martínez & Molero 2011**(5120)** [High mountain cushion siliceous shrublands]

QUERCETEA ILICIS Br.-Bl. ex A. & O. Bolòs 1950

Quercetalia ilicis Br.-Bl. ex Molinier 1934

Quercion broteroi Br.-Bl., P. Silva & Rozeira 1956 em. Rivas-Martínez 1975 corr. Ladero 1974

32. *Adenocarpo decorticantis-Quercetum rotundifoliae* Rivas-Martínez 1987 **(9340)** [Continental holm oak forests]

– *quercetosum rotundifoliae*

QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937

Quercetalia roboris Tüxen 1931

Quercion robori-pyrenaicae (Br.-Bl., P. Silva, Rozeira & Fontes 1950) Rivas-Martínez 1975

Quercenion pyrenaicae Rivas-Martínez 1975

33. *Adenocarpo decorticantis-Quercetum pyrenaicae* Martínez-Parras & Molero-Mesa 1982 **(9230)** [*Quercus pyrenaica* oak forests]

– *quercetosum pyrenaicae*

– *aceretosum granatensis* Martínez-Parras & Molero-Mesa 1982 [Mesophilic mixed oak forest]

Quercetalia pubescentis Klika 1933

Aceri granatensis-Quercion fagineae (Rivas-Goday, Rigual & Rivas-Martínez in Rivas-Goday, Borja, Esteve, Galiano, Rigual & Rivas-Martínez 1960) Rivas-Martínez 1987

34. *Poo nemoralis-Prunetum avium* Pavón-Núñez, Pérez-Latorre & Hidalgo-Triana ass. nova **(9180)** [Deciduous, mixed climatophilic and temporo-hygrophilic forests]

Fagetalia sylvaticae Pawłowski in Pawłowski, Sokołowski & Wallisch 1928

35. Community of ***Fraxinus excelsior*** **(91B0)** [Deciduous, riparian ash and hybrids mixed mesophilic forests]

Betulo pendulae-Populetalia tremulae Rivas-Martínez, Fernández-González, Loidi, Lousã & Penas 2001

Betulion fontqueri-celtibericae Rivas-Martínez & M. Costa in Rivas-Martínez et al. 2002

36. *Salici capreae-Betuletum fontqueri* Molero & Rivas-Martínez in Rivas-Martínez & al. 2002 **(92B0_2)** [Andalusian high mountain birch trees forests]

Zone-potential vegetation

The Table 12 summarises the potential of the climatophyllic vegetation zones and relates their ecological characteristics across the different cenotopes of the study area.

Table 12. Climatophyllic vegetation and its relationship with zone-potential and ecological aspects in the different cenotopes of the study area.
Tabela 12. Klimatofilna vegetacija in njen odnos do potenciala območja in ekoloških vidikov v različnih cenotopih proučevanega območja.

Lithology/cenotope	Edaphology	Thermotype	Ombrotype	Zonopotentiality
Slopes with high insolation	Luvisol / Cambisol	Meso-supramediterranean	Dry - Subhumid	Holm oak forest (*Quercus rotundifolia*)
Slopes with low insolation and deep soils	Luvisol	Supramediterranean	Subhumid	Pyrenean oak pure forest (*Quercus pyrenaica*)
Slopes with low insolation and deep soils	Luvisol	Supramediterranean	Subhumid-humid	Pyrenean oak mixed forest (*Quercus pyrenaica, Acer granatense*)
Shady ravines	Luvisol	Upper supra-lower oromediterranean	Subhumid-humid	Mixed deciduous forests (*Prunus avium, Poa nemoralis*)
Mountain streams	Fluvisol	Upper supra-lower oromediterranean	Subhumid-humid	Birch forest (*Betula fontqueri, Salix caprea*)
Riverbanks	Fluvisol	Supramediterranean	Subhumid	Willow forests (*Salix atrocinerea*)
Riverbanks	Luvisol	Supramediterranean	Subhumid	Mixed ash forests (*Fraxinus excelsior, Fraxinus angustifolia*)
High mountain areas with stony soils	Cambisol	Oromediterranean	Subhumid	Dwarf Juniperus scrub (*Juniperus nana, Juniperus sabina*)
Windy and blizzard areas	Cambisol	Upper oro-lower cryoromediterranean	Subhumid	Silicicolous geliturbate graminoid communities (*Festuca clementei, Festuca indigesta*)
Hygrophilous grassland	Gleysol	Oro-cryoromediterranean	Humid	Hygrophilous grassland communities (*Agrostis nevadensis*)
Hygrophilous grassland	Gleysol	Oro-cryoromediterranean	Humid	Hygrophilous boggy communities (*Nardus stricta, Festuca iberica*)
Hygrophilous grassland	Histosol	Oro-cryoromediterranean	Humid	Hygrophilous peaty communities (*Carex nigra, Pinguicula nevadensis, Sphagnum subnitens*)
Ponds and ditches	Argisol	Supra-oromediterranean	Subumid	Floating and helophytic vegetation (*Ranunculus omiophyllus*)
Siliceous rock walls	Litosol	Meso-supramediterranean	Subumid	Rock walls and overhangs (*Sarcocapnos speciosa*)

Altitudinal catenal distribution of vegetation in the study area

Figure 4 illustrates the altitudinal and slope-orientation-dependent (geosigmetum) distribution of the forests and climax vegetation in the study area.

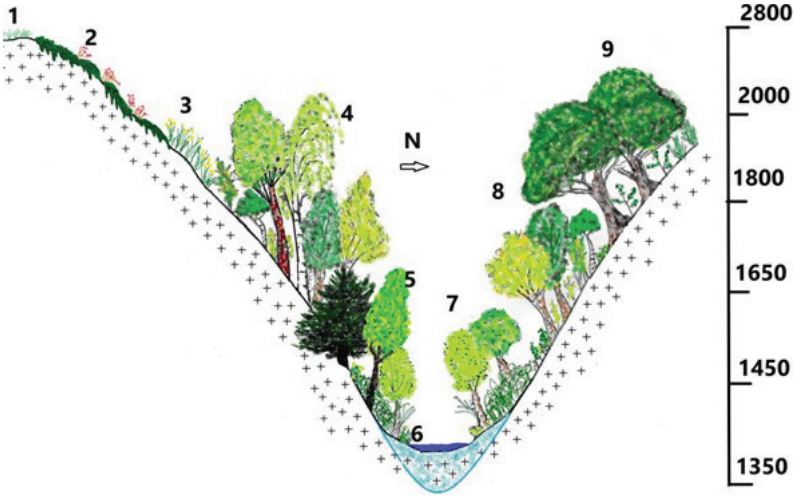

Figure 4: Geosigmetum of vegetation in the study area:
1 – Siliceous geliturbate graminoid communities (*Erigeronto frigidi-Festucetum clementei*); 2 – Juniper prostrate woodlands (*Genisto versicoloris-Juniperetum nanae*); 3 – Siliceous broom (*Genisto versicoloris-Cytisetum nevadensis*); 4 – Mixed deciduous climatophyllic forests (*Poo nemoralis-Prunetum avium* ass. nova); 5 – Mixed ash forests (Community of *Fraxinus excelsior*); 6 – Floating and helophytic vegetation (*Montio fontanae-Ranunculetum omiophylli* ass. nova); 7 – Willow forests (*Carici camposii-Salicetum atrocinereae*); 8 – Pyrenaic oak mixed forest (*Adenocarpo decorticantis-Quercetum pyrenaicae aceretosum granatensis*); 9 – Pyrenaic oak pure forest (*Adenocarpo decorticantis-Quercetum pyrenaicae quercetosum pyrenaicae*).

Slika 4: Geosigmetum vegetacije na območju raziskave: 1 – travišča na geliturbatni silikatni podlagi (*Erigeronto frigidi-Festucetum clementei*); 2 – brinovi gozdovi (*Genisto versicoloris-Juniperetum nanae*); 3 – sestoji reličnika na silikatu (*Genisto versicoloris-Cytisetum nevadensis*); 4 – mešani listopadni klimatofilni gozdovi (*Poo nemoralis-Prunetum avium* ass. nova); 5 – mešani jesenovi gozdovi (združba z vrsto *Fraxinus excelsior*); 6 – plavajoča in helofitska vegetacija (*Montio fontanae-Ranunculetum omiophylli* ass. nova); 7 – vrbovi gozdovi (*Carici camposii-Salicetum atrocinereae*); 8 – mešani gozd pirenejskega hrasta (*Adenocarpo decorticantis-Quercetum pyrenaicae aceretosum granatensis*); 9 – čisti gozd pirenejskega hrasta (*Adenocarpo decorticantis-Quercetum pyrenaicae quercetosum pyrenaicae*).

Conclusion

The study area on the northern slope of Sierra Nevada is an exceptional enclave for its relict flora and vegetation in an acceptable state of conservation, very scarce in the south of the Iberian Peninsula and western Europe (Losa-Quintana et al. 1986). Recent studies updating knowledge of its current plant communities (Lorite et al., 2003; Rivas-Martínez, 2007; Rivas-Martínez, 2011) and high floristic richness (Blanca et al., 2011; Lorite, 2016; Pavón-Núñez et al., 2020a) are a fundamental basis for carrying out conservation and management tasks.

We highlight the relevance of the phytocenological diversity of mixed deciduous forests with a high concentration of Eurosiberian species (*Poo nemoralis-Prunetum avium* ass. nova) from the only deciduous forest association documented for this biogeographic sector (Nevadensian Sector) until the present study, as the marcescent forests of *Quercus pyrenaica*. We also described a new hydrophytic association (*Montio fontanae-Ranunculetum omiophylli* ass. nova), two new Eurosiberian shrubland sub-associations (*Genisto versicoloris-Juniperetum nanae rosetosum villosae* subass. nova and *Lonicero arboreae-Crataegetum granatensis ribetosum austroeuropaei* subass. nova) and a new community of *Fraxinus excelsior*. We also highlight the floristic catalogue, including some taxa of very high ecological, chorological or paleobotanical value such as *Geranium sylvaticum*, *Arum cylindraceum*, *Geranium divaricatum*, *Pedicularis comosa*, *Ranunculus omiophyllus* and some very rare fern species in Sierra Nevada and the south of the Iberian Peninsula, including *Ophioglossum vulgatum* and *Botrychium lunaria*.

Author contributions

Conceptualisation, M.P.N., N.H.T. and A.V.P.L.; methodology, M.P.N., N.H.T. and A.V.P.L.; formal analysis, M.P.N. and N.H.T.; investigation, M.P.N., N.H.T. and A.V. P.L.; fragmentation analysis, M. P.N.; writing original draft preparation, M.P.N. and A.V.P.L.; writing review and editing, M.P.N., N.H.T. and A.V.P.L.; supervision, N.H.T. and A.V.P.L.; project administration, A.V.P.L. and N.H.T.; funding acquisition, A.V.P.L. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

All data supporting this study are included within the article and/or supporting materials.

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References

Arnaiz, C. (1979). Ecología y fitosociología de los zarzales y espinales madrileños comprendidos en los sectores Guadarrámico, Manchego y Celtibérico-Alcarreño. *Lazaroa*, *1*, 129–138

ANTHOS (2024). (Plant information system of Spain). Facilitated by the Royal Botanic Garden and Diversity Foundation. http://www.anthos.es/.Retrieved April 5, 2024.

Balsera-Medina, J. (1989). *Mapa de suelos de Andalucía*. CSIC-IARA. Madrid.

Bañares, Á., Blanca, G., Güemes, J., Moreno, J. C., & Ortiz, S. (Eds.) (2004). *Atlas y Libro Rojo de la Flora Vascular Amenazada de España*. Dirección General de Conservación de la Naturaleza.

Bañares, Á., Blanca, G., Güemes, J., Moreno, J. C., & Ortiz, S. (Eds.) (2010). *Atlas y Libro Rojo de la Flora Vascular Amenazada de España* (*Adenda 2010*). Dirección General de Medio Natural y Política Forestal (Ministerio de Medio Ambiente, y Medio Rural y Marino) – Sociedad Española de Biología de la Conservación de Plantas.

Blanca G., Cabezudo, B., Hernández-Bermejo, J. E., Herrera, C. M., Molero-Mesa, J., Muñoz J., & Valdés B. (1999). *Libro rojo de la flora silvestre amenazada de Andalucía*. (2 vols.) Consejería de Medio Ambiente, Junta de Andalucía.

Blanca, G., Cabezudo, B., Cueto, M., Morales-Torres C., & Salazar C. (eds.) (2011). *Flora Vascular de Andalucía Oriental* (2ª edición corregida y aumentada). Consejería de Medio Ambiente. Junta de Andalucía.

Blanca, G., López, M. R., Lorite, J., Martínez, M. J., Molero, J., Quintana, J., Ruiz, M., Varo, M. A., & Vidal, S. (2001). *Flora amenazada y endémica de Sierra Nevada*. Universidad de Granada, Consejería de Medio Ambiente de la Junta de Andalucía. Granada.

Blanca, G., & Algarra, J. A. (2011). Flora del Espacio natural de Sierra Nevada, In: Serra Laliga, L. (Ed.), *Jornadas Estatales de estudio y divulgacion dela flora de los Parques Nacionales y Naturales* (pp. 21–36).

Blanca, G., Cueto, M., & Romero, A. T. (2019). Rareza y endemicidad de la flora vascular de Sierra Nevada, In: Peñas, J. & Lorite, J. (Eds.) *Biología de la conservación de plantas en Sierra Nevada. Principios y retos para su preservación* (pp. 117–132). Editorial Universidad de Granada.

Braun-Blanquet, J. (1979). *Fitosociología*. Ed. Blume.

Braun-Blanquet, J., & Tuxen, R. (1952). *Irische Pflanzengesellschaften. Veröffentlichungen des Geobotanischen Instituts Rübel.*

Cabezudo, B., Talavera, S., Blanca, G., Salazar, C., Cueto, M., Valdés, B., & Navas, D. (2005). *Lista roja de la flora vascular de Andalucía*. Consejería de Medio Ambiente, Junta de Andalucía.

Cabezudo, B., Pérez-Latorre, A. V., Navas-Fernández, D., Gavira, Ó., & Caballero, G. (2005). Contribución al conocimiento de la flora del Parque Natural de las Sierras Tejeda, Almijara y Alhama (Málaga-Granada, España). *Acta Botanica Malacitana, 30*, 55–110. https://doi.org/10.24310/abm.v30i0.7184

Cabezudo, B., Pérez-Latorre, A. V., Casimiro-Soriguer Solanas, F., Pavón, M., & Hidalgo-Triana, N. (2011). Algunas plantas interesantes de Andalucía Oriental (Málaga-Granada), *Acta Botanica Malacitana, 36*, 213–217.

Castroviejo S. (Ed.), (1986–2021). *Flora iberica*. Real Jardín Botánico. CSIC.

Cueto, M., Fuentes, J., Giménez, E., Gutiérrez, L., Melendo, M., & Blanca, G. (2025). Catálogo actualizado y análisis de la Flora Vascular de Andalucía (Sur de España). *Acta Botanica Malacitana*, *50*, 21307. https://doi.org/10.24310/abm.50.2025.21307

De Pedraza Gilsanz, J. (1996). Geomorfología: Principios, Métodos y Aplicaciones. Editorial Rueda.

Decree 23/2012, of February 14, regulating the conservation and sustainable use of wild flora and fauna and their habitats [Decreto 23/2012, de 14 de febrero, por el que se regula la conservación y el uso sostenible de la flora y la fauna silvestres y sus hábitats]

DERA (Spatial Reference Data of Andalusia) (2019). Facilitated by Government of Andalusia. http://www.juntadeandalucia.es/instituto-deestadisticaycartografia./DERA/index.htm Retrieved February, 2019.

FAO. (2009). Guía para la descripción de suelos [Guide for soil description].

Fernández, S., Fuentes, N., Carrión, J. S., González-Sampériz, P., Montoya, E., Gil, G., Vega-Toscano, G., & Riquelme, J. A., (2006). The Holocene and Upper Pleistocene pollen sequence of Carihuela Cave, southern Spain. Séquence pollinique dans la Grotte de la Carihuela al'Holocene et dans le Pléistocene supérieur (sud-est de l'Espagne). *Geobios, 217*, 1–16. https://doi.org/10.1016/j.geobios.2006.01.004

Fernández-Calzado, M. R., & Molero-Mesa, J. (2011). The cartography of vegetation in the cryoromediterranean belt of Sierra Nevada: a tool for biodiversity conservation. *Lazaroa, 32*, 101–115.

Galán de Mera, A., Pérez-Latorre, A. V., & Vicente-Orellana, J. A. (2003). Relaciones fitogeográficas entre el suroccidente de la península Ibérica y el noroeste de África. Una propuesta de sectorización. *Lagascalia, 23*, 27–52.

GBIF (Global Biodiversity Information Facility) (2018). http://www.gbif.es/ Accessed from August 2018 to July 2023.

Gehú J. M., & Rivas-Martínez S. (1981). *Notions fondamentales de Phytosociologie. Syntaxonomie*. Berichte der Internationalen Symposien der Internationalen Vereinigung für Vegetationskunde. Kramer.

Guerra-Montes, J., Pérez-Latorre, A. V., Cano, M. J., Gallego, M. T., & Cabezudo, B. (2004). Ecological behaviour of *Sphagnum denticulatum* in the Thermo-Mediterranean belt of Southern Iberian Peninsula. *Nova Hedwigia, 78*. 165–178. https://doi.org/10.1127/0029-5035/2004/0078-0165

Guerra, J., Cano, M. J., & Ros, R. M. (eds). (2007–2018). *Flora Briofítica Ibérica*, vol. I-VI. Universidad de Murcia and Sociedad Española de Briología.

IGME (Geological and Mining Institute of Spain) (2020). www.igme.es/. Retrieved July 17, 2020.

Lorite, J. (2001). *Estudio Florístico y Fitosociológico de la Sierra Nevada Almeriense: Bases para la Gestión de las comunidades vegetales*. Tesis Doctoral. Departamento de Biología Vegetal. Universidad de Granada.

Lorite, J., Valle, F., & Salazar, C. (2003). Síntesis de la vegetación edafohigrófila del Parque Natural y Nacional de Sierra Nevada. *Monografías de la Flora y Vegetación Béticas, 13*, 47–110.

Lorite, J., Ruiz-Girela, M., & Donaire, F. (2005). Datos sobre flora endémica, rara o amenazada de Sierra Nevada (SE. España). *Acta Botanica Malacitana, 30*, 237–239

Lorite, J. (2016). An updated checklist of the vascular flora of Sierra Nevada (SE Spain). *Phytotaxa, 261*(1), 1–57. doi: http://dx.doi.org/10.11646/phytotaxa.261.1.1

Lorite, J., Ros-Candeira, A., Alcaraz-Segura, D., & Salazar-Mendías, C. (2020). *FloraSNevada: A trait database of the vascular flora of Sierra Nevada, southeast Spain*. *Ecology, 101*(9), e03091. https://doi.org/10.1002/ecy.3091

Losa-Quintana, J. M., Molero-Mesa J., & Casares, M. (1986). *El paisaje vegetal de Sierra Nevada: la cuenca alta del río Genil*. Secretariado de Publicaciones de la Universidad. Granada..

Manzano, S., Carrión, J. S., López-Merino, L., González-Sampériz, P., Munuera, M., Fernández, S., Martín-Lerma, I., & Gómez Ferreras, M. C. (2017). Mountain strongholds for woody angiosperms during the Late Pleistocene in SE Iberia. *Catena, 149*, 701–712. https://doi.org/10.1016/j.catena.2016.03.008

Marfil, J. M., Molero, J., Cantó, P., & Rivas-Martínez, S. (2016). Bioindicators and bioclimatic data as essential tools towards a consistent biogeographic district typology of Sierra Nevada National Park (Spain). *Lazaroa, 38*(1), 7–25. doi: http://dx.doi.org/10.5209/Lazaroa.47929

Martín, J. M., Braga, J. C., & Gómez-Pugnaire, M. T. (2008). *Itinerarios geológicos por Sierra Nevada. Guía de campo por el Parque Nacional y el Parque Natural de Sierra Nevada*. Consejería de Medio Ambiente, Junta de Andalucía.

Martín-Peinado, F. J., Jiménez-Morales, M. N. & Fernández-Ondoño, E. (2019). *Los suelos de Sierra Nevada, su relación con la litología y la vegetación*. En *Biología de la conservación de plantas en Sierra Nevada*, eds. Peñas & Lorite. Granada: Univ. de Granada.

Martínez-Parras, J. M. & Molero-Mesa, J. (1982). Ecología y fitosociología de *Quercus pyrenaica* Willd. en la provincia Bética. Los melojares béticos y sus etapas de sustitución. *Lazaroa, 4*, 91–104.

Martínez-Parras, J. M., Peinado, M., & Alcaraz, F. (1987). *Comunidades vegetales de Sierra Nevada (España)*. Servicio de Publicaciones de la Universidad de Alcalá.

Martínez-Parras, J. M., Peinado-Lorca, M., & Alcaraz-Ariza, F. (1985). Datos sobre la vegetación de Sierra Nevada. *Lazaroa, 7*, 515–533.

Médail, F., & Quézel, P. (1999). Biodiversity hotspots in the Mediterranean Basin: Setting global conservation priorities. *Conservation Biology*, *13*(6), 1510–1513. https://doi.org/10.1046/j.1523-1739.1999.98467.x

Molero-Mesa, J., Pérez-Raya F., & F. Valle. (1992). *Parque Natural de Sierra Nevada. Paisaje, Fauna, Flora e Itinerarios*. Ed. Rueda.

Molero-Mesa, J. & Marfil, J. M. (2017). Betic and Southwest Andalusia. In: J. Loidi (ed.). *The Vegetation of the Iberian Peninsula II, Plant and Vegetation*, vol 13, (pp. 143–247). Springer, Cham. doi: https://doi.org/10.1007/978-3-319-54867-8_4

Muñoz-Díaz, J. M. & Molero-Mesa, J. (2019). Conservación frente a un nuevo escenario en las comunidades vegetales y tendencias poblacionales. In: Peñas, J. & Lorite, J. (Eds.), *Biología de la Conservación de plantas en Sierra Nevada. Principios y retos para su preservación* (pp. 233–246). Editorial Universidad de Granada.

Pavón-Núñez, M. & Pérez-Latorre, A. V. (2010). Sobre las avellanedas subbéticas con *Ulmus glabra* Huds. en las sierras de Cazorla-Segura-Alcaraz, Jaén-Albacete (España). *Lagascalia, 30*, 393–405.

Pavón-Núñez, M., Pérez-Latorre, A. V., & Hidalgo-Triana, N. (2015). Novedades fitosociológicas y florísticas en el Parque Natural de Tejeda-Almijara y Alhama (Málaga-Granada, España). *Acta Botanica Malacitana, 40*, 199–205. https://doi.org/10.24310/abm.v40i0.2541

PavónNúñez, M., PérezLatorre, A. V., & Hidalgo-Triana, N. (2019). Flora amenazada y protegida del Parque Nacional de Sierra Nevada (GranadaAlmería, España): Bioindicadores de zonas de reserva. *Libro de Resúmenes – VII Congreso de la Sociedad Española de Biología de la Conservación de Plantas (SEBICOP)*. Granada.

Pavón-Núñez, M., Hidalgo-Triana, N., & Pérez-Latorre, A. V. (2020a). Novedades florísticas en la vertiente Norte de Sierra Nevada (Granada, España). *Acta Botanica Malacitana*, *45*, 165–172. https://doi.org/10.24310/abm.v45i.7393

Pavón-Núñez, M., Hidalgo-Triana, N., & Pérez-Latorre, A. V. (2020b). *Quercus* × *trabutii* HY en el sur de la península ibérica (Sierra Nevada, Granada). *Flora Montiberica, 76,* 130–132. https://doi.org/10.13140/RG.2.2.18871.06564

Peñas, J., Cañadas, E., & Del Río, J. (2019). Fitogeografía de Sierra Nevada e implicaciones sobre su conservación. In Peñas, J. & Lorite, J. (Eds.), *Biología de la Conservación de plantas en Sierra Nevada. Principios y retos para su preservación*. Editorial Universidad de Granada.

Peñas, J., & Lorite, J. (2023). *Biología de la Conservación de Plantas en Sierra Nevada. Principios y retos para su preservación*. Editorial Universidad de Granada.

Pérez-Latorre, A. V., Navas-Fernández, D., Gavira, O., Caballero, G., & Cabezudo, B. (2004). Vegetación del P. N. de las Sierra Tejeda, Almijara y Alhama. *Acta Botanica Malacitana, 29,* 117–190. https://doi.org/10.24310/abm.v29i0

Pérez-Latorre A. V., Caballero G., Casimiro-Soriguer F., Gavira O., & Cabezudo, B. (2008). Vegetación del sector Malacitano-Axarquiense (comarca de la Axarquía, Montes de Málaga). *Acta Botanica Malacitana, 33,* 215–270. https://doi.org/10.24310/abm.v33i0.6981

Pérez-Latorre, A. V., Pavón-Núñez, M., & Hidalgo-Triana, N. (2011). Sobre las alisedas nevadenses (Sierra Nevada, Granada-Almería, España). *Lagascalia, 31*, 161–174.

Pérez-Raya, F. A. (1987). *La vegetación en el sector malacitano-almijarense de Sierra Nevada (Investigaciones sintaxonómicas y sinfitosociológicas).* Tesis doctoral. Dep. Biología Vegetal. Universidad de Granada.

Prieto, P. (1975). Los bosques de Sierra Nevada. *Anales del Instituto Botánico Cavanilles, 32*(2), 1099–1129.

Quézel, P. (1953). Contributions à l'étude phytosociologique et geobotanique de la Sierra Nevada. *Memorias de la Sociedad Broteriana*, *IX*, 5–82

REDIAM (2020). *Guía de Identificación de Hábitats de Interés Comunitario de Andalucía*. Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible. Secretaría General de Medio Ambiente, Agua y Cambio Climático. Junta de Andalucía.

REDIAM (1996–2006). *Mapa de vegetación de los ecositemas forestal de Andalucía*. Consejería de Medio Ambiente y Ordenación del Territorio. Junta de Andalucía.

Regional Government of Andalusia. (2003). *Law 8/2003, of October 28, on wild flora and fauna* (BOJA No. 218, November 12, 2003, pp. 23790–23810). Ministry of the Environment, Andalusian Government. *(Original title: Ley 8/2003, de 28 de octubre, de la flora y la fauna silvestres)*

Rivas-Martínez, S. (1961). Los pisos de la vegetación de la Sierra Nevada. *Boletín de la Real Sociedad Española de Historia Natural. Sección Biológica, 59*, 55–64.

Rivas-Martínez, S. (1987). *Memoria del mapa de series de vegetación de España 1:400.000*. ICONA, Ministerio de Agricultura, Pesca y Alimentación..

Rivas-Martínez, S. Díaz, T. E., Fernández-González, F., Izco, J., Loidi, J., Lousa, M. & Penas, A. (2002). Vascular plant communities of Spain and Portugal, addenda to the syntaxonomical checklist of 2001. *Itinera Geobotanica*, *15*(1), 5–432.

Rivas-Martínez, S., Penas A., Asensi A., & Costa, M. (2003). *Atlas y Manual de los Hábitats de España*. Tragsa, Área de Medio Ambiente.

Rivas-Martínez, S. (2007). Memoria del mapa de vegetación potencial de España. *Itinera geobotanica, 17*, 1–433.

Rivas-Martínez S., Penas A., Díaz, T. E., Ladero, M., Asensi, A., Díez, B., Molero, J., Valle, F., Cano, E., Costa, M., López, M. L., Fernández, J. A., Llorens, L., Del Arco, M., Pérez, P. L., Wildpret, W., Sánchez, D., Fernández, F., Masalles, R., Ladero, M., Izco, J., Amigo, J., Loidi, J., Alcaraz, F., Del Rio, S., & Herrero, L. (2011a). Mapa de Series, Geoseries y Geopermaseries de Vegetación de España. Memoria del Mapa de Vegetación Potencial de España. Parte I. *Itinera geobotanica, 18*(1), 5–424.

Rivas-Martínez, S., Rivas-Sáenz, S., & Penas, A. (2011b). Worldwide bioclimatic classification system. *Global Geobotany, 1,* 1–638.

Rivas-Martínez, S., Penas, Á., del Río, S., Díaz González, T. E., & Rivas-Sáenz, S. (2017). Bioclimatology of the Iberian Peninsula and the Balearic Islands. In: Loidi, J. (eds) *The Vegetation of the Iberian Peninsula. Plant and Vegetation*, vol 12. Springer, Cham. 30–38 pp. doi: https://doi.org/10.1007/978-3-319-54784-8_2

Royal Decree 6 30/2013, of 2 August, regulating the Spanish Catalogue of Invasive Alien Species. *Boletín Oficial del Estado*, No. 185, 3 August 2013, pp. 56864–56890.

Ruiz-Girela, M., López-Onieva, M., Lorite, J., Montes, J., & Vidal, S. (2001). Bases para la recuperación del abedul, *Betula pendula* subsp., *fontqueri* (Roht.) G. Moreno & Peinado, en Sierra Nevada. III Congreso Forestal Español.

Salazar, C. (1996). *Estudio Fitosociológico de la Vegetación Riparia Andaluza (Provincia Bética): Cuenca del Guadiana Menor*. Tesis Doct. Departamento de biología animal, vegetal y ecologia. Universidad de Jaén.

Salazar, C., García-Fuentes, A., & F. Valle. (2001a). Datos sobre la vegetación edafohigrófila del sector Malacitano-Almijarense (Málaga-Granada, sur de España). *Acta Botanica Malacitana, 26*, 111–141

Salazar, C., Lorite, J., Garcia-Fuentes, A., Torres, J. A., Cano, E., & Valle. F. (2001b). A Phytosociological study of the hygrophilous vegetation of Sierra Nevada (Southern Spain). *Studia Geobotanica, 21*, 17–32.

Salazar, C., & Valle, F. (2019). Las formaciones vegetales de Sierra Nevada y su conservación. In Peñas, J. y Lorite, J. (Eds.) *Biología de la Conservación de plantas en Sierra Nevada. Principios y retos para su preservación* (pp.211–232). Editorial Universidad de Granada.

Sánchez-Gómez, P., López-Espinosa, J. A., Vera, J. B., López-Romero, C. & Jiménez, J. F. (2005). Novedades corológicas para la flora vascular del sureste ibérico. *Anales de Biología. Facultad de Biología*, *27*, 127–132.

Sanz-Elorza, M., Dana-Sánchez, E. D., &. Sobrino-Vesperinas, E. (eds.) (2004). *Atlas de las Plantas Alóctonas Invasoras en España*. Dirección General para la Biodiversidad.

Schuhwerk, F. (1990). Relikte und Endemiten in Pflanzen gesellschaften Bayerns – einevorlaufige Ubersicht. *Berichte der Bayerischen Botanischen Gesellschaft, 61*, 303–323.

SIVIM (Iberian and Macaronesian Vegetation Information System) (2022). http://www.sivim.info/sivi/. Retrieved May 28, 2022.

Theurillat, J. P., Willner, W., Fernández-González, F., Bültmann, K., Čarni, A., Gigante, D., Mucina, L., & Weber, H. E. (2021). International Code of Phytosociological Nomenclature. 4th edition. *Applied Vegetation Science, 24,* e12491, 1–62. https://doi.org/10.1111/avsc.12491

Thiers, B. M. (updated continuously). *Index Herbariorum.* https://sweetgum.nybg.org/science/

Valdés, B., Talavera, S., & Galiano, E. F. (eds.) (1987). *Flora vascular de Andalucía Occidental*. Ed. Ketres.

Valle, F., Gómez-Mercado, F., & Mota, J. F. (1988). Los robledales de la Sierra de Segura y otras comunidades relacionadas con ellos. *Anales del Jardín Botánico de Madrid, 45*(1), 247–257.

Varo, J. & Salvo, A. E. (1982). Ensayo biogeográfico sobre la pteridoflora de Sierra Nevada (Granada, España). *Acta Botanica Malacitana, 7*, 203–210.

Weber, H. E., Moravec J., & Theurillat, J. P. (2000). International Code of Phytosociological Nomenclature. *Journal of Vegetation Science, 11*, 738–739.

Appendix

Floristic list of the study area

The following symbols were used:
◆ Endemic of the natural area of Nevada following Blanca et al. (2011)
● Threatened. Data from Cabezudo et al. (2005).
▲ Species from relevés and which do not have an MGC herbarium sheet.
■ Alien plant. Data from Spanish Legislation Royal Decree 630/2013 and Sanz-Elorza et al. 2004.
△ Species found in databases and not confirmed by our collections.

Table 13: List of taxa with their status ofendemicity,degree of threat, protection, exotic nature, source of relevés or databases.
Tabela 13: Seznam taksonov z njihovim statusom endemičnosti, stopnjo ogroženosti, zaščito, eksotičnostjo,virom podatkovnih baz.

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
BRYOPHYTA							
Aulacomnium palustre Schwaegrichen	*Bryaceae*						
Brachythecium rivulare Schimp.	*Bryaceae*						
Bryum caespiticium Hedw.	*Bryaceae*						
Fontinalis antipyretica Hedw.	*Bryaceae*						
Homalotheciom meridionale (M.Fleisch. & Warnst.) Hedenäs	*Bryaceae*						
Lewinskya rupestris (Schleich. ex Schwägr.) F. Lara, Garilleti & Goffinet	*Bryaceae*						
Orthotrichum affine Brid.	*Bryaceae*						
Orthotrichum lyelii (Hook. & Taylor) Plášek, Sawicki & Ochyra	*Bryaceae*						
Pellia epiphylla (L.) Corda	*Bryaceae*						
Philonotis caespitosa Jur.	*Bryaceae*						
Philonotis fontana (Hedw.) Brid.	*Bryaceae*						
Philonotis seriata Mitten	*Bryaceae*						
Polytrichum juniperinum Hedw.	*Bryaceae*						
Pterigynandrum filiforme Hedwig	*Bryaceae*						
Sphagnum auriculatum Schimp.	*Bryaceae*						
Sphagnum subnitens Russow & Warnst.	*Bryaceae*						
Syntrichia ruralis (Hedw.) F.Weber & D.Mohr	*Bryaceae*						
PTERIDOPHYTES							
▲ *Dryopteris affinis* (Lowe) Fraser–Jenkins subsp. *affinis*	*Aspidiaceae*					X	
Dryopteris affinis (Lowe) Fraser–Jenkins subsp. *borreri* (Newman) Fraser–Jenkins	*Aspidiaceae*						
● *Dryopteris filix–mas* (L.) Schott	*Aspidiaceae*		X				

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
△ *Asplenium trichomanes* L. subsp. *quadrivalens* D. E. Meyer	*Aspleniaceae*						X
Athyrium filix-foemina (L.) Roth	*Athyriaceae*						
Cystopteris dickieana R. Sim	*Athyriaceae*						
Cystopteris fragilis (L.) Bernh. subsp. *fragilis*	*Athyriaceae*						
Cystopteris viridula (Desv.) Desv.	*Athyriaceae*						
● *Botrychium lunaria* (L.) Swartz	*Botrychiaceae*		X				
Pteridium aquilinum (L.) Kuhn subsp. *aquilinum*	*Hypolepidaceae*						
● *Ophioglossum vulgatum* L.	*Ophioglossaceae*		X				
GYMNOSPERMS							
▲ *Juniperus communis* L. subsp. *alpina* (Suter) Čelak.	*Cupressaceae*					X	
Juniperus communis L. subsp. *hemisphaerica* (K. Presl) N	*Cupressaceae*						
Juniperus sabina L.	*Cupressaceae*						
● *Taxus baccata* L.	*Taxaceae*		X	X			
ANGIOSPERMS							
Acer opalus Mill. subsp. *granatense* (Boiss.) Font Quer & Rothm.	*Aceraceae*						
▲ *Angelica major* Lag.	*Apiaceae*					X	
Anthriscus sylvestris (L.) Hoffm.	*Apiaceae*						
▲ *Apium nodiflorum* (L.) Lag.	*Apiaceae*					X	
▲ *Bunium macuca* Boiss. subsp. *macuca*	*Apiaceae*					X	
Carum verticillatum (L.) W. D. J. Koch	*Apiaceae*						
Chaerophyllum hirsutum L.	*Apiaceae*						
Conopodium pyrenaeum (Loisel.) Miegev.	*Apiaceae*						
Eryngium bourgatii Gouan	*Apiaceae*						
▲ *Eryngium campestre* L.	*Apiaceae*					X	
Eryngium glaciale Boiss.	*Apiaceae*						
Heracleum sphondylium L. subsp. *granatense* (Boiss.) Briq.	*Apiaceae*						
△ *Hydrocotyle verticillata* Thunb.	*Apiaceae*						X
Ligusticum lucidum Mill. subsp. *lucidum*	*Apiaceae*						
▲ *Myrrhoides nodosa* (L.) Cannon	*Apiaceae*					X	
△ *Oenanthe crocata* L.	*Apiaceae*						X
Peucedanum hispanicum (Boiss.) Endl.	*Apiaceae*						
● *Prangos trifida* (Mill.) Herrnst. & Heyn	*Apiaceae*		X				
Tordylium maximum L.	*Apiaceae*						
▲ *Torilis arvensis* (Huds.) Link	*Apiaceae*						
Arum cylindraceum Gasp.	*Araceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Hedera helix L. subsp. *helix*	*Araliaceae*						
Aristolochia paucinervis Pomel	*Aristolochiaceae*						
Asphodelus macrocarpus Parl. subsp. *rubescens* Díaz Lifante & Valdés	*Asphodelaceae*						
● *Andryala agardhii* DC.	*Asteraceae*		X				
Andryala integrifolia L.	*Asteraceae*						
△ *Anthemis cotula* L.	*Asteraceae*						X
▲ *Anthemis pedunculata* Desf.	*Asteraceae*					X	
Anthriscus sylvestris (L.) Hoffm.	*Asteraceae*						
Artemisia absinthium L.	*Asteraceae*						
▲ *Artemisia campestris* L. subsp. *glutinosa* (Besser) Batt.	*Asteraceae*					X	
Arctium minus (Hill) Bernh	*Asteraceae*						
Carduus platypus subsp. *granatensis* (Willk.) Nyman.	*Asteraceae*						
Carduus tenuiflorus Curtis.	*Asteraceae*						
▲ *Carthamus lanatus* L.	*Asteraceae*					X	
Carlina corymbosa subsp. *hispanica* (Lam.) O. Bolòs & Vigo	*Asteraceae*						
Centaurea calcitrapa L.	*Asteraceae*						
Centaurea ornata Willd.	*Asteraceae*						
Centaurea solstitialis L. subsp. *solstitialis*	*Asteraceae*						
Cirsium acaulon (L.) Scop. subsp. *gregarium* (Boiss.ex DC) Talavera	*Asteraceae*						
Cirsium echinatum (Desf.) DC.	*Asteraceae*						
Cirsium odontolepis Boiss. ex DC.	*Asteraceae*						
Cirsium pyrenaicum (Jacq.) All.	*Asteraceae*						
Cota triumfettii (L.) J. Gay	*Asteraceae*						
Crepis oporinoides Boiss.	*Asteraceae*						
Doronicum plantagineum L.	*Asteraceae*						
Erigeron acer L.	*Asteraceae*						
Erigeron major (Boiss.) Vierh.	*Asteraceae*						
Filago pyramidata L.	*Asteraceae*						
▲ *Hyoseris radiata* L.	*Asteraceae*					X	
△ *Inula montana* L.	*Asteraceae*						X
Jurinea humilis (Desf.) DC.	*Asteraceae*						
Lactuca tenerrima Pourr.	*Asteraceae*						
Lapsana communis L. subsp. *communis*	*Asteraceae*						
Leontodon boryi DC.	*Asteraceae*			X			
Leontodon longirrostris (Finch & P. D. Sell) Talavera	*Asteraceae*						
Leucanthemopsis pectinata (L.) G. López & Ch. E. Jarvis	*Asteraceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Mantisalca salmantica (L.) Briq. & Cavill.	*Asteraceae*						
Onopordum acanthium subsp. *acanthium* L.	*Asteraceae*						
Pilosella argyrocoma (Fr.) F. W. Schultz & Sch. Bip.	*Asteraceae*						
Pilosella castellana (Boiss. & Reut.) F. W. Schultz & Sch. Bip.	*Asteraceae*						
▲ *Pilosella pseudopilosella* (Ten.) Soják	*Asteraceae*					X	
Rhagadiolus edulis Gaertn.	*Asteraceae*						
Santolina rosmarinifolia L. subsp. *canescens* (Lag.) Ny	*Asteraceae*						
◆● *Scorzoneroides microcephala* (Boiss.) Holub	*Asteraceae*	X	X	X			
◆ *Scorzoneroides nevadensis* (Lange) Greuter	*Asteraceae*	X					
Senecio duriaei J. Gay	*Asteraceae*						
Senecio jacobaea L.	*Asteraceae*						
Senecio pyrenaicus L. subsp. *granatensis* (Boiss.) Rivas Mart.	*Asteraceae*						
Silybum marianum (L.) Gaertn.	*Asteraceae*						
Solidago virgaurea L.	*Asteraceae*						
▲ *Sonchus oleraceus* L.	*Asteraceae*					X	
Tanacetum parthenium (L.) Sch. Bip.	*Asteraceae*						
Taraxacum laevigatum (Willd.) DC.	*Asteraceae*						
Taraxacum obovatum (Willd.) DC.	*Asteraceae*						
Berberis hispanica Boiss. & Reut.	*Berbericaceae*						
Alnus glutinosa (L.) Gaertn.	*Betulaceae*						
● *Betula pendula* Roth subsp. *fontqueri* (Rothm.) G. Moreno & Peinado	*Betulaceae*		X	X			
△ *Anchusa undulata* L. subsp. *granatensis* (Boiss.) Braun–Blanq. & Maire	*Boraginaceae*						X
Myosotis arvensis Hill subsp. *arvensis*	*Boraginaceae*						
Myosotis decumbens Host subsp. *teresiana* (Sennen) Grau	*Boraginaceae*						
Myosotis stricta Roemer & Schultes	*Boraginaceae*						
Alyssum granatense Boiss. & Reut.	*Brassicaceae*						
▲ *Alyssum minutum* DC.	*Brassicaceae*					X	
Alliaria petiolata (M. Bieb.) Cavara & Grande	*Brassicaceae*						
▲ *Arabis verna* (L.) R. Br.	*Brassicaceae*					X	
Biscutella valentina subsp. *valentina* (Loefl. ex L.) Heywood	*Brassicaceae*						
Calepina irregularis (Asso) Thell.	*Brassicaceae*						
Capsella bursa–pastoris (L.) Medik.	*Brassicaceae*						
Cardamine flexuosa With.	*Brassicaceae*						
Cardamine hirsuta L.	*Brassicaceae*						
Coincya monensis (L.) Greuter & Burdet subsp. *cheiranthos* (Vill.) Aedo, Leadlay & Muñoz Garm.	*Brassicaceae*						
Draba lutescens Coss.	*Brassicaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Erophila verna (L.) Chevall.	*Brassicaceae*						
Hormathophylla spinosa (L.) P. Küpfer	*Brassicaceae*						
Lepidium petrophilum Coss.	*Brassicaceae*						
Lepidium villarsii Gren. & Godr. subsp. *villarsii*	*Brassicaceae*						
Raphanus raphanistrum L. subsp. *raphanistrum*	*Brassicaceae*						
Sisymbrella aspera (L.) Spach. subsp. *aspera*	*Brassicaceae*						
Sisymbrium crassifolium Cav.	*Brassicaceae*						
Sisymbrium orientale L.	*Brassicaceae*						
Thlaspi arvense L.	*Brassicaceae*						
Thlaspi perfoliatum L.	*Brassicaceae*						
Callitriche stagnalis Scop.	*Callitrichaceae*						
Campanula herminii Hoffmanns. & Link	*Campanulaceae*						
Campanula lusitanica L.	*Campanulaceae*						
Campanula rapunculus L.	*Campanulaceae*						
Jasione montana L. subsp. *montana*	*Campanulaceae*						
Lonicera arborea Boiss.	*Caprifoliaceae*						
Lonicera etrusca G. Santi	*Caprifoliaceae*						
Lonicera periclymenum L. subsp. *hispanica* (Boiss. & Reut.) Nyman	*Caprifoliaceae*						
Sambucus ebulus L.	*Caprifoliaceae*						
Sambucus nigra L.	*Caprifoliaceae*						
Agrostemma githago L.	*Caryophyllaceae*						
Arenaria armerina Bory subsp. *armerina* var. *frigida*(Boiss.) Cuatrec.	*Caryophyllaceae*						
Arenaria grandiflora L. subsp. *grandiflora*	*Caryophyllaceae*						
Arenaria pungens Lag. subsp. *pungens*	*Caryophyllaceae*						
Arenaria tetraquetra L. subsp. *amabilis* (Bory) H. Lindb. fil.	*Caryophyllaceae*						
▲ *Cerastium alpinum* var. *nevadense* Pau	*Caryophyllaceae*					X	
Cerastium brachypetalum subsp. *brachypetalum* N.H.F. Desp. ex Pers.	*Caryophyllaceae*						
Cerastium fontanum Baumg. subsp. vulgare (Hartm.) Greuter & Burdet	*Caryophyllaceae*						
Cerastium gibraltaricum Boiss. var. *viridulum* (Pau) Font Quer	*Caryophyllaceae*						
Cerastium pumilum Curtis	*Caryophyllaceae*						
Cerastium ramosissimum Boiss.	*Caryophyllaceae*						
Dianthus brachyanthus Boiss.	*Caryophyllaceae*						
Minuartia dichotoma L.	*Caryophyllaceae*						
Moehringia pentandra J. Gay	*Caryophyllaceae*						
Moehringia trinervia (L.) Clairv.	*Caryophyllaceae*						
Paronychia argentea Lam.	*Caryophyllaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Petrorhagia dubia (Raf.) G. López & Romo	*Caryophyllaceae*						
Petrorhagia nanteuilii (Burnat) P. W. Ball & Heywood	*Caryophyllaceae*						
Sagina apetala Ard.	*Caryophyllaceae*						
Sagina procumbens L.	*Caryophyllaceae*						
Sagina saginoides (L.) H. Karst. subsp. *nevadensis* (Boiss. & Reut.) Greuter & Burdet	*Caryophyllaceae*						
Silene boryi Boiss.	*Caryophyllaceae*						
Silene latifolia Poir.	*Caryophyllaceae*						
Silene nutans L. subsp. *nutans*	*Caryophyllaceae*						
Silene rupestris L.	*Caryophyllaceae*						
Silene vulgaris (Moench) Garcke subsp. *vulgaris*	*Caryophyllaceae*						
Spergula morisonii Boreau	*Caryophyllaceae*						
Spergularia capillacea (Kindb.) Willk.	*Caryophyllaceae*						
Spergularia rubra (L.) J. Presl & C. Presl	*Caryophyllaceae*						
Spergularia segetalis (L.) G. Don fil.	*Caryophyllaceae*						
Stellaria alsine Grimm	*Caryophyllaceae*						
Stellaria media (L.) Vill.	*Caryophyllaceae*						
△ *Celtis australis* L.	*Celtidaceae*						X
Cistus laurifolius L.	*Cistaceae*						
Halimium umbellatum (L.) Spach subsp. *viscosum* (Willk.) O. Bolos & Vigo	*Cistaceae*						
Helianthemum apenninum (L.) Mill. subsp. *suffruticosum* (Boiss.) G. López	*Cistaceae*						
Hypericum perforatum L.	*Clusiaceae*						
Hypericum tetrapterum Fr.	*Clusiaceae*						
▲ *Hypericum undulatum* Willd.	*Clusiaceae*					X	
Colchicum triphyllum G. Kunze	*Colchicaceae*						
Merendera montana (Loefl. ex L.) Lange	*Colchicaceae*						
Cuscuta triumvirati Lange	*Convolvulaceae*						
Sedum acre L.	*Crassulaceae*						
Sedum album L.	*Crassulaceae*						
Sedum forsterianum Sm.	*Crassulaceae*						
Sedum villosum subsp. *villosum* L.	*Crassulaceae*						
Sedum rubens L.	*Crassulaceae*						
◆ *Sempervivum minutum* (Willk.) Pau	*Crassulaceae*	X					
● *Sempervivum tectorum* L.	*Crassulaceae*		X				
▲ *Umbilicus rupestris* (Salisb.) Dandy	*Crassulaceae*					X	
Bryonia dioica Jacq.	*Curcubitaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From databases
◆ *Carex camposii* Boiss. & Reut.	*Cyperaceae*	X		X			
△ *Carex divulsa* Stokes subsp. *divulsa*	*Cyperaceae*						X
▲ *Carex leporina* L.	*Cyperaceae*					X	
Carex muricata L. subsp. *pairae* (F. W. Schultz) Čelak	*Cyperaceae*						
◆ *Carex nevadensis* Boiss. & Reut.	*Cyperaceae*	X					
Carex nigra (L.) Reichard	*Cyperaceae*						
Isolepis setacea (L.) R. Br.	*Cyperaceae*						
Scabiosa turolensis Pau	*Dipsacaceae*						
◆ *Vaccinium uliginosum* L. var. *nana* Boiss.	*Ericaceae*	X					
Euphorbia flavicoma DC. subsp. *flavicoma*	*Euphorbiaceae*						
Adenocarpus decorticans Boiss.	*Fabaceae*						
Astragalus nevadensis Boiss. subsp. *nevadensis*	*Fabaceae*						
◆ *Cytisus galianoi* Talavera & Gibbs	*Fabaceae*	X					
Cytisus scoparius (L.) Link subsp. *reverchonii* (Degen & Hervier) Rivas Goday & Rivas Mart.	*Fabaceae*						
Erinacea anthyllis Link subsp. *anthyllis*	*Fabaceae*						
Genista umbellata (L'Hér.) Dum. Cours. subsp. *equisetiformis* (Spach) Rivas Goday & Rivas Mart.	*Fabaceae*						
◆ *Genista versicolor* Boiss.	*Fabaceae*	X					
Lathyrus pratensis L.	*Fabaceae*						
▲ *Lotus corniculatus* L. subsp. *carpetanus* (Lacaita) Rivas Mart.	*Fabaceae*					X	
◆ *Lotus corniculatus* subsp. *glacialis* (Boiss.) Valdés	*Fabaceae*	X					
Lotus pedunculatus Cav.	*Fabaceae*						
Pisum sativum L.	*Fabaceae*						
▲ *Trifolium angustifolium* L.	*Fabaceae*					X	
Trifolium campestre Schreb.	*Fabaceae*						
Trifolium fragiferum L.	*Fabaceae*						
▲ *Trifolium ochroleucon* Huds.	*Fabaceae*					X	
Trifolium pratense L. subsp. *pratense*	*Fabaceae*						
Trifolium repens L.	*Fabaceae*						
Trifolium repens subsp. *nevadense* (Boiss.) D. E. Coombe	*Fabaceae*						
Vicia dasycarpa Ten.	*Fabaceae*						
▲ *Vicia benghalensis* L.	*Fabaceae*					X	
▲ *Vicia cracca* subsp. *incana* (Gouan) Rouy	*Fabaceae*					X	
Vicia onobrychioides L.	*Fabaceae*						
Vicia tenuifolia Roth	*Fabaceae*						
Quercus pyrenaica Willd.	*Fagaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Quercus rotundifolia Lam.	*Fagaceae*						
Quercus x *trabutii* Hy	*Fagaceae*						
● *Gentiana alpina* Vill.	*Gentianaceae*		X				
● *Gentiana boryi* Boiss.	*Gentianaceae*		X	X			
◆● *Gentiana pneumonanthe* L. subsp. *depressa* (Boiss.) Malag.	*Gentianaceae*	X	X				
◆● *Gentiana sierrae* Briq.	*Gentianaceae*	X	X	X			
Geranium lucidum L.	*Geraniaceae*						
Geranium rotundifolium L.	*Geraniaceae*						
Geranium robertianum L.	*Geraniaceae*						
Geranium divaricatum Ehrh.	*Geraniaceae*						
Geranium sylvaticum L. subsp. *sylvaticum*	*Geraniaceae*						
Erodium cheilanthifolium Boiss.	*Geraniaceae*						
Erodium cicutarium (L.) L'Her.	*Geraniaceae*						
●*Ribes uva–crispa* L. subsp. *austro–europaeum* (Bornm.) Bech.	*Grossulariaceae*		X				
Muscari comosum (L.) Mill.	*Hyacithaceae*						
Crocus nevadensis Amo	*Iridaceae*						
△ *Crocus serotinus* Salisb. subsp. *salzmannii* (J. Gay) Mathew	*Iridaceae*						X
Gagea lacaitae A. Terracc.	*Iridaceae*						
Gagea reverchonii Degen	*Iridaceae*						
Juncus alpino-articulatus Chaix subsp. *alpino-articulatus*	*Juncaceae*						
Juncus articulatus L. subsp. *articulatus*	*Juncaceae*						
Juncus bufonius L.	*Juncaceae*						
Juncus capitatus Weigel	*Juncaceae*						
▲ *Juncus inflexus* L. subsp. *inflexus*	*Juncaceae*					X	
Juncus tenageia L. fil.	*Juncaceae*						
Luzula campestris (L.) DC.	*Juncaceae*						
Juglans regia L.	*Junglandaceae*						
Acinos alpinus (L.) Moench	*Lamiaceae*						
Clinopodium vulgare L.	*Lamiaceae*						
Lamium amplexicaule L.	*Lamiaceae*						
▲ *Marrubium supinum* L.	*Lamiaceae*					X	
▲ *Mentha aquatica* L.	*Lamiaceae*					X	
Mentha longifolia (L.) Huds.	*Lamiaceae*						
▲ *Mentha pulegium* L.	*Lamiaceae*					X	
▲ *Mentha suaveolens* Ehrh.	*Lamiaceae*					X	

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Nepeta granatensis Boiss.	*Lamiaceae*						
Prunella vulgaris L.	*Lamiaceae*						
Sideritis glacialis Boiss.	*Lamiaceae*						
◆▲ *Teucrium aureum* Schreb. subsp. *angustifolium* (Willk.) Valdés Berm. & Sánchez Crespo	*Lamiaceae*					X	
Teucrium similatum T. Navarro & Rosúa	*Lamiaceae*						
Thymus mastichina (L.) L. subsp. *mastichina*	*Lamiaceae*						
Thymus serpylloides Bory subsp. *gadorensis* (Pau) Jalas	*Lamiaceae*						
◆▲ *Thymus serpylloides* Bory subsp. *serpylloides*	*Lamiaceae*	X				X	
▲ *Thymus zygis* L. subsp. *gracilis* (Boiss.) R. Morales	*Lamiaceae*					X	
◆● *Pinguicula nevadensis* (H. Lindb.) Casper	*Lentibulariaceae*	X	X	X			
Malva neglecta Wallr.	*Malvaceae*						
Fraxinus angustifolia Vahl.	*Oleaceae*						
Fraxinus excelsior L.	*Oleaceae*						
Fraxinus excelsior × *angustifolia*	*Oleaceae*						
Epilobium alsinifolium Vill.	*Onagraceae*						
Epilobium atlanticum Litard. & Maire	*Onagraceae*						
Epilobium collinum C. C. Gmel.	*Onagraceae*						
Epilobium lanceolatum Sebast. & Mauri	*Onagraceae*						
Epilobium montanum L.	*Onagraceae*						
Epilobium palustre L.	*Onagraceae*						
Epilobium parviflorum Schreb.	*Onagraceae*						
Dactylorhiza elata (Poir.) Soó	*Orchidaceae*						
Dactylorhiza maculata (L.) Soó	*Orchidaceae*						
△ *Orobanche clausonis* Pomel	*Orobanchaceae*						X
Orobanche gracilis Sm. subsp. *gracilis*	*Orobanchaceae*						
△ *Orobanche haenseleri* Reut.	*Orobanchaceae*						X
Orobanche minor Sm.	*Orobanchaceae*						
Paeonia coriacea Boiss.	*Paeoniaceae*						
▲ *Papaver argemone* L.	*Papaveraceae*					X	
Papaver pinnatifidum Moris	*Papaveraceae*						
● *Sarcocapnos speciosa* Boiss.	*Papaveraceae*		X	X			
Plantago holosteum Scop.	*Plantaginaceae*						
Plantago major L. subsp. *intermedia* (Gilib.) Lange	*Plantaginaceae*						
◆ *Plantago nivalis* Boiss.	*Plantaginaceae*	X					
◆● *Armeria filicaulis* (Boiss.) Boiss. subsp. *nevadensis* Nieto Fel., Roselló & Fuertes	*Plumbaginaceae*	X	X				

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Armeria villosa Girard. subsp. *bernisii* Nieto Fel.	*Plumbaginaceae*						
Aegilops geniculata Roth	*Poaceae*						
Aegilops ventricosa Tausch	*Poaceae*						
Agrostis castellana Boiss. & Reut.	*Poaceae*						
◆ *Agrostis nevadensis* Boiss.	*Poaceae*	X					
Agrostis stolonifera L.	*Poaceae*						
Anthoxanthum odoratum L.	*Poaceae*						
▲ *Anthriscus caucalis* M. Bieb.	*Poaceae*					X	
▲ *Avena sterilis* L. subsp. *ludoviciana* (Durieu) Gillet & Magne	*Poaceae*					X	
Avenella flexuosa (L.) Drejer subsp. *iberica* (Rivas Mart.) Valdés & H. Scholz	*Poaceae*						
▲ *Brachypodium sylvaticum* (Huds.) P. Beauv. subsp. *sylvaticum*	*Poaceae*					X	
Bromus intermedius Guss.	*Poaceae*						
Bromus sterilis L	*Poaceae*						
Cynosurus echinatus L.	*Poaceae*						
▲ *Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman	*Poaceae*					X	
Elymus hispanicus (Boiss.) Talavera	*Poaceae*						
Festuca ampla Hack.	*Poaceae*						
Festuca baetica (Hack.) K. Richt.	*Poaceae*						
Festuca capillifolia L. Dufour	*Poaceae*						
◆● *Festuca clementei* Boiss.	*Poaceae*	X	X	X			
Festuca elegans Boiss.	*Poaceae*						
Festuca iberica (Hack.) K. Richt.	*Poaceae*						
Festuca indigesta Boiss.	*Poaceae*						
▲ *Festuca nevadensis* (Hack.) K. Richt.	*Poaceae*					X	
Festuca patula Desf.	*Poaceae*						
Festuca scariosa (Lag.) Asch. & Graebn.	*Poaceae*						
Glyceria declinata Bréb.	*Poaceae*						
Helictotrichon sedenense (DC.) Holub subsp. *sedenense*	*Poaceae*						
Holcus lanatus L.	*Poaceae*						
▲ *Hordeum murinum* L. subsp. *leporinum* (Link) Arcang.	*Poaceae*					X	
Hordeum murinum L. subsp. *murinum*	*Poaceae*						
◆ *Koeleria dasyphylla* Willk. subsp. *nevadensis* (Hack.) Quintanar & A. T. Romero García	*Poaceae*	X					
Nardus stricta L.	*Poaceae*						
Phalaris coerulescens Desf.	*Poaceae*						
◆● *Phleum brachystachyum* (Salisb.) Gamisans, Romero García & C. Morales subsp. *abbreviatum* (Boiss.) Gamisans,Romero García & C. Morales	*Poaceae*	X	X				

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Phleum bertolonii DC.	*Poaceae*						
Poa annua L.	*Poaceae*						
Poa bulbosa L.	*Poaceae*						
▲ *Poa ligulata* Boiss.	*Poaceae*					X	
◆ *Poa minor* Gaudin subsp. *nevadensis* Nannf.	*Poaceae*						
Poa nemoralis L.	*Poaceae*						
Poa pratensis L. subsp. *pratensis*	*Poaceae*						
▲ *Poa supina* Schrad.	*Poaceae*					X	
Poa trivialis L.	*Poaceae*						
◆●▲ *Trisetum glaciale* (Bory) Boiss.	*Poaceae*	X	X			X	
▲ *Vulpia bromoides* (L.) S. F. Gray	*Poaceae*					X	
Vulpia myuros (L.) C. C. Gmel.	*Poaceae*						
Polygonum rurivagum Boreau	*Polygonaceae*						
Rumex acetosa L. subsp. *acetosa*	*Polygonaceae*						
Rumex acetosella L. subsp. *angiocarpus* (Murb.) Murb.	*Polygonaceae*						
▲ *Rumex angiocarpus* Murb.	*Polygonaceae*					X	
Rumex bucephalophorus L. subsp. *gallicus* (Steinh.) Rech. fil.	*Polygonaceae*						
Rumex induratus Boiss. & Reut.	*Polygonaceae*						
▲ *Rumex pulcher* L. subsp. *woodsii* (De Not.) Arcang.	*Polygonaceae*					X	
Rumex scutatus L.	*Polygonaceae*						
Montia fontana L. subsp. *fontana*	*Portulacaceae*						
▲ *Anagallis arvensis* L.	*Primulaceae*					X	
◆● *Androsace vitaliana* (L.) Lapeyr. subsp. *nevadensis* (Chiarugi) Luceño	*Primulaceae*	X	X				
◆● *Primula elatior* (L.) L. subsp. *lofthousei* (Hesl.–Harr.) W.W. Sm. & Fletcher	*Primulaceae*	X	X	X			
Polygonatum odoratum (Mill.) Druce	*Ruscaceae*						
● *Aconitum burnatii* Gáyer	*Ranunculaceae*		X	X			
Aconitum vulparia Rchb. subsp. *neapolitanum* (Ten.) Muñoz Garm.	*Ranunculaceae*						
● *Aquilegia vulgaris* L. subsp. *nevadensis* (Boiss. & Reut.) T. E. Diaz	*Ranunculaceae*		X				
▲ *Clematis flammula* L.	*Ranunculaceae*					X	
Clematis vitalba L.	*Ranunculaceae*						
Delphinium emarginatum K. Presl subsp. *nevadense* (G. Kunze) C. Blanche & Molero	*Ranunculaceae*						
▲ *Delphinium pentagynum* Lam.	*Ranunculaceae*					X	
Helleborus foetidus L.	*Ranunculaceae*						
Parnassia palustris L.	*Ranunculaceae*						
Ranunculus granatensis Boiss.	*Ranunculaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From data-bases
Ranunculus monspeliacus L.	*Ranunculaceae*						
Ranunculus muricatus L.	*Ranunculaceae*						
Ranunculus ollissiponensis Pers. subsp. *ollissiponensis*	*Ranunculaceae*						
Ranunculus omiophyllus Ten.	*Ranunculaceae*						
Ranunculus parviflorus L.	*Ranunculaceae*						
Ranunculus repens L.	*Ranunculaceae*						
Reseda lutea L. subsp. *lutea*	*Resedaceae*						
▲ *Sesamoides purpurascens* (L.) G.López subsp. *prostrata* (Boiss.) Martín–Bravo	*Resedaceae*					X	
● *Rhamnus cathartica* L.	*Rhamnaceae*		X	X			
▲ *Alchemilla filicaulis* Buser	*Rosaceae*					X	
Alchemilla straminea Buser	*Rosaceae*						
Cotoneaster granatensis Boiss.	*Rosaceae*						
Crataegus granatensis Boiss.	*Rosaceae*						
Crataegus monogyna Jacq.	*Rosaceae*						
Geum heterocarpum Boiss.	*Rosaceae*						
Geum urbanum L.	*Rosaceae*						
Malus sylvestris (L.) Mill.	*Rosaceae*						
Potentilla cinerea Vill.	*Rosaceae*						
Potentilla hirta L.	*Rosaceae*						
◆ *Potentilla nevadensis* Boiss.	*Rosaceae*	X					
● *Prunus avium* L.	*Rosaceae*		X	X			
◆● *Prunus ramburii* Boiss.	*Rosaceae*	X	X				
Pyrus cordata Desv.	*Rosaceae*						
Rosa corymbifera Borkh.	*Rosaceae*						
Rosa dumalis Bechst.	*Rosaceae*						
Rosa pouzinii Tratt.	*Rosaceae*						
Rosa sicula Tratt.	*Rosaceae*						
Rosa villosa L. (*Rosa mollis* Sm.)	*Rosaceae*						
Rubus caesius L.	*Rosaceae*						
Rubus canescens DC.	*Rosaceae*						
Rubus ulmifolius Schott.	*Rosaceae*						
▲ *Sanguisorba minor* Scop. subsp. *balearica* (Nyman) Muñoz Garm. & C. Navarro	*Rosaceae*					X	
● *Sorbus aria* (L.) Crantz	*Rosaceae*			X			
● *Sorbus aucuparia* L.	*Rosaceae*		X	X			
Galium aparine L. subsp. *aparine*	*Rubiaceae*						

	Family	Endemic	Threatened	Protected	Exotic	From relevés	From databases
Galium nevadense Boiss. & Reut.	*Rubiaceae*						
Galium pyrenaicum Gouan	*Rubiaceae*						
▲ *Rubia peregrina* L.	*Rubiaceae*					X	
Populus tremula L.	*Salicaceae*						
Salix atrocinerea Brot.	*Salicaceae*						
● *Salix caprea* L.	*Salicaceae*		X	X			
Saxifraga carpetana Boiss & Reut. subsp. *carpetana*	*Saxifragaceae*						
Saxifraga granulata L.	*Saxifragaceae*						
▲ *Saxifraga stellaris* L. subsp. *robusta* (Engl.) Gremli	*Saxifragaceae*					X	
Antirrhinum hispanicum Chav.	*Scrophulariaceae*						
△ *Digitalis obscura* L. subsp. *obscura*	*Scrophulariaceae*						X
Digitalis purpurea L. subsp. *purpurea*	*Scrophulariaceae*						
Euphrasia willkommii Freyn	*Scrophulariaceae*						
Linaria aeruginea (Gouan) Cav. subsp. *aeruginea*	*Scrophulariaceae*						
◆ *Linaria aeruginea* (Gouan) Cav. subsp. *nevadensis* (Boiss.) Malag.	*Scrophulariaceae*	X					
◆ *Pedicularis comosa* L. subsp. *nevadensis* (Pau) À. M. Romo	*Scrophulariaceae*	X					
Scrophularia lyrata Willd.	*Scrophulariaceae*						
◆ *Verbascum nevadense* Boiss.	*Scrophulariaceae*	X					
■ *Datura stramonium* L.	*Solanaceae*				X		
Cuscuta triumvirati Lange	*Solanaceae*						
▲ *Daphne gnidium* L.	*Thymelaeaceae*					X	
Urtica dioica L.	*Urticaceae*						
Valeriana tuberosa L.	*Valerianaceae*						
Valerianella locusta (L.) Laterr. subsp. *locusta*	*Valerianaceae*						
Linaria verticillata Boiss. subsp. *verticillata*	*Veronicaceae*						
Veronica anagallis–aquatica L. subsp. *anagallis–aquatica*	*Veronicaceae*						
Veronica beccabunga L. subsp. *beccabunga*	*Veronicaceae*						
Veronica hederifolia L.	*Veronicaceae*						
◆ *Veronica nevadensis* (Pau) Pau var. *nevadensis*	*Veronicaceae*	X					
Veronica sibthorpioides Debeaux, Degen & Hervier	*Veronicaceae*						
Veronica verna L.	*Veronicaceae*						
◆▲ *Viola crassiuscula* Bory	*Violaceae*	X				X	
Viola kitaibeliana Schult.	*Violaceae*						
Viola palustris L. subsp. *palustris*	*Violaceae*						
▲ *Viola riviniana* Rchb.	*Violaceae*					X	