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EXCURSIONS

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Contents

Excursion 1. Sierra de Guadarrama

Vegetation of the Sierra de Guadarrama National Park

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Introduction: general background of Sierra de Guadarrama

Sierra de Guadarrama is one of the ranges forming the Sistema Central, a northeast-southwest running mountain range including other mountain chains (Sierra de Ayllón, Sierra de Ávila, Sierra de Gredos, Sierra de Béjar, and Serra da Estrela). The massif is built by paleozoic blocks from the Hercynan orogeny (350-250 Ma). Later, the massif was uplifted during the Alpine orogeny (40-10 Ma) and its relief was renewed during the Pleistoce (2 Ma -10.000 years ago), due to the activity of the glacial and periglacial erosion in the summit areas, while sorrounding areas conserve flat surfaces from the pre-Alpine erosion period.

The geographical limits of Sierra de Guadarrama are Somosierra pass (1444 m asl) in the northeast, and Peña de Cenicientos (1253 m asl) in the southwest running from the provinces of Madrid, Segovia and the southeastern corner of Avila. The most relevant peaks are: Peñalara (2430 m asl), Cabezas de Hierro (2383 m asl), Valdemartín (2280 m asl) and Siete Picos (2138 m asl).

The dominant outcropping materials in the Sierra de Guadarrama are crystalline rocks rich in acid silicates, some of which are of plutonic origin (granite, adamellite (quartz monzonite) and granodiorite) and others metamorphic (biotite and hornblende gneiss). In a much lower proportion, there are in some high areas, aplites and filonian porfids as well as some ultrabasic gabbro and marbles outcropping in some localized spots. In the piedmont areas of both the Segovia and Madrid sides, especially on the borders of the faults of the tectonic fosses originated during the Alpine orogeny, there have remained Mesozoic materials rich in clay and calcareous rocks (limestone, conglomerate, marl, etc.) which bear different vegetation of basophilous character.

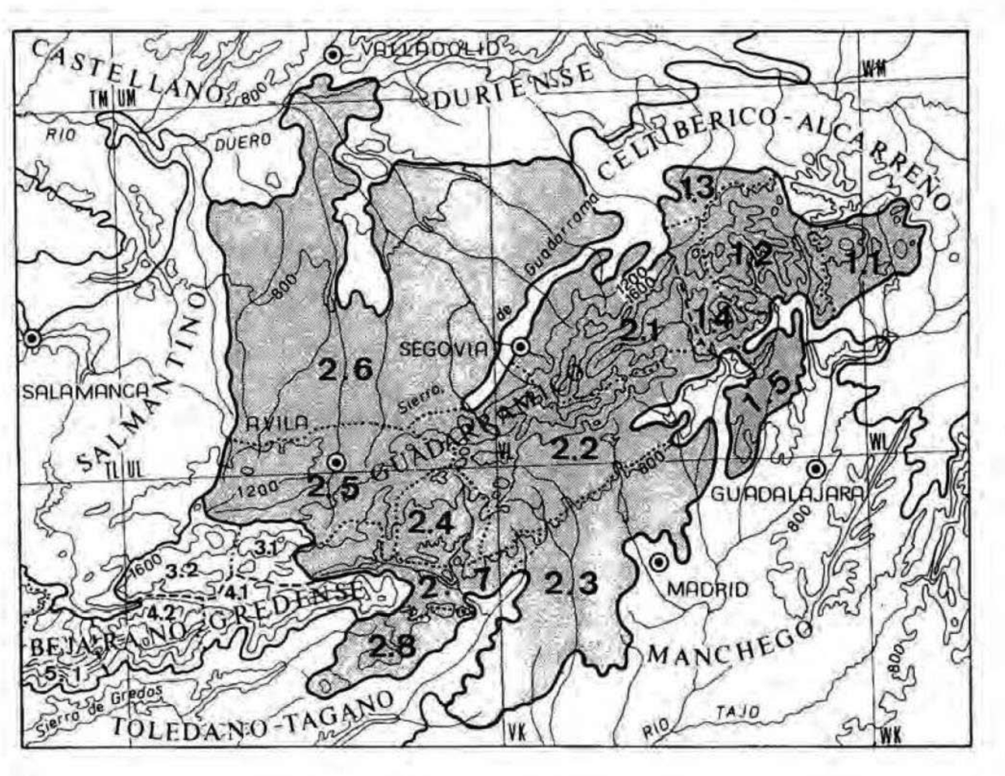
Sierra de Guadarrama has traditionally an economy based on husbandry and forestry (*Pinus sylvestris* and *Pinus pinaster* plantations). Socio-economic changes have replaced progressively the traditional land use by touristic and cultural uses in present days. Nevertheless, those traditional uses continues in some areas such as El Paular and the northern Segovia slope although rural abandonment have improved forestry.

The threats affecting conservation of biodiversity are mainly related to the influence of big cities such as Madrid, the third most populous city in Europe with over three million inhabitants and more than six million in the Greater Madrid Area. The city is only 60 kilometres from Sierra de Guadarrama. There are other smaller cities such as Ávila and Segovia with populations of approximately 50,000 which are also located very near the Sistema Central mountains. They exert an influence on the landscape similar to Madrid and there are similarities in their use of mountain resources. Threats to mountain environments come mainly from recreational uses such as the presence of traditional ski resorts or new ski resorts more recently built in some areas of the western Sistema Central. Hiking is probably the least harmful leisure activity in mountain areas, but hiking trails in many cases require some form of refurbishment.

Biogeography. According to Rivas-Martínez et al. (1990, 2002) Sierra de Guadarrama and a substantial part of its surrounding area in Madrid, Avila and Segovia, are part of the biogeographical Guadarramean sector. The complete biogeographical typology for this area is (see also Map 1):

Holarctic Kingdom; Mediterranean Region; Western Mediterranean Subregion; Mediterranean West Iberian Province; Carpetan-Leonese Subprovince; Guadarramean Sector:

1. Ayllonense Subsector
   - 1.1 Atienzano District
   - 1.2 Ayllonense District
   - 1.3 Riacense District
   - 1.4 Somoserrano District
   - 1.5 Ucedano District
2. Guadarramense Subsector
   - 2.1 Paularense District
   - 2.2 Guadarramense District
   - 2.3 Matritense District
   - 2.4 Cofiense District
   - 2.5 Abulense District
   - 2.6 Arevalense District
   - 2.7 Temblense District
   - 2.8 Cadalsiano District



Map 1. Biogeographical units of Sierra de Guadarrama and Sierra de Ayllón: Guadarramean Sector: 1, Ayllonense Subsector: 1.1 Atienzano District; 1.2 Ayllonense District; 1.3 Riacense District; 1.4 Somoserrano District; 1.5 Ucedano District. 2, Guadarramense Subsector: 2.1 Paularense District; 2.2 Guadarramense District; 2.3 Matritense District; 2.4 Cofiense District; 2.5 Abulense District; 2.6 Arevalense District; 2.7 Temblense District 2.8. Cadalsiano District. From Rivas-Martínez et al. 1990.

Bioclimatology. According to Rivas-Martínez et al (1999) two macroclimates are represented in Sierra de Guadarrama: Mediterranean and Temperate, although the second appears in some localities above 1500 m asl, where the rainfall is more abundant. It is called 'Temperate Submediterranean variant'. Mediterranean thermotypes in this area are meso-, supra-, oro- and cryoromediterranean (Rivas-Martínez 1996), but in those rainiest areas temperate submediterranean variants (supra-, oro- and cryorosubmediterranean) could be found.

The availability of water in soils is an important parameter in Mediterranean territories, where water is scarce during the summer. Soil water availability for plants is a fundamental aspect of moisture that determines vegetation structure and composition. In central Spain sclerophyllous forest shows water storage below zero a month before summer (May) and there are locations that never reach the highest storage value. Deciduous forest shows deficit in water during the whole summer season. High mountain vegetation showed water deficit only in August. Water balances for May and November marked the beginning and the end of this water deficit, while they also separated physiognomic vegetation. Water availability in spring is a limiting factor for the development of deciduous forest (Gavilán and Fernández-González 1997; Gavilán 2005).

Table 1. Bioclimatic data from Sierra de Guadarrama and surrounding areas. Abbreviations are: Alt., altitude (m asl); T. Annual mean temperature; P: Annual precipitation; Tp, Positive temperature (sum(*10) of monthly mean temperatures above 0ºC); Pp, Positive precipitation (sum of monthly precipitation used in Tp); Itc: compensated thermicity index (=10*(T+M+m); M and m are the maximum and minimum monthly mean temperature); Thermot., Thermotype; meso-,supra-,orosub-, mesomediterranean, supramediterranean, orosubmediterranean; Ombrot., Ombrotype; shum, subhumid; hum, humid; hhum, hiperhumid;U, upper; L, lower. Extracted from Rivas-Martínez et al 1999.

Locality	Alt.	Year	T	P	Tp	Pp	ltc	Thermot.	Ombrot.
Madrid	667	40	13.9	438	1666	438	244	U meso-	L dry
Avila	1131	40	10.4	364	1253	364	154	L supra-	U dry
Segovia	1002	40	11.5	468	1375	468	168	L supra-	U dry
Colmenar Viejo	879	38	12.7	725	1521	725	207	L supra-	L shum
Manjirón	1000	39	11.1	650	1336	650	175	L supra-	L shum
Rascafría	1159	27	9.9	858	1188	858	159	L supra-	L hum
San Ildefonso	1191	18	8.8	885	1056	885	109	U supra-	L hum
Navacerrada Pass	1860	38	6.5	1511	798	1019	42	L orosub-	L hhum

Table 2. Guadarramean Sector ombrotypes and thermotypes threshold values. For abbreviations see Table 1. Extracted from Rivas-Martínez et al 1990, 1999.

Thermotype	Itc	Tp	Ombrotype	P
Mesomediterranean	210-350	1500-2150	Dry	350-600
Supramediterranean	80-210	900-1500	Subhumid	600-1000
Orosubmediterranean	80- -10	450-900	Humid	1000-1600
			Hiperhumid	1600-2300

Vegetation

Madrid to Sierra de Guadarrama, Cotos Pass (Figure 1)

The altitudinal zonation of vegetation in Sierra de Guadarrama from Madrid (valley) to the summits includes:

1. Silicicolous evergreen oak forest of *Quercus rotundifolia.*

2. Silicicolous broad-leaved oak forest of *Quercus pyrenaica*.

3. Pine forests of *Pinus sylvestris* var. *iberica* and shrub communities of broom (*Cytisus oromediterraneus*).

4. Dwarf juniper communities (*Juniperus communis* subsp. *alpina*) with broom (*Cytisus oromediterraneus*).

5. Psychroxerophilous (dry) grasslands of *Festuca curvifolia* and other alpine communities.

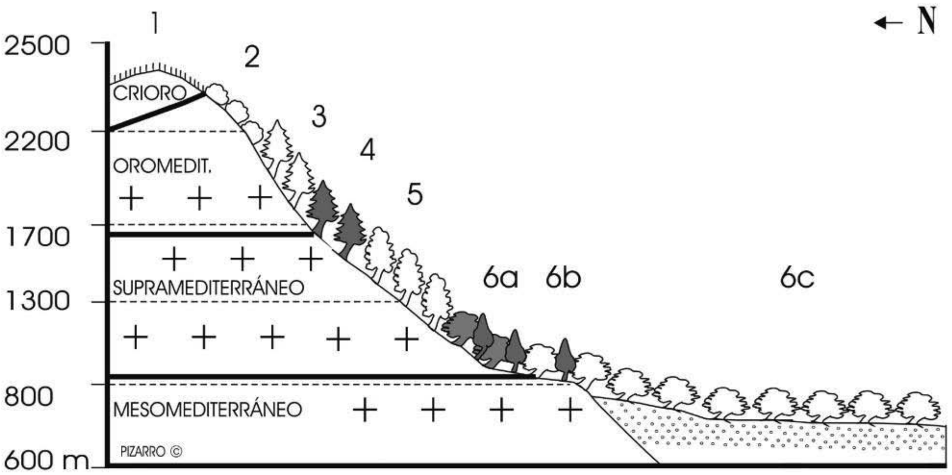


Figure 1. Altitudinal zonation of the southern slope of the Sierra de Guadarrama from Peñalara peak to the valley (Madrid): 1, *Hieracio myriadeni-Festucetum curvifoliae*; 2, *Senecioni carpetani-Cytisetum oromediterranei*; 3, *Avenello ibericae-Pinetum ibericae*; 4, *Pteridio aquilini-Pinetum ibericae*; 5, *Luzulo forsteri-Quercetum pyrenaicae*; 6, *Junipero oxycedri-Quercetum rotundifoliae*: 6a: supramediterranean variant *arenarietosum montanae,* 6b: mesomediterranean typical variant, 6c: mesomediterranean sandy soils variant. From Rivas-Martínez et al 1990, 1999.

1. Silicicolous evergreen oak forest (*Junipero oxycedri-Quercetum rotundifoliae*) and seral communities (Figure 2)

These forests appear at the foothills of Sierra de Guadarrama, both at meso- and supramediterranean belts. The herb layer of these forest are quite different, in mesomediterranean areas they have *Asparagus acutifolius* and other species that not appear in the supramediterranean belt whose herb layer is much poorer. Other relevant differences between them appear in seral communities such as broom forest mantles and grasslands. In the mesomediterranean belt those forests form a mosaic with scrub communities of *Cytiso scoparii-Retametum sphaerocarpae* and grasslands of *Centaurea ornatae-Stipetum lagascae* while in the supramediterranean belt they do it with those of *Genisto floridae-Cytisetum scoparii* and grasslands of *Arrhenathero baetici-Stipetum giganteae.* This suprameditarranean aspect is called *Junipero oxycedri-Quercetum rotundifoliae arenarietosum montanae.* However, shrublands are the same in both variants: *Rosmarino officinalis-Cistetum ladaniferi*.

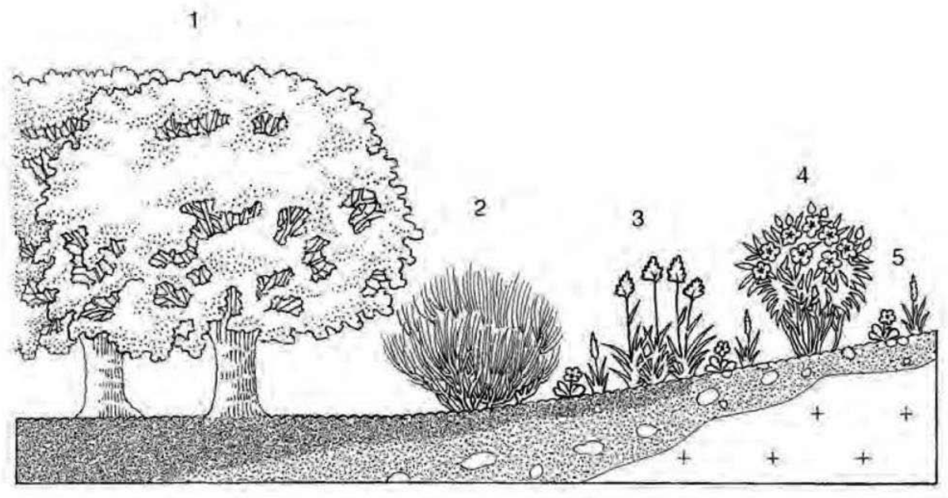


Figure 2. Supramediterranean silicicolous evergreen oak forest and seral communities: l. Forest (*Junipero oxycedri-Quercetum rotundifoliae arenarietosum montanae*)*;* 2. Broom (*Genisto floridae-Cytisetum scoparii*)*;* 3. Grasslands (*Arrhenathero-Stipetum giganteae*); 4. Shrublands (*Rosmarino-Cistetum ladaniferi*); 5. Mediterranean ephemeral pastures (*Hispidello-Tuberarietum guttatae*). From Rivas-Martínez et al. 1990.

Some details about the floristic composition of these communities are:

Junipero oxycedri-Quercetum rotundifoliae: V *Quercus rotundifolia*, IV *Carex distachya*, IV *Daphne gnidium*, IV *Dactylis hispanica*, III *Juniperus oxycedrus*, III *Doronicum plantagineum,* III *Rubus ulmifolius*, III *Crataegus monogyna*, III *Arenaria montana*, III *Agrostis castellana*, III *Lavandula pedunculata*, II *Rubia peregrina*, II *Paeonia broteroi*, II *Lonicera etrusca*, II *Asparagus acutifolius* (dif. subass.), II *Ruscus aculeatus,* II *Cardamine hirsuta,* II *Galium spurium* subsp. *aparinella*, II *Sanguisorba verrucosa,* II *Carex pairae,* I *Phillyrea angustifolia* (dif. subass.), etc. (Rivas-Martínez 1964; Fernández-González 1991)

Genisto floridae-Cytisetum scoparii: V *Cytisus scoparius*, IV *Genista florida* subsp. *florida*, IV *Genista cinerascens*, IV *Pteridium aquilinum*, IV *Lavandula pedunculata*, IV *Quercus pyrenaica* (S2), IV *Dactylis hispanica*, IV *Santolina rosmarinifolia*, III *Adenocarpus complicatus* susbsp. *complicatus*, III *Quercus rotundifolia* (S2), III *Stipa gigantea*, III *Agrostis castellana*, etc. (RivasMartinez & Cantó 1987; Fernandez-Gonzalez 1991)

Arrhenathero baetici-Stipetum giganteae: V *Stipa gigantea*, IV *Arrhenatherum tuberosum* subsp. *baeticum*, IV *Armeria lacaitae*, IV *Koeleria caudata* subsp. *crassipes*, IV *Dactylis hispanica*, III *Agrostis castellana*, III *Lavandula pedunculata*, II *Allium guttatum* subsp. *sardoum*, II *Allium pallens*, II *Centaurea gabrielis-blancae*, II *Centaurea alba*, II *Stipa lagascae*, II *Thapsia villosa*, II *Avenula sulcata*, II *Arrhenatherum elatius* subsp. *carpetanum*, etc. (Rivas-Martínez et al. 1986; Fernández-González 1988).

2. Silicicolous broad-leaved forest (*Luzulo forsteri-Quercetum pyrenaicae*) and seral communities (Figure 3)

They are considered mountain forest because their water needs. The altitudes vary depending on situations and the rainfall records. Thus in dry areas evergreen oak forest (*Junipero-Quercetum rotundifoliae)* reaches 1400 m asl, but in subhumid areas they appears at 1000 m asl. The upper altitudinal limit in Sierra de Guadarrama is about 1500-1600 m asl. Above it the climatophilous potential natural vegetation corresponds to pine forests of *Pinus sylvestris* var. *iberica* (*Avenello ibericae-Pinion ibericae*). Due to antropic influence (husbandry, selective tree plantations, fire, etc.) the pine forests of *Pteridio aquilini-Pinetum ibericae* can totally replace those forest above 1200 m asl and form large pine forest stands sometimes in mosaic with them.

The lower and warmer altitudes where these forest live (*Luzulo forsteri-Quercetum pyrenaicae paeonietosum broteroi*) bear the same type of scrub and grasslands communities as the supramediterranean evergreen oak forest: *Genisto floridae-Cytisetum scoparii* and *Arrhenathero baetici-Stipetum giganteae.* The upper horizon (upper supramediterranean) of them is indicated by the subassociation *Luzulo forsteri-Quercetum pyrenaicae deschampsietosum ibericae* (diffs. *Avenella flexuosa* subsp. *iberica, Luzula lactea, Avenula sulcata, Linaria nivea*) as well as by the forest mantle (*Cytiso oromediterranei-Genistetum cinerascentis*) and the chamaephytic grasslands on lithosols (*Thymo zygidis-Plantaginetum radicatae*).

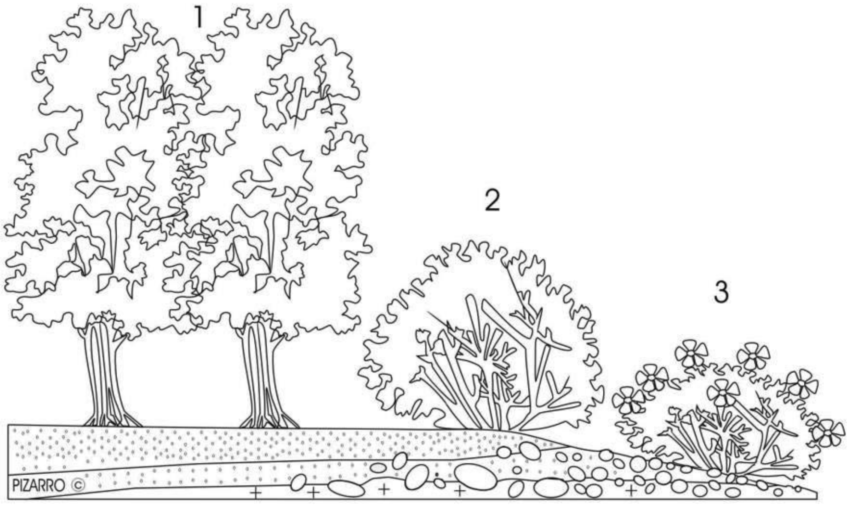


Figure 3. Silicicolous broad-leaved forest (*Quercus pyrenaica*) and seral communities in Sierra de Guadarraman: 1, Forest (*Luzulo forsteri-Quercetum pyrenaicae*); 2, Broom shrubland or piornal (*Genisto floridae-Cytisetum scoparii*); 3, Cistus shrubland (*Santolino-Cistetum laurifolii*). From Rivas-Martínez et al. 1999.

Some details about the floristic composition of these communities are:

Luzulo forsteri-Quercetum pyrenaicae: V *Quercus pyrenaica*, V *Holcus mollis*, V *Arenaria montana*, V *Poa nemoralis*, V *Satureja vulgaris* subsp. *arundana*, V *Cruciata glabra*, V *Pteridium aquilinum*, IV *Luzula forsteri*, IV *Viola riviniana*, *N Melica uniflora*, IV *Sedum forsteranum*, IV *Lathyrus linifolius*, IV *Dactylis glomerata*, IV *Genista florida* subsp. *florida*, III *Potentilla sterilis*, III *Primula veris*, III *Brachypodium sylvaticum*, III *Hyacinthoides non-scripta*, III *Rosa canina*, III *Lonicera hispanica*, III *Viola odorata*, III *Silene nutans*, III *Lathyrus niger*, III *Vicia tenuifolia*, III *Potentilla micrantha*, III *Teucrium scorodonia*, III *Carex pairae*, III *Moehringia trinervia*, III *Vicia sepium*, III *Tanacetum corymbosum*, III *Conopodium pyrenaeum*, III *Lactuca viminea*, III *Trisetum flavescens*, etc. (Rivas-Martínez 1963; Fernández-González 1991).

From Cotos Pass to summits: Sierra de Guadarrama National Park

3. Pine forests of *Pinus sylvestris* var. *iberica* and shrub communities of broom (*Cytisus oromediterraneus*) (Figure 4).

They appear in Sierra de Guadarrama around 1700 m asl of altitude, within a range of 70 m depending on the orientation, limit between the supra- and oromediterranean belts. In lower altitudes forests of *Pteridio aquilini-Pinetum ibericae* appear forming mosaic with *Quercus pyrenaica* forest as explained before. In such case *Cytiso oromediterranei-Genistetum cinerascentis* appear as seral communities together to Cistus communities with bearberries and dwarf junipers (*Erico arboreae-Arctostaphyletum crassifoliae juniperetosum hemisphaericae*) and thyme-grasslands (*Thymo-Plantaginetum radicatae*).

Seral communities of *Avenello-Pinetum* favored by fire and husbandry correspond to broom communities of *Senecioni carpetani-Cytisetum oromediterranei* and psychroxerophilous grasslands of *Hieracio castellani-Festucetum curvifoliae.*

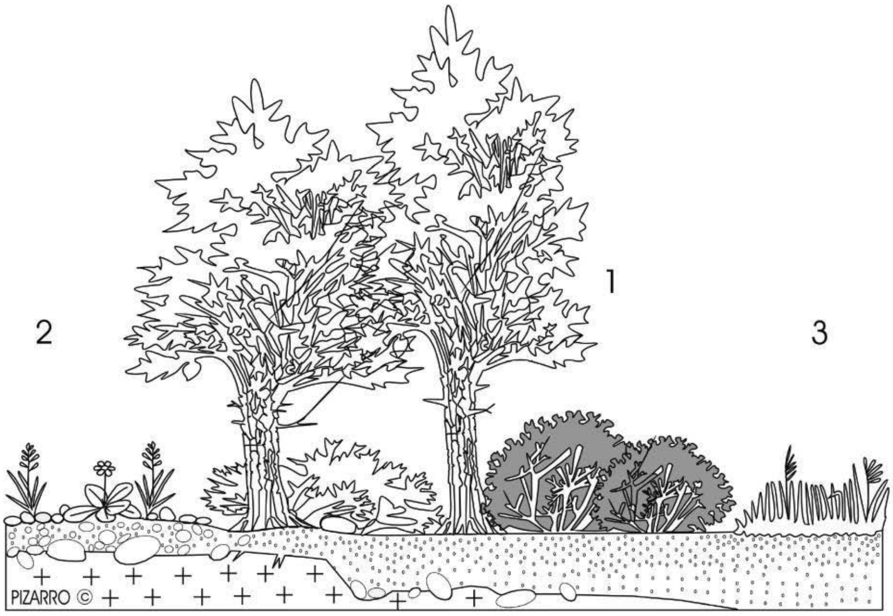


Figure 4. Distribution of the plant communities in the Cotos Pass: 1, Pine forest (*Avenello ibericae-Pinetum ibericae*); 2, Psychroxerophilous oromediterranean grasslands (*Hieracio castellani-Festucetum curvifoliae*); 3, Chionophile *Nardus* grasslands (*Campanulo-Festucetum ibericae*). From Rivas-Martínez et al. 1999.

Some details about the floristic composition of these communities are:

Pteridio aquilini-Pinetum ibericae: V *Pinus sylvestris* var. *iberica*, V *Avenella flexuosa* subsp. *iberica*, V *Juniperus communis* subsp. *hemisphaerica*, V *Pteridium aquilinum*, V *Conopodium pyrenaeum*, V *Galium rotundifolium*, V *Avenaria montana*, IV *Cytisus oromediterraneus*, IV *Holcus mollis*, IV *Luzula forsteri*, IV *Viola riviniana*, IV *Cruciata glabra*, III *Genista florida* subsp. *florida*, III *Satureja vulgaris*, III *Luzula lactea*, III *Veronica officinalis*, III *Dicranum scoparium*, III *Agrostis castellana*, III *Avenula sulcata*, III *Satureja alpina* subsp. *meridionalis*, II *Linaria nivea*, II *Erica arborea*, II *Rumex acetosa* subsp. *pyrenaicus*, II *Rubus castellarnaui*, II *Rosa canina*, II *Cistus laurifolius* (dif. subass.), II *Arctostaphylos uva-ursi* subsp. *crassifolia* (dif. subass.) (Rivas-Martínez & Molina 1999).

Cytiso oromediterranei-Genistetum cinerascentis: V *Cytisus oromediterraneus*, V *Genista cinerascens*, IV *Pteridium aquilinum*, IV *Avenella flexuosa* subsp. *iberica*, IV *Koeleria caudata* subsp. *crassipes*, III *Genista florida* subsp. *florida*, III *Juniperus communis* subsp. *hemisphaerica*, III *Stipa gigantea*, III *Santolina rosmarinifolia*, III *Cytisus scoparius*, III *Jasione crispa* subsp. *sessiliflora*, III *Luzula lactea*, III *Arrhenatherum elatius* subsp. *carpetanum*, III *Agrostis castellana*, III *Orobanche rapum-genistae*, II *Erica arborea*, II *Festuca summilusitana*, II *Lavandula pedunculata*, II *Avenula sulcata*, II *Linaria nivea*, II *Festuca curvifolia*, II *Coryhephorus canescens*, II *Adenocarpus hispanicus* (dif. subass.) (Rivas-Martínez 1970; Rivas-Martínez & Cantó 1987; Fernández-González 1991).

Avenello ibericae-Pinetum ibericae: V *Pinus sylvestris* var. *iberica,* V *Avenella flexuosa* subsp. *iberica*, V *Juniperus communis* subsp. *alpina*, IV *Juniperus communis* subsp. *hemisphaerica*, IV *Jasione laevis* subsp. *carpetana*, IV *Cytisus oromediterraneus*, IV *Linaria nivea*, IV *Luzula lactea*, IV *Arenaria montana*, IV *Dicranum scoparium*, IV *Rumex acetosella* subsp. *pyrenaicus*, IV *Cerastium ramosissimum*, III *Agrostis castellana*, III *Conopodium pyrenaeum*, III *Festuca marginata* subsp. *braun-blanquetii*, III *Festuca iberica*, III *Nardus stricta*, III *Leontodon hispidus* subsp. *bourgaeanus*, II *Festuca curvifolia*, II *Avenula sulcata*, II *Erica arborea*, II *Leucanthemopsis pallida* subsp. *alpina*, etc. (Rivas-Martínez & Molina 1999; Fernández-González 1991).

Senecioni carpetani-Cytisetum oromediterranei: V *Cytisus oromediterraneus*, V *Juniperus communis* subsp. *alpina*, V *Avenella flexuosa* subsp. *iberica*, IV *Luzula lactea*, IV *Arenaria montana*, III *Juniperus communis* subsp. *hemisphaerica*, III *Senecio pyrenaicus* subsp. *carpetanus*, III *Arrhenathenun elatius* subsp. *carpetanum*, III *Erica arborea*, III *Rumex acetosella* subsp. *pyrenaicus*, III *Festuca curvifolia*, III *Linaria nivea*, III *Agrostis castellana*, III *Lactuca viminea*, II *Adenocarpus hispanicus* subsp. *hispanicus* (dif. subass.), II *Arctostaphylos uva-ursi* subsp. *crassifolia* (dif. subass.), II *Ranunculus ollissiponensis* subsp. *alpinus*, II *Pinus sylvestris* var. *iberica* (Rivas-Martínez 1963; Rivas-Martínez & Cantó 1987; Fernández-González 1991).

Hieracio castellani-Festucetum curvifoliae: V *Festuca curvifolia*, V *Hieracium castellanum*, V *Thymus bracteatus* subsp. *bracteatus*, V *Koeleria caudata* subsp. *crassipes*, IV *Jurinea humilis*, IV *Agrostis truncatula*, IV *Sedum brevifolium*, IV *Poa bulbosa*, IV *Jasione crispa* subsp. *sessiliflora*, IV *Leucanthemopsis pallida* subsp. *alpina*, III *Armeria caespitosa*, III *Avenella flexuosa* subsp. *iberica*, II *Corynephorus canescens*, II *Agrostis castellana*, II *Plantago radicata*, II *Dianthus toletanus* subsp. *cutandae*, II *Festuca rivas-martinezii*, II *Linaria elegans*, II *Avenula sulcata.* (Rivas-Martinez & Cantó 1987; Fernández-González 1988).

4. Dwarf juniper communities (*Juniperus communis* subsp. *alpina*) with broom (*Cytisus oromediterraneus*): *Avenello ibericae-Juniperetum nanae* (Figure 5)

In the upper orosubmediteranean belt (cryoromediterranean) and, topographically in the cryorosubmediterranean, mostly in fire safe rocky habitats, the climatophylous potential vegetation can be a dwarf juniper shrubland: *Avenello ibericae-Juniperetum nanae.* This vegetation, form a mosaic on lithosols with the psychroxerophilous grasslands of *Hieracio myriadeni-Festucetum curvifoliae*.

The floristic composition of this vegetation is:

Avenello ibericae-Juniperetum alpinae: V *Juniperus communis* subsp. *alpina*, V *Avenella flexuosa* subsp. *iberica*, VI *Festuca curvifolia*, III *Senecio pyrenaicus* subsp. *carpetanus*, II *Cytisus oromediterraneus*, II *Thymus praecox* subsp. *penyalarensis*, II *Hieracium vahlii* subsp. *myriadenum*, II *Veronica fruticans* subsp. *cantabrica*, II *Festuca iberica*, II *Nardus stricta*, II *Saxifraga willkommiana*, etc. (Fernández-González 1991, sub *Senecioni carpetani-Cytisetum oromediterranei juniperetosum nanae* (Rivas-Martínez 1970; Rivas-Martínez & Fernández-González 1991).

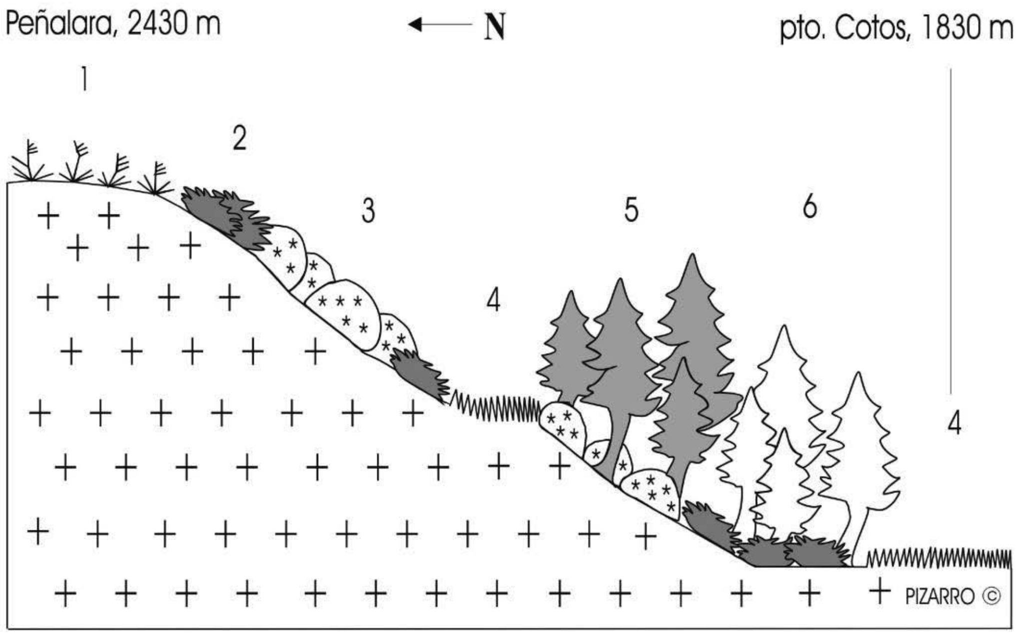


Figure 5. Altitudinal distribution of vegetation between the Cotos Pass and Peñalara summit: 1, Psychroxerophilous cryoromediterranean grasslands (*Hieracio myriadeni-Festucetum curvifoliae*; 2, Dwarf juniper scrub (*Avenello ibericae-Juniperetum alpinae*); 3, Scrublands (*Senecioni carpetani-Cytisetum oromediterranei*); 4, Chionophile *Nardus* grasslands (*Campanulo-Festucetum ibericae*); 5, Pine forest (*Avenello ibericae-Pinetum ibericae*) with *Adenocarpus hispanicus;* 6, Pine forest (*Avenello ibericae-Pinetum ibericae*). From Rivas-Martínez et al. 1999.

5. Psychroxerophilous (dry) grasslands of *Festuca curvifolia* and other alpine communities.

The cryorosubmediterranean belt is only well represented in the Sierra de Guadarrama in summit areas above 2,150 m, under strong windy conditions, becoming general above 2,250 m. The climacic vegetation corresponds to tufty psychroxerophilous grasslands of the *Hieracio myriadeni-Festucetum curvifoliae*, which is replaced by the more mesophytic grasslands of *Campanulo herminii-Festucetum ibericae hieracietosum myriadeni* in areas with long-lasting snow cover (Rivas-Martínez et al. 1999).

Festuca curvifolia grasslands are not very palatable to cows due to the hard leaves of this plant. They prefer *Festuca iberica* or *Nardus stricta* pastures developing in meadows or concave sites where snow remains for longer, except in very dry summers. The flowers of a cushion plant, *Silene ciliata*, are usually eaten by sheep. This could have consequences on its reproduction and on plant community development.

The floristic composition of these communities are:

Hieracio myriadeni-Festucetum curvifoliae: V *Festuca curvifolia*, V *Hieracium vahlii* subsp. *myriadenum*, V *Jasione crispa* subsp. *centralis*, V *Silene ciliata* subsp. *elegans*, IV *Minuartia recurva* var. *bigerrensis*, IV *Armeria caespitosa*, IV *Thymus praecox* subsp. *penyalarensis*, IV *Jurinea humilis*, IV *Luzula hispanica*, IV *Sedum brevifolium*, IV *Agrostis delicatula*, III *Phyteuma hemisphaericum*, III *Leucanthemopsis pallida* subsp. *alpina*, III *Erysimum penyalarense*, III *Avenella flexuosa* subsp. *iberica*, II *Senecio boissieri*, II *Agrostis rupestris*, II *Veronica fruticans* subsp. *cantabrica*, II *Sedum candollei*, II *Plantago alpina* subsp. *penyalarensis* (dif. subass.), *Festuca iberica* (dif. subass.), II *Sempervivum vicentei* subsp. *paui* (dif. subass.), etc. (Rivas-Martínez 1963; Fernandez-Gonzalez 1991)

This type of vegetation in the central Iberian Peninsula is organized in mosaics of vegetation surrounded by open areas. The conservation of this natural vegetation in the Mediterranean mountains (and elsewhere) guarantees slope stabilization and prevents erosion processes that could exert a strong negative influence on the capacity of water reservoirs downhill. Facilitation phenomena have been described as in other alpine areas, it means that some species profit from others, being this effect stronger than competition for resources. The mechanisms involved in facilitation are diverse and include provision of shelter or shade, attraction of pollinators, protection from herbivores, and improvement of soil. Some species receive more visits from pollinators when accompanied by other species than when alone. Bare ground with no vegetation impairs establishment of plant seedlings: the soil is overheated by the sun and seedlings may suffer from freezing of the ground on clear nights (Gavilán et al. 2002; Gutiérrez-Girón and Gavilán 2010).

The re-survey done in Sierra de Guadarrama summits provide some insights with regard to studies from other regions (Jiménez-Alfaro et al. 2014). We found upward species shifts that agree with the expected responses to climate warming in temperate regions, but in *generalists* species. We found a general increase in species richness as observed in other mountain ranges, such as in the Alps, Pyrenees and in Scandinavia, but in contrast to the decline observed in other Mediterranean mountain summits. These findings support the idea that climate change effects differ among different mountain regions and emphasize possible differences between Mediterranean mountains. Indeed, changes in Mediterranean high-mountain communities may not be homogeneous among different biogeographic regions, as suggested for temperate-alpine habitats.

Orophile *Nardus stricta* grasslands and mires (*Campanulo-Nardion, Caricion fuscae*).

These grasslands are dominated by *Nardus stricta* and *Festuca iberica* and constitute one of the most important summer pasture resources in the Iberian high mountains. Their communities are distributed into several well characterized alliances in the Iberian Peninsula. *Nardion* (Pyrenean and eastern Cantabrian supra and orotemperate), *Violion caninae* (Atlantic, supratemperate: incl. *Juncion squarrosi*), *Campanulo-Nardion* (Carpetan-Iberian-Leonesian, western Orocantabrian, supra-, oro- and cryorosubmeditarranean) and *Plantaginion nivalis* (Nevadense, oro- and cryoromediterranean). In Sierra de Guadarrama there are five associations of the *Campanulo-Nardion* alliance: *Campanulo hermini-Festucetum ibericae, Luzulo carpetanae-Juncetum squarrosi* [syn.: *Luzula sudetica-Pedicularis sylvatica* ass.], *Campanulo herminii-Festucetum rivularis, Allietum latiorifolii* and *Festuco rothmaleri-Juncetum squarrosi.* The first four mentioned occur in the orosubmediterranean belt in Sierra de Guadarrama; *Allietum latiorifolii* is an endemic association of the Peñalara massif which lives on lithosols and crevices frequently flooded by the water from melting snow which is characterized by the endemic plant *Allium schoenoprasium* subsp. *latiorifolium.* The oro-cryorosubmediterranean chionophilous association of stream edges *Campanulo herminii-Festucetum rivularis* is well characterized by the orophilous Iberian endemic grass *Festuca rivularis* Boiss (Rivas-Martínez et al 1999).

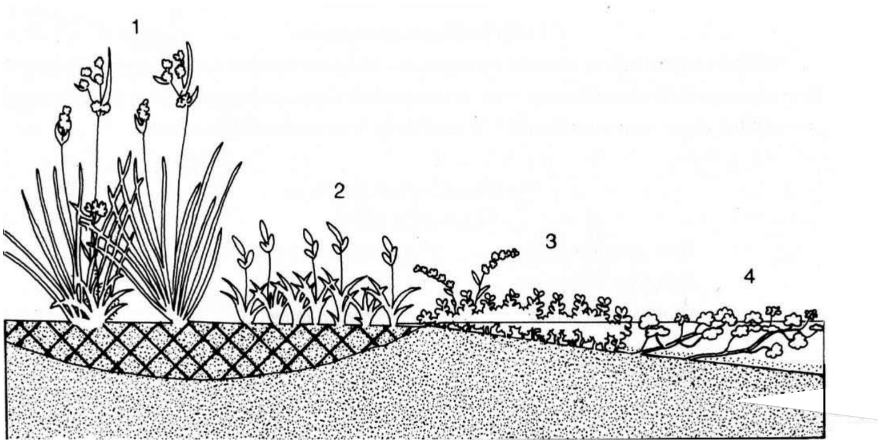


Figure 6. Distribution of hygrophytic vegetation in Cotos Pass. 1, *Luzulo-Juncetum squarrosi*; 2, *Caricetum ibericae*; 3, *Myosotidetum stoloniferae*; 4, *Ranunculetum hederacei*. From Rivas-Martínez et al. 1990.

The most common Nardus grasslands in Sierra de Guadarrama are the mesophytic corresponding to the association *Luzulo-Juncetum squarrosi,* which in mires is in contact with the sedge community of mires *Caricetum (carpetanae) ibericae* (Figure 6). The floristic composition of these communities are:

Campanulo hermini-Festucetum ibericae: V *Campanula herminii*, V *Festuca iberica*, V *Narduus stricta*, V *Jasione laevis* subsp. *carpetana*, IV *Narcissus bulbocodium* subsp. *nivalis*, III *Luzula campestris* subsp. *carpetana*, III *Ranunculus bulbosus* subsp. *cacuminalis*, III *Agrostis truncatula*, III *Hieracium pilosella*, III *Lotus glareosus*, III *Rwnex acetosella* subsp. *pyrenaicus*, III *Polytrichum juniperinum*, II *Euphrasia willkommii*, II *Gagea nevadensis*, II *Dianthus deltoides*, II *Galium rivulare*, II *Pedicularis sylvatica*, II *Galium saxatilis*, II *Polygala vulgaris*, II *Danthonia decumbens*, II *Potentilla erecta*, II *Pedicularis sylvatica*, II *Plantago alpina* subsp. *penyalarensis*, II *Trifolium repens* subsp. *nevadense*, I *Ranunculus abnormis*, I *Selinum pyrenaeum*, I *Hieracium pseudovahlii*, I *Juncus squarrosus*, etc. (Rivas-Martínez 1963: 127; Fernández-González 1991).

Caricetum (carpetanae) ibericae: V *Carex nigra* subsp. *iberica*, V *Carex echinata*, IV *Sphagnum sp. pl.*, IV *Viola palustris* subsp. *juressi*, III *Agrostis canina*, III *Carex demissa*, III *Drosera rotundifolia*, III *Potentilla erecta*, III *Nardus stricta*, III *Pedicularis sylvatica*, III *Parnassia palustris*, II *Eleocharis quinqueflora*, II *Carex ovalis*, II *Epilobium palustre*, II *Luzula campestris* subsp. *carpetana*, II *Aulacomnium palustre*, II *Juncus alpinoarticulatus* subsp. *alpestris*, II *Ranunculus bulbosus* subsp. *cacuminalis*, II *Epilobium palustre*, II *Calliergonella cuspidata*, II *Erica tetralix*, I *Pinguicula grandiflora*, etc. (Rivas-Martínez 1963; Fernández-González 1991).

Orophilous rupicolous and scree vegetation (*Saxifragion willkommianae, Linario-Senecionion carpetani*) (Figures 7, 8)

The Sierra de Guadarrama in general terms is not exceedingly abrupt but its summital areas have been carved out during the Wurmian ice period and they bear an important quantity of rupicolous and scree habitats. They bear plant communities rich in endemic plants, specialized in living under such extreme conditions. The outstanding oro and cryorosubmediterranean communities are *Saxifragetum willkommianae* (rock crevices, chionofobous) and *Digitali carpetanae-Senecionetum carpetani* (unstable screes, chionophilous).

The chasmophytic silicicolous association has the following floristic composition:

Saxifragetum willkommianae: V *Saxifraga willkommiana*, V *Murbeckiella boryi*, V *Hieracium carpetanum*, IV *Asplenium septentrionale*, III *Alchemilla saxatilis*, III *Cryptogramma crispa*, III *Sedum brevifolium*, III *Avenella flexuosa* subsp. *iberica*, II *Silene boryi* subsp. *penyalarensis*, II *Sedum hirsutum*, II *Alchemilla transiens*, II *Agrostis rupestris*, II *Hieracium amplexicaule*, II *Poa nemoralis* subsp. *glauca*, II *Cystopteris fragilis*, II *Veronica fruticans* subsp. *cantabrica*, etc. (Rivas-Martínez 1963; Fernández-González 1991).

The chionophilous scree association has the following floristic composition:

Digitali carpetanae-Senecionetum carpetani: V *Senecio pyrenaicus* subsp. *carpetanus*, I *Digitalis purpurea* subsp. *carpetana*, I *Paronychia polygonifolia*, I *Cryptogramma crispa*, II *Linaria saxatilis*, II *Leontodon hispidus* subsp. *bourgaeanus*, III *Biscutella intermedia* subsp. *gredensis*, III *Solidago virgaurea* subsp. *fallit-tirones*, III *Agrostis truncatula*, III *Sedum brevifolium*, III *Leucanthemopsis pallida* subsp. *alpina*, II *Epilobium collinum*, II *Galeopsis angustifolia* subsp. *carpetana*, II *Arrhenatherum elatius* subsp. *carpetanum*, I *Poa fontqueri*, etc. (Rivas-Martínez 1963; Fernández-González 1991).

Figure 7. Peñalara peak and lake.

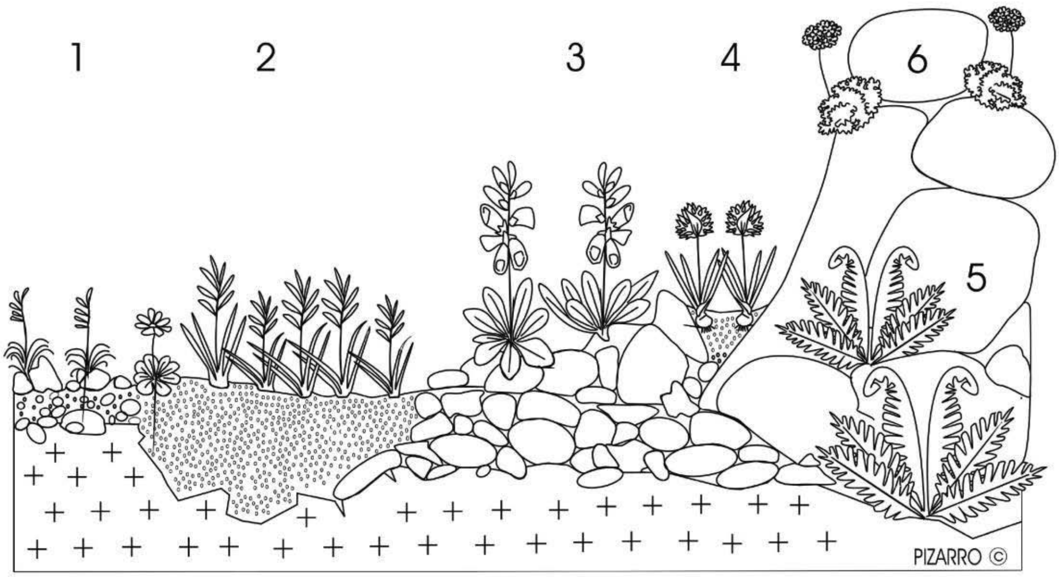


Figure 8. Plant communities distribution in Peñalara summit: 1, Psychroxerophilous cryoromediterranean grasslands (*Hieracio myriadeni-Festucetum curvifoliae*); 2, Chionophile *Nardus* grasslands or cervunales (*Campanulo-Festucetum ibericae*); 3, Stabilized scree communities (*Digitali-Senecietum carpetani*); 4, Wet rupicolous communities (*Allietum latioriflori*); 5, Scree fern communities (*Cryptogrammo-Dryopteridetum oreadis*); 6, Rock crevices communities (*Saxifragetum willkommianae*). From Rivas-Martínez et al 1999.

Appendix 1. Endemic taxa with optimum in Sierra de Guadarrama and/or in other mountains

Allium schoenoprasum subsp. *latiorifolium*
Armeria caespitosa (Sierra de Guadarrama and Sierra de Gredos)
Erodium paularense (restricted to the limestone outcrops of the Paular valley)
Erysimum penyalarense
Hieracium vahlii subsp. *myriadenum* (with disjunctions in western Sierra de Gredos)
Adenocarpus hispanicus subsp. *hispanicus* (with disjunctions in eastern Sierra de Gredos)
Festuca curvifolia (= F. indigesta gr.)
Sedum pedicellatum subsp. *pedicellatum*
Biscutella intermedia subsp. *gredensis* (Sierra de Guadarrama and Sierra de Gredos)
Hippocrepis carpetana (Sierra de Guadarrama and Sierra de Gredos)
Sempervivum vicentei subsp. *paui* (Sierra de Guadarrama and Sierra de Gredos)
Senecio pyrenaicus subsp. *carpetanus*
Silene boryi subsp. *penyalarensis* (Sierra de Guadarrama and Sierra de Gredos)
Thymus bracteatus subsp. *bracteatus*
Thymus praecox subsp. *penyalarensis* (Sierra de Guadarrama and Sierra de Gredos)
Viola langeana.

Appendix 2. Taxonomic list

The following list is formed by taxa not considered in the following basic floras: *Flora iberica* (1986-2015), *Flora Europaea* (Tutin & al. 1964-1980; 1993) and *Euro-Mediterranean Plant Diversity* (Euro+Med).

Arctostaphylos uva-ursi subsp. *crassifolia* (Braun-Blanq.) Rivas Mart.
Armeria lacaitae (Villar) Rivas Mart.
Arrhenatherum elatius subsp. *carpetanum* Rivas Mart., Fern.Gonz. & Sánchez Mata ined.
Arrhenatherum tuberosum subsp. *baeticum* (Romero Zarco) Rivas Mart., Fern.Gonz. & Sánchez Mata.
Avenella flexuosa subsp. *iberica* (Rivas Mart. in Rivas Mart., Izco & M.J.Costa) Garcia-Suárez, Fem.-Carv. & Fem.Prieto in Garcia-Suárez & al. 1997. (=*A. flexuosa* subsp. *iberica* (Rivas Mart.) Valdés & H. Scholz 2006).
Avenula sulcata (Gay ex Boiss.) Dumort.
Biscutella intermedia subsp. *gredensis* (Guinea) Malag.
Carex nigra subsp. *iberica* Rivas Mart.
Digitalis purpurea subsp. *carpetana* (Rivas Mateos) Rivas Mart., Fern.Gonz. & Sánchez Mata
Festuca curvifolia Lag. ex Lange
Festuca marginata subsp. *braun-blanquetii* Fuente, Ortuñez & L.M. Ferrero
Festuca rivas-martinezii Fuente & Ortuñez
Festuca summilusitana Franco & Rocha Afonso
Galium spurium subsp. *aparinella* (Lange) Rivas Mart. & Castrov.
Hieracium vahlii subsp. *myriadenum* (Boiss. & Reut.) Zahn
Juncus alpinoarticulatus subsp. *alpestris* (Hartm.) Hämet-Ahti
Koeleria caudata subsp. *crassipes* (Lange) Rivas Mart.
Leontodon hispidus subsp. *bourgaeanus* (Willk.) Rivas Mart. & Sáenz de Rivas
Leucanthemopsis pallida subsp. *alpina* (Boiss. & Reut.) Rivas Mart., Fern.Gonz. & Sánchez Mata
Luzula campestris subsp. *carpetana* Rivas Mart.
Minuartia recurva var. *bigerrensis* (Pau) Font Quer
Plantago alpina subsp. *penyalarensis* (Pau) Rivas Mart.
Plantago radicata Hoffmanns. & Link (=*P. holosteum* Scop.)
Poa fontqueri Braun-Blanq.
Poa nemoralis subsp. *glauca* (Rouy) Gaud.
Sempervivum vicentei subsp. *paui* Fern.Casas
Senecio pyrenaicus subsp. *carpetanus* (Willk.) Rivas Mart. 206
Silene boryi subsp. *penyalarensis* (Pau) Rivas Mart.
Silene ciliata subsp. *elegans* (Link ex Brot.) Rivas Mart.
Solidago virgaurea subsp. *fallit-tirones* (Font Quer) Rivas Mart., Fern.Gonz. & Sánchez Mata
Thymus praecox subsp. *penyalarensis* (Pau) Rivas Mart., Fern.Gonz. & Sanchez Mata
Veronica fruticans subsp. *cantabrica* M. Laínz

References

Fernández-González, F. 1991. La vegetación del valle del Paular (Sierra de Guadarrama, Madrid), I. Lazaroa 12: 153–272.

Gavilán R. 2005. The use of climatic parameters and indices in vegetation distribution. A case study in the Spanish Sistema Central. Int. J. Biomet. 50(2): 111–120.

Gavilán, R. & Fernández-González, F. 1997. Climatic discrimination of Mediterranean broad-leaved sclerophyllous and deciduous forests, in Central Spain. J. Veg. Sci. 8: 377–386.

Gavilán, R., Sánchez-Mata, D., Rubio, A. & Escudero, A. 2002. Spatial structure and interspecific interactions in Mediterranean high mountain vegetation (Sistema Central, Spain). Israel J. Plant Sci. 50(3): 217–228.

Gutiérrez-Girón, A. & Gavilán, R.G. 2010. Spatial patterns and interspecific relations analysis help to better understand species distribution patterns in a Mediterranean high mountain grassland. Plant Ecol. 210: 137–151.

Jiménez-Alfaro, B, Gavilán R.G., Escudero, A., Iriondo, J.M. & Fernández-González F. 2014. Decline of dry grassland specialists in Mediterranean high-mountain communities influenced by recent climate warming. J. Veg. Sci. 25: 1394–1404.

Rivas-Martínez, S. 1963. Estudio de la vegetación y flora de las sierras de Guadarrama y Gredos. An. Inst. Bot. Cavanilles 21: 5–325.

Rivas-Martínez, S. et al. 1990. Vegetación de la Sierra de Guadarrama: Guía geobotánica de la Excursión de las II Jornadas de Taxonomía Vegetal (Madrid, 27-V-1990). Itinera Geobot. 3: 3–132.

Rivas-Martínez, S. et al. 1999. Villalba-Benavente (19 July). Synopsis of the Sierra de Guadarrama vegetation. Itinera Geobot. 13: 189–206.

Excursion 2. Landscapes on Miocene bedrock in southeastern Madrid province

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Itinerary (Figure 1) and distances (approx. km)

1. Madrid – 2. Yepes - Huerta de Valdecarábanos (70 km) – 3. El Salobral de Ocaña (16 km) – 4. Morata de Tajuña (26 km, lunch) – 5. Nuevo Baztán, Olmeda de las Fuentes (22 km) – 1. Madrid (46 km)

-Altitudinal interval: (450)-550-(730) m asl
-Bioclimatic framework (Rivas-Martínez & al., 2017):
-Thermotype : upper mesomediterranean
-Ombrotypes: lower dry to lower subhumid

Figure 1. Itinerary of the EVS 2019 field trip in the S and SE Madrid landscapes.

The itinerary for this excursion has been designed to show the natural vegetation and relief of the landscape in the territories located to the south and east of Madrid, along with the ones proper to the autonomous community.

The areas intended for this visit comprise the landscapes representative of the Spanish/Castillian depression in the Tajo river basin. Here, sediments have accumulated between the Miocene and Pliocene from eroded materials of adjacent areas. In the specific case of the eastern territories, these sediments come from the Iberian mountains, explaining the predominance of calcareous deposits. In turn, the badlands (600-700 m asl) located in the east area of the Community of Madrid feature fragile tabular substrates such as marls, gypsum and clays, and crowned by pontian hard limestones of continental facies, mainly of horizontal structure. These badlands have been spalled by the fluvial network flowing through the countryside, and are the natural areas for cottonwoods, oaks and willows; though, nowadays, the natural vegetation of these areas has been greatly altered due to the proliferation of orchards and croplands.

The Tajo depression in Spain encompasses sizeable basal formations of evaporitic substrates, mainly gypsum and gypsum marls from the Miocene, creating a typical post-alpine landscape. This landscape entails gentle hills greatly susceptible to erosion, with numerous gully formations and basal deposits given the very fragile lithological materials that constitute them.

In the south of Madrid, we find a dry mesomediterranean landscape with gypsum marls, crystalline gypsum deposits and green clays as main substrates. Areas surrounding Madrid (i.e. Vallecas, Villaverde, Vicálvaro, Cerro Negro), representative of the aforementioned landscape, have been subject of interest to naturalists and botanists to studying the biodiversity within these biomes.

Our itinerary includes two contrasting habitats, to be visited throughout the day. First, in the morning we will visit the limits of the Community of Madrid with Castilla-La Mancha (Yepes, Huerta de Valdecarábanos and 'El Salobral de Ocaña'), allowing us to study the plant communities exclusive of the endorheic depressions. In these, the vegetation is scarce or testimonial, being the seral communities the main vegetation type present in these landscapes. As for the permanent plant communities, they feature the dominant species found in saline soils. In the context of conservation ecology, most of the vegetation types inhabiting these endorheic depressions from La Mancha constitute vulnerable natural habitats, with great value for biodiversity (European Commission 1992, 2003; Rivas-Martínez & al. 2001, 2011). Hence, these have been designated as protected habitats by the European Union under the Castilian-Manchego network for protected areas. In addition, 'El Saboral de Ocaña' has been acknowledged as a natural micro-reserve in Castilla-La Mancha (Decreto 291/2003 D.O.C.M. 156).

In the afternoon we will visit the area of Nuevo Baztán, which evokes those landscapes of calcareous badlands. In this site, we will study the potential vegetation of the area (i.e. Castillian oak woodlands -'encinares'- and eastern oak woodlands -'quejigares'- inhabiting calcareous substrates), intact until this day, together with the ensemble of seral communities present in the area. This section of the excursion includes a walking tour through the 'Senda de Valmores', going from Nuevo Baztán and ending in 'Valle del Arroyo de la Vega' in Olmeda de las Fuentes.

Taxonomic nomenclature follows Euro+Med PlantBase (accesed July 31, 2019); the exceptions include their authorities. Syntaxonomical units follow the proposals or Rivas-Martínez & al. (2001, 2011).

Mainland salt marshes: 'SALADARES DE YEPES' and 'EL SALOBRAL DE OCAÑA*

Two excellent examples of endorheic basins with saline substrates, where the seasonal rainfall dictates the water regimes, regarded as the key factor driving plant development. Moreover, the water regimes also mediate the maintenance of the seral stages substituting the natural vegetation in the area.

I. Vegetation on saline soils (Figure 5)

Ia. Potential vegetation (forest formations)

-Open woodlands structured by 'tarays' on saline soils (*Tamaricetum canariensis*)

-Tamaricetum canariensis, 200 m^2 (elaborated from Laorga 1986): V *Tamarix canariensis*, II *Tamarix africana*, III *Atriplex halimus*, II *Althaea officinalis*, II *Asparagus acutifolius*, II *Rubia tinctorum*, II *Bryonia dioica*

Ib. Seral plant communities

-Fruticose communities: *Suaedion braun-blanquetii* alliance (*Suaedo braun-blanquetii-Arthrocnemetum macrostachyi* -'sapinales'- and *Puccinellio fasciculatae-Suaedetum braun-blanquetii*)

-***Suaedo braun-blanquetii-Arthrocnemetum macrostachyi*** – Huerta de Valdecarábanos, Saladares de Yepes, 100 m^2: 5 **Arthrocaulon* (*Arthrocnemum*) *macrostachyum*, 1 ***Suaeda braun-blanquetii*, 1 *Juncus maritimus*, 1 *Aeluropus littoralis*, 1 *Frankenia thymifolia*, + *Suaeda vera* (Fig. 2)

* *Arthrocaulon macrostachyum* (Moric.) Piirainen & Kadereit
** *Suaeda braun-blanquetii* (Pedrol & Castrov.) Rivas Mart., Cantó & Sánchez-Mata

-Puccinellio fasciculatae-Suaedetum braun-blanquetii (elaborated from Águila 1982 and Laorga 1986), 100 m^2: V *Suaeda braun-blanquetii*; V, II *Puccinellia stenophylla*; I *Frankenia thymifolia*; I, II *Arthrocaulon* (*Arthrocnemum*) *macrostachyum*; I *Juncus maritimus*; III, I *Limonium latebracteatum*; II, II *Suaeda maritima*; II *Spergularia marina*; III, II *Aeluropus littoralis*; II *Hordeum marinum*; II, I *Salicornia* aff. *patula*; II *Atriplex halimus*; I *Juncus subulatus*; I *Frankenia thymifolia*; I *Plantago maritima*; I *Spergularia salina*; I *Festuca fenas*

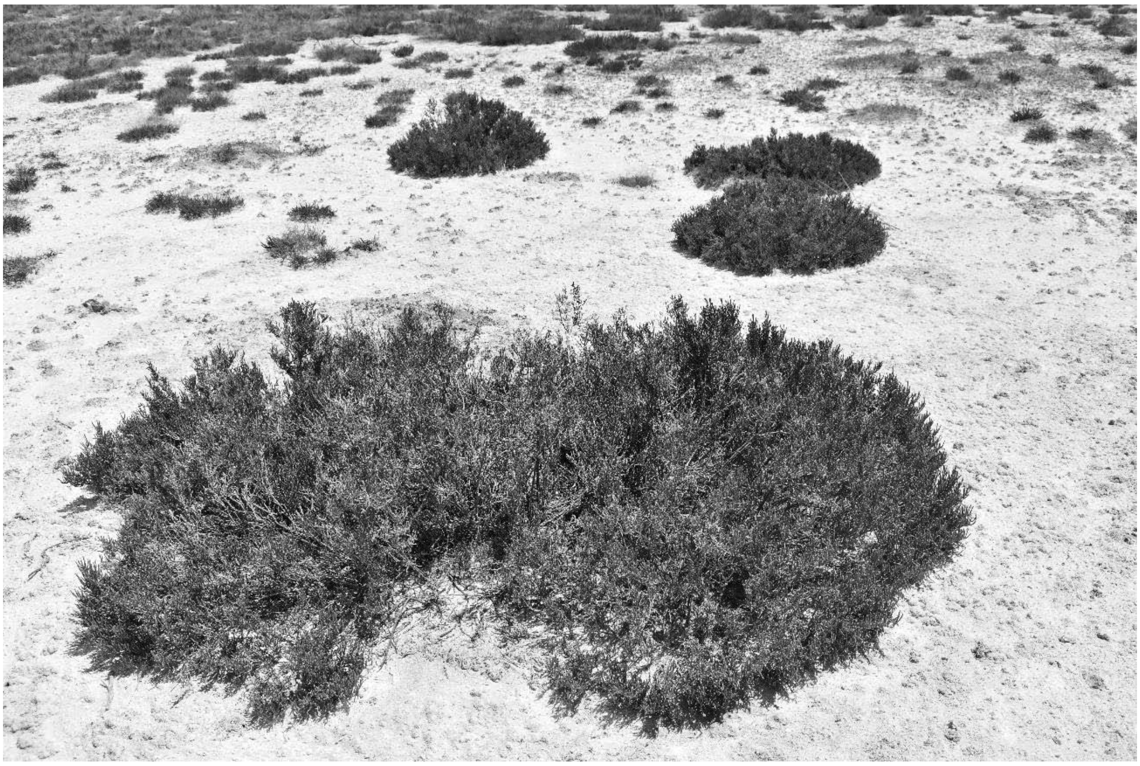

Figure 2. *Suaedo braun-blanquetii-Arthrocnemetum macrostachyi* (Chinchón, Madrid).

-Reedbeds, 'juncales': *Elymo curvifolii-Juncetum maritimi, Aeluropodo littoralis-Juncetum subulati, Bupleuro tenuissimi-Juncetum gerardi*

-Halophile perennial tall-grass formations, 'albardinares': *Senecioni auriculae-Lygeetum sparti* (Figure 3)

-***Senecioni auriculae-Lygeetum sparti*** (elaborated from Águila 1982 and Laorga 1986) 100 m^2: V, V *Lygeum spartum*; V, . *Jacobaea auricula*; V, II *Limonium dichotomum*; V, II *Sonchus crassifolius*; IV, II *Schoenus nigricans*; IV, II *Limonium latebracteatum*; IV, . *Lepidium cardamines*; II, V *Elytrigia curvifolia*; IV, . *Aeluropus littoralis*; III, II *Juncus maritimus*; III, . *Sonchus maritimus*; III, . *Asphodelus cerasiferus*; IV, . *Polypogon monspeliensis*; II, . *Scirpoides holoschoenus*; II, . *Dittrichia viscosa*; ., II *Atriplex halimus*

-Hemicriptophytic and perennial grass formations: *Schoeno nigricantis-Plantaginetum maritimae*, Frankenio *thymifoliae-Limonietum latibracteato* y *Puccinellietum lagascanae*

Figure 3. *Senecioni auriculae-Lygeetum sparti* and *Microcnemetum coralloidis* (Chinchón, Madrid).

II. Permanent vegetation (Figure 5)

-Aquatic communities on brackish waters: *Ruppietum maritimae*

-Halophile tall-grass and reedbeds formations: *Typho angustifoliae-Schoenoplectetum tabernaemontani* y *Bolboschoeno compacti-Schoenoplectetum litoralis*

-Halophile terophytic ephemeral and pioneer communities on saline soils: *Suaedo splendentis-Salicornietum patulae* y *Microcnemetum coralloidis* (Fig. 3 and 4)

-***Suaedo splendentis-Salicornietum patulae*** (elaborated from Águila 1982 and Laorga 1986) 20 m^2: V, V *Salicornia* aff. *patula*; V, III *Suaeda splendens*; IV, . *Hordeum marinum*; II, I *Puccinellia stenophylla*; I, . *Frankenia laevis*; ., I *Atriplex patula*; ., III *Aeluropus littoralis*; ., II *Puccinellia fasciculata*; ., I *Suaeda maritima*; ., I *Polypogon maritimum*; ., I *Spergularia salina*

-***Microcnemetum coralloidis*** (elaborated from Águila 1982 and Laorga 1986) 4 m^2: V,V *Microcnemum coralloides*; II, II *Salicornia* aff. *patula*; III, II *Aeluropus littoralis*; III, II *Suaeda maritima*; II,. *Puccinellia stenophylla*; II., *Limonium latebracteatum*; I., *Suaeda braun-blanquetii*; I, . *Elytrigia curvifolia*

Figure 4. *Suaedo splendentis-Salicornietum patulae* (Chinchón, Madrid).

III. Halo-nitrophilous plant communities

-Fruticose formations: *Salsolo vermiculatae-Peganetum harmalae, Artemisio herbae-albae-Frankenietum thymifoliae*, *Limonio dichotomi-Atriplicetum halimi.*

-Annual plant communities: *Atriplici roseae-Salsoletum ruthenicae, Parapholido incurvae-Frankenietum pulverulentae, Polypogono maritimi-Hordeetum marini, Suaedo splendentis-Salsoletum sodae*.

IV. Remarkable nitrophilous vegetation

-Thistle communities (‘cardales’) and megaforbs on disturbed enriched soils: *Onopordetum nervosi*, *Carduo bourgaeani-Silybetum mariani* y *Resedetum suffruticosae* (Figure 6)

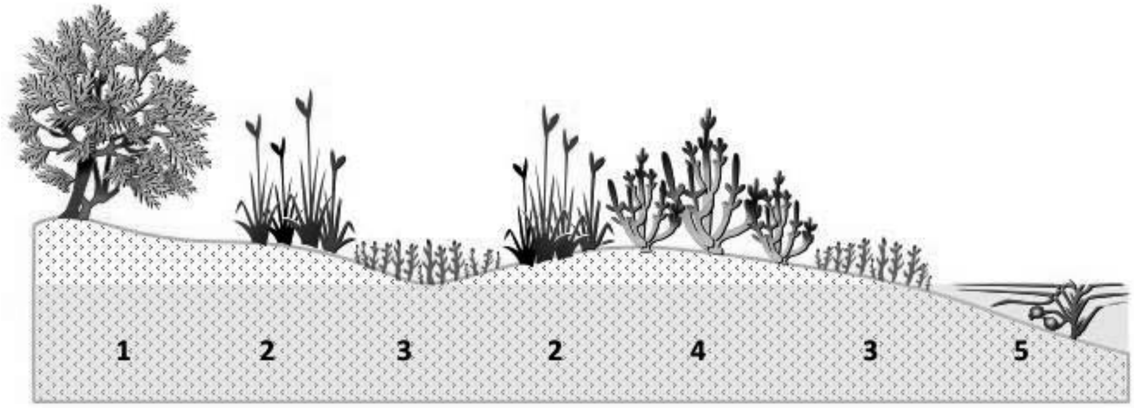

Figure 5. Catena of ‘El Salobral de Ocaña’ (Toledo): 1. *Tamaricetum canariensis,* 2. *Senecioni auriculae-Lygeetum sparti*, 3. *Microcnemetum coralloidis* and *Suaedo splendentis-Salicornietum patulae,* 4. *Suaedo braunblanquetii-Arthrocnemetum macrostachyi*, 5. *Ruppietum cirrhosae.*

-***Resedetum suffruticosae*** (elaborated from Laorga 1986) 20 m^2: V *Reseda suffruticosa*, II, *Asphodelus ramosus*, II *Helianthemum squamatum*, II *Lepidium subulatum*, II *Artemisia herba-alba*, II *Eruca vsesicaria*, II *Frankenia thymifolia*, I *Thymus sylvestris*, I *Sedum gypsicola*, I *Thymus lacaitae* (Figure 6).

-Shrub communities: *Rubio tinctorum-Sambucetum ebuli.*

-Megaforb nitrophilous vegetation: *Galio aparines-Conietum maculati.*

-Communities on clay compacted soils: *Coronopodo procumbentis-Sclerochloetum durae.*

NUEVO BAZTÁN –‘SENDA DE VALMORES’ – VALLE DEL ARROYO VEGA – OLMEDA DE LAS FUENTES

I. Potential forest vegetarion on calcareous soils (Figure 8)

Climatophilous woodland formations

-Castillian oak woodlands, ’encinares’: *Asparago acutifolii-Quercetum rotundifoliae* (Figure 7).

Figure 6. *Resedetum suffruticosae* (Titulcia, Madrid).

-Eastern oak woodlands ('quejigares'): *Cephalantehro rubrae-Quercetum fagineae* (Figure 7).

-Hygro-edaphic and riparian forests.

-Elm woodlands ('olmedas'): *Opopanaco chironii-Ulmetum minoris.*

-Cottonwood formations ('choperas'): *Rubio tinctorum-Populetum albae.*

Figure 7. *Asparago acutifolii-Quercetum rotundifoliae* and *Cephalanthero-Quercetum fagineae* (Nuevo Baztán, 'Valmores trail', Madrid).

II. Calciphilous seral shrub formations (Figure 8)

-Kermes oak woodlands ('coscojares'): *Daphno gnidii-Quercetum cocciferae.*

*-**Daphno gnidii-Quercetum cocciferae*** (elaborated from Águila, 1982) 200 m^2: V *Quercus coccifera,* V *Jasminum fruticans,* IV *Rhamnus lycioides,* IV *Asparagus acutifolius,* II *Ephedra major,* V *Carex hallerana,* V *Rosmarinus officinalis,* III *Klasea pinnatifida,* V *Asphodelus cerasiferus,* V *Thymus sylvestris,* V *Teucrium polium,* III *Staehelina dubia,* III *Lithodora fruticosa,* III *Helianthemum violaceum,* II *Macrochloa tenacissima,* II *Cachrys trifida,* I *Thapsia villosa,* II *Iberis cinerea,* II *Reseda stricta.*

-Sera tall-grass communities: 'atochares', *Arrhenathero erianthi-Stipetum tenacissimae*; 'lastonares', *Irido chamaeirido-Brachypodietum retusi*; 'albardinares', *Dactylido hispanicae-Lygeetum sparti.*

-Grass formations: 'majadales', *Poo bulbosae-Astragaletum sesamei*; 'gramales', *Trifolio fragiferi-Cynodontetum dactyli* and 'fenalares': *Agropyro-Brachypodietum phoenicoidis.*

-Broom formations: *Genisto scorpii-Retametum sphaerocarpae* ('retamares'), *Lino differentis-Salvietum lavandulifoliae* ('salviares') and *Cisto clusii-Rosmarinetum officinalis* ('romerales').

-Reedbeds, 'juncales': *Cirsio-Holoschoenetum vulgaris* y *Holoschoeno-Juncetum acuti.*

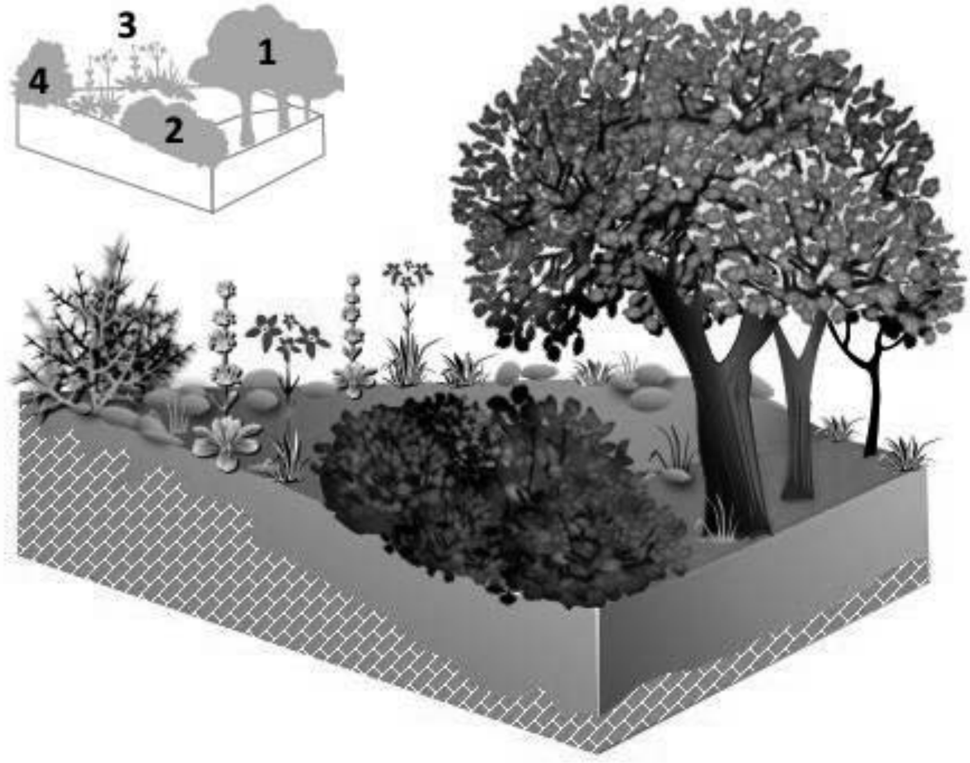

Figure 8. Transect of ‘Valmores trail’ (Nuevo Baztán, Madrid): 1. *Cephalanthero-Quercetum fagineae*, 2. *Daphno gnidii-Quercetum cocciferae*, 3. *Lino differentis-Salvietum lavandulifoliae*, 4. *Genisto scorpii-Retametum sphaerocarpae*.

III. Gypsophilous vegetation

-Nano-therophytic pioneer ephemeral communities growing on gipsy soils: *Chaenorhino reyesii-Campanuletum fastigiatae.*

-Gypsicolous scrub: ***Gypsophilo struthii-Centaureetum hyssopifoliae*** (elaborated from Águila, 1982) 100 m^2: V *Gypsophila struthium*, V *Centaurea hyssopifolia*, V *Helianthemum squamatum*, V *Lepidium subulatum*, V *Thymus sylvestris*, V *Asphodelus albus*, IV *Thapsia villosa*, III *Lithodora fruticosa*, III *Teucrium capitatum*, III *Helianthemum violaceum*, II *Thymus lacaitae*, II *Koeleria castellana*, II *Herniaria fruticosa*, II *Launea fragilis*, II *Asteriscus aquaticus*, II *Iberis cinerea*, II *Sixalix atropurpurea*, II *Teucrium pseudochamaepitys*, II *Sedum gypsicola*, II *Cachrys trifida*, II *Stipa iberica*.

-Communities on crystalline gyosum crusts: ***Herniario fruticosae-Teucrietum pumili*** (elaborated from Águila, 1982) 0,5 m^2: V *Teucrium pumilum*, V *Herniaria fruticosa*, V *Koeleria castellana*, V *Helianthemum squamatum*, V *Centaurea hyssopifolia*, V *Lithodora fruticosa*, V *Thymus sylvestris*, III *Lepidium cardamines.*

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Bibliography

Águila, C. 1981. Datos florísticos sobre la comarca de "El Salobral" (Toledo, España). Lazaroa 3: 341-343.

Águila, C. 1982. Flora y vegetación de la cuenca endorreica de la comarca de "El Salobral" (Toledo). Memoria de Licenciatura. Facultad de Farmacia. Universidad Complutense. 189 pp. Madrid.

Diario Oficial Castilla-La Mancha (D.O.C.M.). 2003. Decreto 291/2003, de 14-10-2003, por el que se declara la Microrreserva Salobral de Ocaña en los términos municipales de Ocaña y Ontígola en la provincia de Toledo. D.O.C.M. 156, Fascículo 3: 17563-17566.

Euro+Med. 2006. Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. Published on the Internet http://ww2.bgbm.org/EuroPlusMed/ [accessed July 31, 2019]

European Commission. 1992. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora: pp. 7-50. Official Journal of the European Communities L206, 22.7.92.

European Commission. 2003. Interpretation manual of European Union Habitats. Eur 25.

Ignacio, J., Fuente, J. de la, Lorente, M., Sardinero, S. Pérez Badia, R. & Fernández-González, F. 2010. Cartografía de la vegetación del Salobral de Ocaña y de la Laguna del Altillo Chica (Toledo). II Congreso de la Naturaleza de la Provincia de Toledo: pp. 289-294. Diputación Provincial. Toledo.

Laorga Sánchez, S. 1986. Estudio de la flora y vegetación de las comarcas toledanas del tramo central de la cuenca del Tajo. Memoria doctoral. Facultad de Farmacia. Universidad Complutense. 449 pp. Madrid.

Peinado Lorca, M., Monje Arenas, L., Martínez Parras, J.M. 2008. El paisaje vegetal de Castilla-La Mancha. Manual de Geobotánica. Ed. Cuarto Centenario. Junta de Comunidades de Castilla-La Mancha. 610 pp. Toledo.

Rivas-Martínez S., Fernández-González F., Loidi J., Lous M. & Penas A. 2001. Syntaxonomical Checklist of vascular plant communities of Spain and Portugal to association level. Itinera Geobotanica 14: 5-341.

Rivas-Martínez, S. & al. 2011. Mapa de series, geoseries y geopermaseries de vegetación de España [Memoria del mapa de vegetación potencial de España, 2011]. Parte II. Itinera Geobotanica 18(1): 5-424.

Rivas-Martínez, S., Penas, Á., del Río, S., Díaz González, T.E. & Rivas Sáenz, S. 2017. Bioclimatology of the Iberian Peninsula and Balearic Islands. In: J. Loidi (ed.). The Vegetation of the Iberian Peninsula 1: 29-80. Plant and Vegetation 12 (2 vols.). Springer.