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Information form for new application for the European Diploma for Protected Areas

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Information form for Candidate Sites

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Site code (to be given by the Council of Europe)								

1. Site identification

1.1. Site name

PARQUE NACIONAL, PARQUE NATURAL Y RESERVA DE LA BIOSFERA DE SIERRA NEVADA

(SIERRA NEVADA NATIONAL PARK, NATURE PARK AND BIOSPHERE RESERVE)

1.2. Country	ESPAÑA							
1.3. Date of application								
1.4. Site information compilation date								
	Y	**Y**	**Y**	**Y**	**M**	**M**	**D**	**D**

1.5. Addresses: administrative authorities

National authority	Regional authority	Local authority
Name: Organismo Autónomo de Parques Nacionales. Ministerio de Transición Ecológica y Reto Demográfico Address: C/ Hernani 59. 18071 Madrid (ESPAÑA-SPAIN) Tel.: +34 91 5468110 & +34 91 5468113 Fax:+34 915468174 E-mail: oapn@oapn.es	Name: Consejería de Sostenibilidad, Medio Ambiente y Economía Azul. Address: Avda. Manuel Siurot 50. 41013 Sevilla (ESPAÑA-SPAIN) Tel.: +34 954544438 Fax.: +34 955003775 E-mail:	Name: Address: Tel. Fax: E-mail:

1.6. Addresses: site authorities

Site manager	Site information centre	Council of Europe contact
Name: Francisco de Asís Muñoz Collado. Director. Address: Carretera Antigua a Sierra Nevada km 7. 18191 Pinos Genil (Granada – SPAIN) Tel.+34 958980241 Fax: +34 958941041 E-mail: franciscoa.munoz@juntadeandalucia.es	Name: Centro Administrativo del Parque Nacional y Parque Natural de Sierra Nevada Address: Carretera Antigua a Sierra Nevada km 7. 18191 Pinos Genil (Granada – SPAIN) Tel.: +34 958 980238 & +34 600169305 Fax: +34 958941041 E-mail: pnSierraNevada.csmaea@juntadeandalucia.es	Name: Address: Tel..... Fax..... E-mail.....

1.7. Summary description

Basic data:

- **Location**: Almería and Granada provinces. Andalusia Autonomous Community
- **Surface area**: 172.238 ha
    - National Park: 85.883 ha.
    - Nature Park: 86.355 ha
- **Perimeter**: 1.350 km
- **Municipalities**: A total of 60 (37 in Granada and 23 in Almería)
- **Inhabitants**: 98.368 (2022):
    - Inside the protected area: 9.837
    - Outside the protected area: 88.531
- **Highest elevation**: Mulhacén peak (3.479 m.a.s.l.)
- **Lowest elevation**: junction of rivers Andarax and Nacimiento: 262 m.a.s.l.

Sierra Nevada is a mountain range 94 km long and 15-30 km wide, located SE to the Iberian Peninsula, very close to the Mediterranean coast (about 60 km in a straight line). It contains the highest peaks of the Iberian Peninsula: Mulhacén (3.479 meters above sea level) and Veleta (3.392 m.a.s.l.), only exceeded at European scale by the French Alps (Mont Blanc, 4.810 m.a.s.l.).

The geological origin of Sierra Nevada is very complex, being the result of the collision between the Euro-Asian and the African tectonic plates, in a still active process. In the high summits the geologic strata placed above the tectonic layer have been eroded. At present the land is formed by materials from the Palaeozoic and Mesozoic Ages, mainly micaschists and quartzites, very fragmented by the action of frost weathering. Carbonated materials like dolomite and limestone can be found in lower elevations forming the so-called carbonated belt, very rich in endemic plants adapted to the lime and to the magnesium of the dolomite. The geological origin and evolution of Sierra Nevada explain the great importance of its geological resources, some of which are extremely rare, like the ultramafic rocks with pseudo-spinifex structure.

Its vast protected area (over 172.000 hectares) includes exceptional natural values. Its strategic position, midway to the Mediterranean Sea and the Atlantic Ocean, and between the Palaearctic and Palaeotropical worlds, makes it into a crossroad of multiple wildlife migrations throughout time and space.

Its orientation East-West determines a strong contrast between slopes north and south. Along with Its great range of elevations (3.217 m between the lowest and the highest), both factors give rise to a high biodiversity, owing to the countless transitions and ecological borders, allowing that a great deal of animal and plant species can find their optimum or sub-optimum habitats.

During the quaternary glaciations many alpine species spread across these mountains and many of them can still be found or undergo a speciation process. To a great extent, it explains the high degree of endemicity of the highest peaks (about 40 %), one of the largest in Europe. Similarly, during arid periods of the Tertiary, when Iberia and Africa were communicated by land, many plant and fauna species from the Middle East and North Africa migrated to these territories, some of them still surviving in suitable habitats. This is why Sierra Nevada hosts Alpine, African,

Atlantic, and mid-Eastern elements. Since their arrival, many of these taxa are experiencing processes of speciation and differentiation from their original ancestor.

Sierra Nevada is considered a hotspot of biodiversity within the Mediterranean Basin biodiversity hotspot, recognised by Conservation International [1] at world scale. An inventory of the biodiversity described so far has been compiled. A total of 9.241 taxa of fauna and flora have been described to date. The group with the greatest contribution to the biodiversity of Sierra Nevada are arthropods (42.8% of all taxa, with 3.959 species) most of them, insects (95,7% of all arthropods, with 3.787 species). Vascular plants (tracheophytes) have also a considerable contribution (25,5%, with 2.356 species) and within these, the dicotyledonous contribute with the largest number of taxa (78,9% of all vascular plants, with 1.860 species). Fungi (including lichens) are the next most important group (16,1%). Algae (4,0%), bryophytes (4,1%), vertebrates (2,8%), nematodes (3,1%), molluscs (0,9%) and myxomycetes (0,7%) are groups with lesser known diversity in relation to those discussed above. The degree of endemicity is one of the most characteristic features of the biological communities of Sierra Nevada. In this sense, regarding plants, among the 2.356 native taxa, 82 are endemic of Sierra Nevada and 100 are endemic of the southeast Iberian mountains. Additionally, 169 species of arthropods are considered endemic of Sierra Nevada.

Above all, Sierra Nevada is the paradigm of the Mediterranean Mountain. Nearly all the bio-climatic belts described for the Mediterranean Region are represented in Sierra Nevada. From the lowest sectors upwards, five belts may be found: thermo-Mediterranean in the Almeria arid lands, followed by meso-Mediterranean, supra-Mediterranean, oro-Mediterranean and cryoro-Mediterranean belt in the summits. Only the infra-Mediterranean belt, typical of the desert areas very rare in Spain, is not represented in Sierra Nevada.

Sierra Nevada is legally protected. The first protection category granted was its declaration as Biosphere Reserve in 1986. Shortly after, the Regional Government enacted the Law 2/1989 on the Inventory of Natural Protected Areas in Andalusia by which the mountain range was declared Nature Park (IUCN Category V), with 140.200 ha. The importance and the good state of conservation of its natural values led to the declaration of higher mountain areas as National Park (IUCN Category II) by means of the National Law 3/1999. The two protection categories co-exist, in agreement with the philosophy of MaB Biosphere Reserves: The National Park acts as the Nuclear zone, most of the Nature Park as the Buffer zone and the most altered area of Nature Park as the Transition zone.

In 2007 the Regional Government (Junta de Andalucía) enacted a Decree declaring the Sierra Nevada Natural Space as a unitary management entity, integrated by the National Park and the Nature Park, maintaining each Park its own legal regulation.

Besides its protection status according to the national legislation, Sierra Nevada has also other international designations:

- Ramsar Site “Turberas y Humedales del Padul” (Padul peatbogs and wetlands) since 2006
- Special Protection Area (Birds Directive) since 2002. Natura 2000 code ES6140004
- Special Area of Conservation (Habitats Directive) since 2012. Natura 2000 code ES6140004
- Area of Special Conservation Interest (ASCI) of the Emerald Network under the Bern Convention
- IUCN Green List of well managed protected areas, since 2014. At present the renewal process is about to conclude.

[1] https://www.conservation.org/priorities/biodiversity-hotspots#:~:text=Around%20the%20world%2C%2036%20areas%20qualify%20as%20hotspots

1.8. European interest justifying the application

1.8.1 – Occurrence of fauna species listed in Annexes of the Birds and the Habitats Directives

A total of 182 bird species have been registered in Sierra Nevada. All of them are either sedentary, nesting or wintering. In other words, species using Sierra Nevada exclusively as stopover are not considered in this list. A total of 48 species inventoried are included in the Directive 2009/147/EC on the conservation of wild birds. Of them, 28 are listed in Annex I, 4 in Annex II A, 14 in Annex II B and 2 in Annex III:

Species	Annex I	Annex IIA	Annex IIB	Annex III
Alcedo atthis	X			
Anthus campestris	X			
Aquila chrysaetos	X			
Aquila fasciata	X			
Asio flammeus	X			
Bubo bubo	X			
Bucanethes githagineus	X			
Calandrella brachydactyla	X			
Caprimulgus europaeus	X			
Circaetus gallicus	X			
Circus aeroginosus	X			
Columba oenas				X
Columba palumbus				X
Coracias garrulus	X			
Coturnix coturnix			X	
Egretta garzetta	X			
Emberiza hortulana	X			
Falco peregrinus	X			
Fulica atra		X		
Galerida theklae	X			
Gallinago gallinago		X		
Gallinula chloropus			X	
Garrulus glandarius			X	
Gypaetus barbatus	X			
Gyps fulvus	X			
Hieraaetus pennatus	X			
Himantopus himantopus	X			
Lullula arborea	X			
Luscinia svecica	X			
Lymnocriptes minimus		X		
Melanocorypha calandra	X			
Oenanthe leucura	X			
Pica pica			X	
Porzana porzana	X			
Pyrrhocorax pyrrhocorax	X			
Rallus aquaticus			X	
Scolopax rusticola		X		
Straptopelia decaocto			X	
Straptopelia turtur			X	
Suturnus vulgaris			X	
Sylvia undata	X			

Tringa glareola	X			
Turdus iliacus			X	
Turdus merula			X	
Turdus philomelos			X	
Turdus pilaris			X	
Turdus viscivorus			X	
Vanellus vanellus			X	

As regards the species listed in Annex II of the Directive 92/43/EEC on the conservation of natural habitats and of fauna and flora, a total of 9 species of vertebrate fauna have been recorded in Sierra Nevada: 7 species of bats, 1 reptile and 1 amphibian. Moreover, 15 taxa are listed in the Annex IV (strict protection), in two cases being also in Annex II. As far as the 8 invertebrate species listed are concerned, 5 are listed in Annex II and 6 in Annex IV:

Species	Class	Habitats Dve. Annex II	Habitats Dve. Annex IV
Bufo calamita	Amphibia		X
Discoglossus jeannae	Amphibia	X	X
Chalcides bedriagai	Reptilia		X
Coronella austriaca	Reptilia		X
Hemorrhois hippocrepis	Reptilia		X
Mauremys leprosa	Reptilia	X	X
Felis sylvestris	Mammalia		X
Hypsugo savii	Mammalia		X
Miniopterus schreibersi	Mammalia	X	
Myotis blythii	Mammalia	X	
Myotis capaccinii	Mammalia		X
Myotis daubentonii	Mammalia		X
Myotis emarginatus	Mammalia	X	
Myotis escalerai	Mammalia		X
Myotis myotis	Mammalia	X	
Pipistrellus kuhlii	Mammalia		X
Pipistrellus pipistrellus	Mammalia		X
Pipistrellus pygmaeus	Mammalia		X
Plecotus austriacus	Mammalia		X
Rhinolophus euryale	Mammalia	X	
Rhinolophus ferrumequinum	Mammalia	X	
Rhinolophus hipposideros	Mammalia	X	
Austropotamobius pallipes	Malacostraca	X	
Baetica ustulata	Insecta	X	X
Cerambyx cerdo	Insecta	X	X
Euphydryas aurinia	Insecta	X	
Macrothele calpeiana	Insecta		X
Parnassius apollo	Insecta		X
Polyommatus (Plebicula) golgus	Insecta	X	X
Proserpinus proserpina	Insecta		X

More detailed information can be found in section “3.4 Fauna”.

1.8.2 – Occurrence of flora species listed in Annex II of the Habitats Directive

A total of 15 Sierra Nevada plant species are listed in Annex II of the habitats Directive,

most of them considered “Endangered” or “Vulnerable” under the Bern Convention. Two more species are included in Annex IV (strict protection) of the Habitats Directive:

Species	Habitats Dve. -Annex II	Habitats Dve.-Annex IV
Arenaria nevadensis	II*	
Artemisia granatensis	II*	
Centaurea gadorensis	II	
Centaurea pulvinata	II	
Erigeron frigidus	II	
Erodium astragaloides	II*	
Erodium rupicola	II*	
Euphorbia nevadensis		IV
Festuca elegans		
Laserpitium longiradium	II*	
Leontodon boryi	II	
Leontodon microcephalus	II	
Moehringia fontqueri		
Narcissus nevadensis	II*	
Odontites granatensis	II	
Pinguicula nevadensis	II	
Santolina elegans		IV
Senecio elodes	II*	
Senecio nevadensis	II	

(*) – priority species

1.8.3 – Occurrence of habitat types listed in Annex I of the Habitats Directive

The inventory of the habitat types of Annex I of the Directive 92/43/EEC, on the conservation of natural habitats and of wild fauna and flora, existing in Sierra Nevada, amounts a total of 39. Of these, 7 are priority types:

1310 *Salicornia* and other annuals colonising mud and sand
1430 Halo-nitrophilous scrubs (*Pegano_salsoletea*)
1510* Mediterranean salt steppes (*Limonietalia*)
3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)
3140. Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
3150. Natural eutrophic lakes with *Magnopotamion* or *Hycrocharition*- type vegetation.
3170* Mediterranean temporary ponds.
3250. Constantly flowing Mediterranean rivers with *Glaucium flavum*
4030. European dry heaths
4060. Alpine and Boreal heaths
4090. Endemic oro-Mediterranean heaths with gorse
5110. Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (*Berberidion p.p.*)
5120 Mountanin *Cytisus purgans* formations.
5210 Arborescent matorral with *Juniperus spp*.
5330 Thermo-Mediterranean and pre-desert scrub.
6160. Oro-iberian *Festuca indigesta* grasslands.
6170. Alpine and subalpine calcareous grasslands.
6220* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*
6230* Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe).
6310 Dehesas with evergreen *Quercus spp*.

6420. Mediterranean tall humid herb grassland of the *Molinio-Holoschoenion*.
6430. Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels.
6510. Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*).
7210*. Calcareous fens with *Cladium mariscus* and species of the *Caridion davallianae*.
8130. Western Mediterranean and thermophilous scree.
8210. Calcareous rocky slopes with chasmophytic vegetation.
8220. Siliceous rocky slopes with chasmophytic vegetation.
8310. Caves not open to the public
91B0. Thermophilous *Fraxinus angustifolia* woods.
91E0*. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)
9230. Galicio-Portuguese oak woods with *Quercus rubur* and *Quercus pyrenaica*.
9240. *Quercus faginea* and *Quercus canariensis* Iberian woods
9260. *Castanea sativa* woods.
92A0. *Salix alba* and *Populus alba* galleries
92B0. Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others
92D0. Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)
9340. *Quercus ilex* and *Quercus rotundifolia* forests
9530* (Sub-) Mediterranean pine forests with endemic black pines.
9540. Mediterranean pine forests with endemic Mesogean pines.

1.8.4 – Monitoring the effect of the climate change: the Sierra Nevada Observatory of Global Change

The Sierra Nevada Global Change Observatory (https://obsnev.es/en/) is an innovative joint institutional initiative whereby the scientific community (coordinated by a Professor of Ecology of the University of Granada) and the decision makers responsible for the management of the Sierra Nevada National Park and Nature Park, work together. The overall aim is to generate the necessary knowledge to be used in improving the strategies, programmes and projects for the long-term conservation of this protected area.

This initiative was born as a consequence of the participation in the UNESCO and European Union joint project GLOCHAMORE (GLObal CHAnge in MOuntain REgions) developed during the earliest years of 21st century. The basic aim was to establish guidelines to characterise the consequences of the climate change and other man-induced impacts on wild species, ecosystems and ecosystem services, in order to implement strategies, programmes, projects and measures to increase, as far as possible, their resilience to mitigate these impacts.

Once finished this project, the continuation of this fruitful cooperation between scientists and managers has given rise over time to the Sierra Nevada Observatory of Global Change, mostly financed by the regional authorities with the co-participation of the national authorities and the European Agricultural Fund for Rural Development (EU-EAFRD). At present a huge database called LINARIA and associated systems to obtain tailored information according to the needs of managers and other users, has been put in practise. The conceptual basis is a model for the implementation in other protected areas of Andalusia and beyond to organise the Andalusia Network of Observatories of Climate Change. This is a mandate of the recent Law 8/2018 on the Climate Change and Energy Transition, unanimously approved by the Andalusia Parliament.

A valuable product of this cooperation has been the book published by Springer Nature Switzerland “The Landscape of the Sierra Nevada: A Unique Laboratory of Global Processes in Spain” (R. Zamora & M. Oliva, 2022). This uncommon publication summarises and updates in 24 chapters the scientific knowledge achieved after decades of work and its application to the conservation and management of this exceptional protected area. A great panoply of scientists

and managers have selflessly cooperated in deploying for a wide range of readers the natural treasures and the cultural heritage of this incomparable mountain.

1.8.5 – Cultural heritage

Sierra Nevada is a territory historically occupied by the human being. The living conditions are often quite difficult in the mountains but also provide opportunities to supply food and shelter if the resources are wisely used. One of the most important testimonies of these abilities is the network of ancient irrigation channels locally called "*acequias*". The arrival of the Arabs to the Iberian Peninsula brought changes in many aspects and one of the most important ones was the agriculture. The abundance of water during ice and snow melting in spring and early summer prompted the initiative of building manually shallow and narrow channels following the contour lines of the mountains, to derive part of melting water for irrigation, very often quite far from the origin. This network dates back from the 8^{th}-16^{th} centuries and has been essential for the thriving irrigated agriculture in the mountains, in the Granada plain and in many other agricultural grounds surrounding Sierra Nevada.

The different cultures occupying Sierra Nevada have left many cultural testimonies. For a better description, see section "4.1 – Cultural heritage"

1.8.6 – Commitment with the socio-economic context

The Spanish model of National Parks considers essential the attention to the socio-economic context and establishes the so-called Socio-Economic Influence Zone, made up by all the Municipalities contributing with territory to the National Park and by extension to the Nature Park. In the case of Sierra Nevada there are 60, 37 in Granada and 23 in Almería. Among other measures, specific calls for subsidies exclusively for the Socio-Economic Influence Area are periodically made, in principle once per year. During the economic crisis these aids had to be interrupted, but at present these subsidies have been restarted to help the Municipalities to improve their infrastructures or financing activities. Moreover, the Participation Council has a prevalent presence of these Municipalities, represented by 10 Mayors rotating in periods of several years.

1.8.7 – Governance model

The governance model of Sierra Nevada and of protected areas at regional and national level are characterised by the following features:

- **Legal framework**. The conservation and management of Sierra Nevada is based on a robust statutory legislation, both at regional (Andalusian), at national and at international scale. The latter applies by the membership of Spain not only to the European Union but also to International Conventions like Ramsar, Bern or Biological Diversity.

- **Transparency and accountability**. The Administration of Sierra Nevada National Park and Nature Park makes every year two extraordinarily comprehensive reports, which are sent and discussed in the Participation Council mentioned below: the "Annual Report of Activities and Results" of the previous year and the "Advanced Annual Plan of Investments and Works" for the year after. Moreover the Administration of Sierra Nevada cooperates with the national authorities of the Autonomous Organism of National Parks in drafting the Annual Report of the national Network of National Parks. All these reports are available in the web pages of the concerned Administrations.

- **Public participation**. The public participation in the ordinary development of the works for

the Sierra Nevada conservation and management is guaranteed at least in three main ways:

- The Sierra Nevada National Park and Nature Park has a specific participatory organ with advisory role, in which all sectors of the Administrations, stakeholders of any kind, private owners and corporations involved, non-governmental organisations, and Municipalities are represented. This organ, called Participation Council, has its own specific regulation and its Plenary meets periodically, at least twice per year, for the discussion and approval (or rejection) of the "Advanced Annual Plan of Investments and Works" and the "Annual Report of Activities and Results", among the most important functions. Any person has a representative in the Participation Council who can express the issue in session and discuss it with all members. This organ also works in thematic Working Commissions, for example, Conservation and Research, Infrastructures or Water-related issues.

- There is specific legislation, both at regional and at national level, to guarantee that any person, stakeholder or legal entity may address their observations or complaints to the competent administration if they feel affected by the decisions. In addition to the ordinary ways to introduce the demands, there is a web portal where the citizens can communicate directly with the Department involved, with immediate acknowledgement of receipt. In any case there is obligation to get a motivated reply within a deadline.

- The Management Plans are periodically renewed and updated. The process is very comprehensive and includes several opportunities to participate in the draft, at the very least either during the Public Consultation Phase, open to any citizen/ organisation, or during the specific consultation open by the competent authority and addressed to the particularly involved persons, stakeholders and legal entities. The Administration has the obligation to make a motivated reply to all and each of the observations formulated.

1.9. Selection methodology

There are evident the synergies between the Bern Convention and the Directives 92/43/EEC (Habitats) and 2009/147/CE (Birds), with similar background and parallel development. Both Directives are the main instrument of the European Union for the implementation of the Bern Convention, and the Natura 2000 sites are also included in the Emerald Network.

The methodology for the selection of Sierra Nevada National Park and Nature Park to assess the European interest justifying the application to the European Diploma for Protected Areas is the occurrence of habitat types and species of flora and fauna in the Annexes of the Habitats and the Bird Directives.

As for other values like the landscape, the cultural heritage and the socio-economic context, the European interest is assessed on the basis of overall descriptions and comparisons with the European context.

1.10. Main aim or motivation

Sierra Nevada is a part of the Baetic Ranges, which extend over the easternmost third of Andalusia. All these mountains feature a very original set of fauna and flora species, with a high degree of endemicity. Standing out from the rest, Sierra Nevada is characterised by an even more complex biodiversity, owing to its wide range of elevations, its orientation, geological diversity and relative isolation respect to other nearby mountains.

Since the very early attempts to protect Sierra Nevada in the 80s decade of 20th century, these mountains were known by the richness, diversity and endemicity of plant species. Some studies made, mainly by the University of Granada, revealed that Sierra Nevada was a major biodiversity hotspot within the Spanish context and also at European scale. For that reason its protection was considered urgent and necessary, not only for its botanic interest, but also for other values like the following:

- Occurrence of the most important population of Iberian Mountain Goat (*Capra pyrenaica*), endemic of the Iberian Peninsula. Before the declaration as protected area, Sierra Nevada was designated National Hunting Reserve in the 60s of 20th century. The purpose was to protect this game species, since the Sierra Nevada population was the largest of its distribution area.

- The bird community, with species quite rare in similar areas, like the blue rock-thrush (*Monticola solitarius*), the mountain greenfinch (*Serinus citrinella*) or the alpine accentor (*Prunella collaris*). The group of the birds of prey with good populations of valuable species like Bonelly's eagle (*Hieraeetus pennatus*), golden eagle (*Aquila chrysaetos*), great owl (*Bubo bubo*) and many other raptors, was also considered as very relevant.

- Some species of invertebrates of restricted distribution area, like the grasshopper *Eumigus rubioi*, the cricket *Baetica ustulata*, both apterous as an adaptation to the elevation, the *beetles Dinodes (Iberodinodes) baeticus* and *Iberodorcadion lorquini*, or the butterfly *Parnasius apollo* subsp. *nevadensis*;

- Remarkable geomorphologic features, like glacialism in the siliceous highest summits, karstic and tectonic processes in the peripheral limestone belt, hydric erosion processes associated to steep slopes, siltation in foothills with impressive alluvial fans, etc.;

- Lithologic diversity: Along with common materials covering most of the surface area, either siliceous rocks (mostly schist and quartzite) or carbonated (limestone and dolomite), many other geologic resources appear across the massif, some of them very original and even rare. Among the most striking there are ultramafic rocks with pseudo-spinifex structure, formed as a consequence of metasomatic processes of peridotites occurred in the ocean floor, and later emerged due to the Alpine orogeny;

- The magnificent landscape and scenery values;

At that time, a number of emerging threats were also considered as needed of specific counteracting actions. Some projects like the enlargement of the existing ski resort and the construction of a new one, further urban developments, installation of a big military antenna on top of the highest peak (Mulhacén), roads crossing the massif, housing sprawl, etc., provoked the reaction of social, cultural, scientific and citizen movements and associations claiming for the protection of the whole mountain massif and the establishment of legal regulations to control the activities.

1.11. Dates *(to be filled in by the Council of Europe)*

Date of first examination

Y	Y	Y	Y	M	M	D	D

Date of expert visit

Y	Y	Y	Y	M	M	D	D

Date of second examination

Y	Y	Y	Y	M	M	D	D

Date of award

Y	Y	Y	Y	M	M	D	D

2. Site location

2.1. Site centre location

Longitude							Latitude						
W	0	0	3	0	8	2	3	“	N	3	7	°	0	3	‘	6	0	“

W/E (Greenwich)

2.2. Area (ha)

Total Area	1	7	2	2	3	8	,	8	9
Core	0	8	5	8	8	3	,	3	6
Buffer	0	6	9	8	7	0	,	4	8
Transition	0	1	6	4	8	5	,	0	6

2.3. Site length (km)

0	9	4	,	1	6	5

2.4. Altitude (m)

Data from MDT 2013:

Minimum				Maximum				Mean			
0	2	6	2	3	4	7	1	1	7	3	6

2.5. Administrative region

Region name	% cover
Andalucía	1, 9 6 6

Marine area not covered by the terrestrial part	

3. Natural heritage

3.1. General abiotic description (Geomorphology, geology and hydrogeology)

Sierra Nevada is the ceiling of the Iberian Peninsula, with several summits exceeding 3.000 m.a.s.l. The highest is the Mulhacén peak, with 3.479 m.a.s.l.

From the geological point of view, these mountains take part of the Baetic Ranges, which extend from the Cadiz province to Alicante, continuing under the Mediterranean Sea up to the Balearic Islands.

The precursor relief of the Sierra Nevada emerged from the sea beds about 16 million years ago, as a consequence of the orogenic pressure produced by the collision of the European and the African tectonic plates, forming a great anticline fold. The orogenic process is still active and the altitude rises half a millimetre per year. The erosion is acting as a powerful geomorphologic driver owing to the great elevation gradient and the subsequent steep slopes.

The rock formations are distributed according to three types of geologic contexts:

1. In the central area, which contains the high summits, the rocks are formed by the metamorphic materials of the so-called *Nevado-Filabride* Domain. The main rocks are mostly dark micaschists and Palaeozoic quartzites older than 250 million years. Above them, light micaschists and Triassic marbles of 200-250 million years. Moreover, the so-called "green rocks" of the Ophiolithic Unit (serpentinite, amphibolite or ecoglite), proceeding from igneous rocks of Jurassic age of about 180 million years, can be found interspersed. These rocks are the only remains known in Spain of the Tethys Ocean.

2. Edging the border of this first core, there is a belt of metamorphic rocks of the so-called *Alpujarride* Complex, older than 200 million years. It is mostly made up by phyllites of vibrant colours, blue, violet or bright grey, known in the region as "*launa*". On top of these, limestone and marbled dolomites generate sharp whitish and greyish reliefs.

3. The most external band of rocks is formed by sedimentary materials much more modern, of Neogene or Quaternary age. They are basically detrital materials (blocks, boulders, gravels and sands), eroded from the rocky massif while rising from the Mediterranean seabed and deposited around the river basins.

Sierra Nevada hosts a great deal of geologic resources of huge interest, having been listed in the National Inventory of Geologic Interest Sites, maintained by the Geologic and Mining Institute of Spain (*IGME - Instituto Geológico y Minero de España*). They are also in the Spain's list of geologic interest sites of the project Global Geosites.

On one hand, morphologies produced by the southernmost glaciers of Europe can be found in the high summits. They developed during different cold events of the Quaternary, throughout the last 260.000 years. Among other structures, glacial circuses, moraines and U-shaped glacial valleys can be clearly distinguished.

On the other hand, in clear contrast with the glacial morphology, appear the sub-desert landscapes of gullies and arid lands existing on the eastern side of the Sierra Nevada. These formations can be found in Almería province, between the rivers Andarax and Nacimiento, and also in the Guadix area, in the Granada province.

Another characteristic landscape of the Sierra Nevada is the fringe of *alpujarride* dolomites of the western sector, in the area of Alayos de Dílar and the Trevenque peak. They are

known as the "*arenales*" (sandy areas) and it is produced by intensely fractured dolomitic rocks.

In Sierra Nevada there are two basic types of aquifers of very different behaviour. On one hand those existing in the limestone fringe and on the other hand those related to metamorphic materials of the central area. In the first case the aquifers are developed within the thick strata of carbonated materials (limestone and dolomite), characterised by a great permeability and storing capacity. The water mainly circulates through fractures and caves. In the second case, the water circulates through the alteration zone of the micaschists and quartzites (about 50 m deep), decelerating the speed and letting water spring months later, albeit not forming big permanent water accumulations.

3.2. Habitats

The great elevation range (between 300 and nearly 3.500 m.a.s.l.), the orientation East-West of the mountain range, the proximity to the coast and the diversity of climatic situations, along with the variations of the chemical and physical nature of the substrates and the historic movements of the species during the late Tertiary and the Quaternary, allow an enormous variety of ecological conditions that wild species can benefit from. Consequently, a great deal of habitat types can be found in Sierra Nevada, from the arid lands in the SE, with dwellers like the trumpeter finch (*Bucanetes githagineus*), an African species arrived to the southeastern Spain some 40-50 years ago, to the frozen desert of the highest summits, the habitat of the alpine accentor (*Prunella collaris*).

The higher areas of the Sierra Nevada massif,a frigid territory above 2500 m.a.s.l. (2600 m.a.s.l. in southern slope) and at least 3-6 months of temperatures below zero, concentrates most of endemic taxa. In the cryoro-Mediterranean belt a mosaic of communities occupy the different high mountain habitats. In this area most of territory, is a desolate desert-like environment with a great number of taxa endemic to Sierra Nevada and two main types of characteristic ecosystems. The first one is a sparse psychro-xerophitic vegetation which corresponds to associations of nanocamephytes, stony soils, lichens and scree covering most surface. The second is made up by hygrophilous peaty and boggy communities locally known as ***borreguiles,*** quite scarcer. The cryoro and oro-Mediterranean belts are very rich in endemic species, like the endangered *Arenaria nevandensis*, *Artemisia granatensis* and widely spread like *Festuca clementei, Erigeron frigidus or Nevadensia purpurea*. Between 2800 and 2200 m.a.s.l., the climax vegetation is the dwarf prostrate shrubby juniper (*Juniperus communis* subsp. *nana,* and subsp. *Hemisphaerica).* The ombrotypes range from the humid at southern and western part of the territory to the dry or even upper semiarid above 3000 m.a.s.l. This territory has the highest number of frosty months.

The high-mountain meadows (*borreguiles*) are of great importance for livestock, since they are a major source of pasture for domestic herbivores in summer. Depending on the degree of soil moisture, in the drier areas species like *Armeria splendens, Agrostis nevadensis, Ranunculus acetosellifolius* or *Potentilla nevadensis* can be found. In hydromorphic deep soils a community of wet meadows with *Nardus stricta, Festuca trichophylla* var. *scabrescens, Plantago nivalis, Ranunculus demissus, Campanula herminii*, etc. are developed. This latter community is a priority habitat type of Annex I of the Habitats Directive (6230).

The lower oromediterranean belt, which starts at 2100-2150 m on the northern slope and at 2200-2250 m on the southern slope, rarely undergoes continuous freezing months. The climacic community is the formation of creeping brushes with*, Juniperus sabina* var. *humilis, Genista versicolor* and *Cytisus galianoi*, alternating with clear areas of pasture with *Festuca indigesta, Arenaria tetraquetra, Deschampsia flexuosa,* and some endemics like *Leontodon boryi, Ondontites granatensis, Euphorbia nevadensis, Arenaria pungens,* etc.

Another important area of high biosiversity is the Trevenque - Alayos territory, which is located among the basins of the Genil, Monachil, Dílar, Durcal, and Torrente rivers, mostly on dolomites, but also on limestones, calco-dolomites and clays. The rainfall is particularly high, but with a very permeable substrate. Many endemics are present like *Erodium astragaloides*, *Armeria trevenqueana*, *Lomelosia pulsatiloides* and *Helianthemum pannosum.*

Before the anthropic destruction of native pine forest the natural potential vegetation consisted of the dwarf juniper communities of *Juniperus hemisphaerica*, which constituted the first serial vegetation stage of the Sierra Nevada Scots pine forest in the lower horizon. This community of junipers is the climax vegetation in the medium and upper oro-Mediterranean belts. The Sierra Nevada Scots pine (*Pinus sylvestris* subsp. *nevadensis*), widely cultivated, continues to be the potential vegetation particularly on shallow soils in the high levels of the upper supra-Mediterranean horizon, where the woodlands of *Quercus pyrenaica* and *Quercus rotundifolia* as well as *Acer granatense, Betula fontqueri* and *Taxus baccata* grow well on deeper soils.

A peculiar situation occurs with the oak woodlands of *Quercus pyrenaica,* existing not only in the northern, but also in the southern slope, where the precipitation during the summer is low, a characteristic of the Mediterranean climate, and the insolation very strong. This is an important factor of hydric stress, since it is in summer when the trees are in full vegetative growth period and the availability of water may be critical. This formation is always placed on siliceous soils. In valley areas, water channels (*acequias*) and water discharges from local aquifers, peculiarities like frequent summer horizontal precipitations (mist) help to compensate the lack of soil moisture and allow the presence of these formations in slopes submitted to the desiccating effect of the sun. These forests are very vulnerable to the climate change. *Quercus pyrenaica* is the dominant species of the deciduous forests of Sierra Nevada, which at present are mostly degraded owing to secular cuttings, fires, uprooting, etc. Their climacic stage it characterised by accompanying species like rowan (*Sorbus aria* and *Sorbus torminalis*) and gall oaks (*Quercus faginea*). In more humid areas it appears with maple (*Acer opalus* subsp. *granatensis = A. granatensis)*), ash (*Fraxinus angustifolia*) and some scattered *Salix caprea*.

The holm oak (*Quercus rotundifolia* = *Q. ballota*) is the dominant species in the most widespread woodland in Sierra Nevada. It may appear on different substrates (either siliceous of carbonated), and in different bioclimatic belts. Although a small proportion occurs in the thermo-Mediterranean (below 900 m.a.s.l.), most of them appear in the meso-Mediterranean (1.300 – 1.450 m) and a few more in the supra-Mediterranean (above 1.400-1.500 up to 1.900 m.a.s.l.), in more xeric conditions due to the elevation. These forests are quite well adapted to the Mediterranean climate and are relatively resilient to the climate change. In particularly humid soils grows *Laserpitum longiradium* a very rare relic plant of the northwestern calcareous zone.

Other woodlands of great interest are:

- Gallery forests either on siliceous soils with alder (*Alnus glutinosa*), willow (*Salix* spp.) and ash (*F. angustifolia*) or on basic soils with elm (*Ulmus* spp.), poplar (*Populus* spp.) and willow (*Salix* spp.).
- Native pine forests of *Pinus sylvestris* subsp. *nevadensis* accompanied by the savin juniper (*Juniperus Sabina*) forming the upper forest limit. In intermediate altitudes, *Pinus nigra* subsp. *salzmanii* can be found on siliceous soils and *Pinus pinaster* subsp. *acutisquama* on calcareous soils.

The list of habitat types listed in Annex I of the Directive 92/43/EEC, on the conservation of natural habitats and of wild fauna and flora, found in Sierra Nevada totals 39, being 7 of them priority types. The complete list of habitat types are included in section 1.8.3.

3.3. Flora

The Sierra Nevada massif in SE Spain has long ago been recognized as a biodiversity hotspot within a wider biodiversity hotspot, the Mediterranean Basin. It may be partly due to its environmental and historical conditions. The high elevation (up to 3.479 m.a.s.l.) allows the formation of alpine habitats, albeit with Mediterranean conditions of a dry and hot summer alternating with the cold winter. The combination of different geochemical substrates, including limestone, dolomite, micaschists, and serpentine, among others, and a general arid Mediterranean climate characterising these mountains, in a location close to the African mainland, makes Sierra Nevada the paradigm of a Mediterranean mountain.

The total number of vascular plant (Magnoliophyta and Pinophyta) taxa accounted for in the last checklist was 2356 species and subespecies.. This amount constitutes 39,3 % of the flora of mainland (peninsular) Spain and 33,2 % of total Spain (i.e. Mainland plus Balearic and Canary islands). This amount is also particularly high in comparison to neighbouring countries of similar size. Some of the species, nearly 150, are endangered, 44 are strictly endemic and others are relicts. Relicts are considered in a historical context, including lineages at different time scales. Longer climatic periods have prompted extinction and range retraction, including the most recent of the Last Glacial Maximum. There are some arctic-alpine species which are outstanding examples within this relict element. Sierra Nevada represents the southernmost limit of twelve cold-adapted species including *Artemisia umbelliformis*, *Draba dubia*, *Ranunculus glacialis*, *Saxifraga oppositifolia*, *Sibbaldia procumbens, Sorbus torminalis*, *S. hybrida*, *Thalictrum alpinum* and *Papaver lapeyrusianum*, among others.

In the Iberian Peninsula 111 species of ferns have been inventoried. Half of them (52), are found in Sierra Nevada. The last one, *Isoetes lacustris,* was reported in 2021.

There are also citations of more than 442 bryophytes, almost 30% of the European bryoflora. The last catalogue of lichens includes 551 taxa (528 lichens and 23 lichenicolous fungi). Nowadays, all these checklists are still growing thanks to new research.

3.4. Fauna

The high environmental heterogeneity characterising Sierra Nevada, along with biogeographic and cultural factors, allows the presence of highly diversified faunal communities rich in endemic and unique elements.

To date, a total of 4.583 animal species have been recorded, albeit new taxa are found or described each year. The Arthropods is the most diversified group, with 3.959 species, representing 86,38 % of all described animal biodiversity inventoried so far in Sierra Nevada.

Among the arthropods, there are 169 species considered endemic, not reported in any other place on the planet. The largest contribution to the arthropod group comes from insects, with a staggering 3.787 species documented in Sierra Nevada. Some of these are listed in the Habitats Directive (92/43/EEC), such as the butterflies *Polyommatus golgus, Parnassius apollo*, *Euphydryas aurinia* and *Proserpinus proserpina*, or the orthopter *Baetica ustulata*. The latter species belongs to a monospecific genus exclusively present in Sierra Nevada, where it is one of

the most emblematic animals. Beetles are the most numerous group of insects in Sierra Nevada (1.288 species), followed by lepidopterans (866 species), dipterans (669 species), hemipterans (321 species), hymenopterans (288 species), neuropterans (112 species) and orthopterans (74 species). The remaining insect orders amount to a total of 164 species.

Regarding other arthropod classes, 6 species of malacostraca have been reported, including the white-clawed crayfish (*Austropotamobius pallipes*), also listed in the Habitats Directive. As for spiders, there are 112 recorded species, including the Iberian endemic Spanish funnel-web spider (*Macrothele calpeiana*), with populations highly localized within the protected area and also listed in the Habitats Directive. This tarantula is the bigger spider species in Europe. It is worth to highlight the endemic arachnid *Roeweritta carpentieri* that can only be found in the high summits of Sierra Nevada.

Regarding the vertebrates, the number of species amounts to 260, including 6 fish species, 20 reptiles, 9 amphibians, 43 mammals and 182 bird species. Among the fishes it is worth to mention the common trout (*Salmo truta*), since its population in Sierra Nevada is the southernmost one of Europe, and they exhibit the peculiarity of being resident, instead of having migratory strategies. Among herpetofauna, two species, a reptile and an amphibian, stand out for their marked uniqueness: the smooth snake (*Coronella austriaca*) and the Baetic midwife toad (*Alytes dickhilleni*). The smooth snake is associated to high summits, and its distribution is deeply influenced by the history of glaciations. The Baetic midwife toad is one of the most threatened amphibians in Europe, endemic to specific mountain areas of the southeastern Iberian Peninsula. The Sierra Nevada population shows a relatively good conservation status.

As far as mammals are concerned, 17 bat species, 2 lagomorphs, 1 sciurid, 5 insectivores, 1 talpidae (the Iberian endemic Spanish mole, *Talpa occidentalis*), 3 ungulates, 9 rodents, and 7 carnivorous species have been inventoried so far. It is important to mention the occurrence in Sierra Nevada of the Iberian Mountain Goat (*Capra pyrenaica*), one of the most conspicuous species, with an estimated population of over 17.000 individuals. This is the largest population worldwide, featuring not only the high population density (about 7 individuals/km^2), but also the highest genetic diversity known for this species. The presence of the European snow vole (*Chionomys nivalis*), a cricetid rodent associated to rocky areas above 2,400 meters, is also noteworthy. The closest populations of this species are in the central Iberian Peninsula (Central System), and its biogeographic history is closely linked to the Pleistocene glaciations in Europe. It is also worth to mention that the Sierra Nevada population of wild cat (*Felis sylvestris* subsp. *tartesia*), is probably one of the most important of Andalusia. However, an important reduction is being observed during the recent 10-15 years, which is also being registered all across its distribution area.

Birds represent the most numerous group of vertebrate species, with a total of 182. This figure includes the sedentary, nesting and wintering species, excluding those of occasional occurrence and those that can be found only in stopover. Sierra Nevada hosts the best populations of Northern wheatear (*Oenanthe oenanthe*) of all the Baetic mountain ranges. Temporarily, many individuals from neighboring mountains gather in Sierra Nevada after having completed their reproductive process and before migrating to their trans-Saharan wintering sites. Other birds associated to high summits are considered unique species, not only in Sierra Nevada but also all over Europe. It is worth to mention the alpine accentor (*Prunella collaris*), the common rock thrush (*Monticola saxatilis*), and the ortolan bunting (*Emberiza hortulana*). The community of

other passerine birds is also rich in species (107), including 4 species of tits, 12 finches, 6 corvids, 18 sylviids, and 19 thrushes, to name a few. Particularly notable is the recent colonization (just over a decade) of species such as the Eurasian blue tit (*Sitta europaea*) and the great spotted woodpecker (*Dendrocopos major*), probably from nearby growing populations. The progressively increasing development and maturity of woodlands in Sierra Nevada have also probably facilitated the recent occurrence of these forest bird species.

Raptors are a particularly unique group from the perspective of natural resource conservation. Their position on top of the trophic chains confer them a certain bioindicator character. The diurnal raptor community in Sierra Nevada includes 15 species, including forest-dwelling species such as the northern goshawk (*Accipiter gentilis*), the Eurasian sparrowhawk (*Accipiter nisus*), the booted eagle (*Hieraaetus pennatus*), the common buzzard (*Buteo buteo*), and the short-toed snake eagle (*Circaetus gallicus*). Small birds of prey like peregrine falcon (*Falco peregrinus*), common and lesser kestrels (*Falco tinnunculus* and *F. naumanni*) and Eurasian hobby (*Falco subbuteo*) are also nesting species. As for nocturnal birds of prey, Sierra Nevada hosts seven species: great owl (*Bubo bubo*), tawny owl (*Strix aluco*), long-eared owl (*Asio otus*), Scops owl (Otus scops), barn owl (*Tyto alba*), little owl (*Athene noctua*) and short-eared owl (*Asio flammeus*), the latter not nesting and in low numbers.

Among the rock-dwelling raptors, Sierra Nevada stands out for hosting the best-preserved population of golden eagle (*Aquila chrysaetos*) in all the Baetic mountain ranges. The approximately 20 breeding pairs are located in the main valleys radiating from the summit axe of the mountain range. Another relevant bird of prey is the Bonelli's eagle (*Aquila fasciata*), a species not well-suited to the high average altitude of the mountainous massif. It competes unfavorably with the high density of golden eagles, being displaced to lower and peripheral areas of the protected area. Despite that, there are about 14 territories defended by this species in Sierra Nevada.

Vultures are also present in the Sierra Nevada, where they provide the essential ecosystem service of cleaning and recycle wild and domestic ungulate carcasses. The populations of griffon vulture (*Gyps fulvus*) have been continuously growing during the past fifteen years. Currently, no breeding pairs are known within the protected area, but the species' dynamics suggest that it will shortly contribute to the Sierra Nevada list of breeding species. At present, their occurrence is constant throughout the year.

The bearded vulture (*Gypaetus barbatus*) is the second vulture species occurring in Sierra Nevada. It became extinct in the middle of the 20th century. Its presence here has been rapidly consolidating over the past few years, thanks to the release of individuals in the Natural Park of the Sierras de Cazorla, Segura, and las Villas and in the Natural Park of the Sierra de Castril, located approximately 80 km far from Sierra Nevada in a straight line. These releases are part of an ambitious international reintroduction project, and some of the individuals released or born in the wild are frequent visitors to Sierra Nevada, where they spend long periods. The ongoing reintroduction project foresees releases of nearly-fledgling birds also in Sierra Nevada from 2024 onwards.

In summary, the fauna of the Sierra Nevada Natural Space is characteristic of the mountain systems of the southeastern Iberian Peninsula, but enriched with a significant number of endemic species or whose populations are unique in this region. As explained for plants, Sierra

Nevada takes part in the Mediterranean Basin Biodiversity Hotspot, hosting and at the same time a very high level of biodiversity and endemicity, being itself a hotspot within a larger hotspot.

3.5. Landscape

The human perception of the landscape in Sierra Nevada is influenced by several aspects. Some of them are linked to its own historical evolution and others to its condition as Mediterranean high-mountain:

- **Mountainous landscape**: The huge elevation gradient involves steep slopes, of great scenery impact. Even to an untrained eye, the following geomorphologic units can be distinguished at a glance:
    - Badlands: In the lowest elevation areas in Almería, appear the most arid zones, with small scale agriculture, mostly abandoned, and erosive landscapes of gullies produced by torrential rainfall events on practically nude soils. The existing vegetation and fauna is of great interest, showing singular adaptations to the local climate conditions and soils poor in nutrients;
    - Foothills up to 1000 m.a.s.l.: this is the most agricultural belt, where the natural vegetation is replaced by crop fields or reafforestation plots;
    - Intermediate-elevations between 1000 and 2500-2800 m.a.s.l.: gentle hills covered by woodlands mostly of *Quercus rotundifolia* and *Quercus pyrenaica* in more humid soils. These formations alternate with serial communities of brushes like rosemary, thyme and gorse or with reafforestation plots. In water discharge spots of higher areas, woody species are replaced by wet meadows locally called “borreguiles”, very used by wild and domestic ungulates;
    - High summits: the particularly hard climate conditions prevent vegetation not adapted to strong winds, ice, long periods under the snow, abrupt weather changes and strong insolation in summer, particularly in the southern slope. In these areas the landscape is dominated by rocks, frequently fragmented by cryoturbation, forming huge scree deposits. Endemic plants can reach 40 % of the species present in this areas and most of them protect their vegetative body in the interstices of the rocks to avoid their exposure to climatic adversities;
- **Seasonal variations**:
    - Snowed *versus* summer landscapes. The differences between summer and winter are spectacular. The snow coverage lasts several months, although its duration is progressively being shorter during the recent decades due to the climate change. Snow coverage prevents the winter human presence to a high degree, whereas in summer great amounts of visitors are attracted to the summits to witness their magnificent sights and to enjoy the fresh temperatures. Sometimes, when the mist disappears, the African continent can be easily seen at (apparently) short distance.
    - The spectacle of snow and ice melting. Frozen water starts melting in early summer forming snow tunnels on top of the streams. This is something very attractive for visitors, particularly for photographers, since fabulous pictures with

ice, wet meadows and running water covered by snow can be obtained.

- The spectacle of autumn in deciduous woodlands. Sierra Nevada features several deciduous forests where the colours dramatically change across the four seasons. The bright green of the summer progressively turn in fall and early winter to yellows in the marcescent oaks, willows and poplars, to reds in the wild cherry trees, to russet in the maples and rowans, creating an incomparable landscape, very appreciated by the visitors;

- **Ice and snow: glacial and periglacial formations**. During the Quaternary glaciations some glaciers appeared in Sierra Nevada. The post-glacial warming has made them disappear, but some features of their past occurrence can still be visible. Glacial circuses, U-shaped valleys and moraines bordering some high-mountain lagoons are still present. Permafrost is not anymore above the surface, although there are still some small underground deposits at the foot of the Veleta peak (Corral del Veleta), about to disappear due to global warming.

- **Water as protagonist**: The strong alternatives of water presence are something striking. The marked differences of the precipitation between the wettest and the driest areas are of such an intensity that only some dozens of kilometres separate the humid ombroclimate, characteristic from the high summits at west, from the semi-arid ombroclimate of the semi-desert at the eastern part of Sierra Nevada. The western side receives precipitations influenced by the North Atlantic Oscillation (NAO), of cyclonic character, whereas the east is mostly influenced by the Western Mediterranean Oscillation (WeMO), whose rainfall behaviour mainly responds to variations and advections from the Mediterranean Sea. The pluvio-nival regime of the west and the strictly pluvial regime of the east are also important factors that explain the strong differences of the water presence and its influence on the landscape features. The network of irrigation channels built centuries ago (see sections 1.8.5 and 4.1.2) is also an impressive resort largely influencing the distribution of the vegetation and, in consequence, the landscape as well.

- **Human influence**: The secular human presence has left its footprint in the Sierra Nevada landscape. The main testimonies are the following:

  - Agriculture. In past times the human occupation of the Sierra Nevada was much higher than at present. In particular, during the first half or two thirds of the 20th century, dwellers used the territory as their source of subsistence for cropping, collecting firewood for heating, livestock farming etc., always at small scale in small plots of land. Progressively these properties or hires were abandoned by their dwellers, which moved to the big cities in search of better opportunities. The woody vegetation started to recover the abandoned crops in a process still continuing. At present, remains of ancient crops can be distinguished in the mountains, by the stone walls limiting the arable terraces built in the slopes. The resultant landscape is very characteristic and only recently some new dwellers are occupying with their families these grounds to recover the ancient ways of life with modern advances. This fact makes the landscape more diverse, since the farmland shows different degrees and stages of recovery or regression.

  - Livestock. As in the case of agriculture, livestock farming was more practised in the past and the composition of the species were also different. Sheep and goats were more abundant decades ago, whereas at present cattle is the dominant species. These changes have implications at landscape scale. In general the progressive reduction of domestic ungulates is allowing the woody vegetation to recover their ancient realms and the forests are increasing and getting older across the Sierra

Nevada, in particular at the upper limits. Local breeding of cattle, like the "*vaca pajuna*" a cow very well adapted to the local climate, is an expanding activity, which produces very good results, both in terms of maintaining the vegetation in good condition and in terms of income for local breeders.

- Tourism. Traditionally Sierra Nevada has been very frequented by the inhabitants of nearby cities and villages and mountaineering clubs are very active. During the recent decades, and singularly since the COVID-19 pandemics, the demand of visitors has largely increased. At landscape scale, the tourism use can be perceived basically by the abundance of trails, panels, garbage containers, signs and roads allowing the approach to wild sectors of the mountains, in particular the highest summits. These impacts have limited extension, however uncivic behaviour from a small proportion of visitors increase the negative effect at this level. For example, opening new mountain-bike trails in slopes, building walls with rocks to stay overnight and protect themselves against nocturnal cold and wind, leaving rubbish, etc. These behaviours leave a footprint difficult to remove and are counteracted with permanent education and information before being prosecuted and punished.

- **Impacts of infrastructures**: Some specific areas show important landscape impacts caused by modern infrastructures.

  - One of the most important is the ski resort, which occupies the higher sectors of rivers Monachil and Dílar, at the foot of the Veleta peak. Ski lifts, ski courses, buildings for restaurants and machinery and wooden fences to maintain the snow on the desired sites, provoke landscape impacts, some of which are easily perceived even from the city of Granada, in the Veleta slope.

  - The electric power lines, particularly those of high voltage, are also very visible infrastructures, even from the distance. They specially affect the western sector of Sierra Nevada, where the villages are more numerous and closer to the mountains, needing to count on electric supplies.

- **Disperse buildings**: Fortunately, the housing is mostly concentrated in urban cores surrounding the protected area. Only scattered farmstead can be seen all over the countryside, although normally they are quite small. The reconstruction of old buildings is allowed by the Sierra Nevada legislation, and can be authorised with limitations like maintaining the same size (unless some increase be justified), not using brilliant colours and materials and respecting the traditional constructive features.

- **Astronomic observatories**: As mentioned in section 5 (Educational and scientific interest) there are 3 research infrastructures in Sierra Nevada for the astronomic study of the universe. They produce an undeniable landscape impact. However, on one hand these facilities have been installed before the declaration of Sierra Nevada as protected areas. On the other hand, they are placed in the area of the ski resort, already altered. The high quality of their research results is a consequence of their privileged placement that cannot be anywhere else.

4. Cultural heritage and socio-economic context

4.1 Cultural heritage

4.1.1 – A brief historical tour

The human occupation of the Sierra Nevada dates back to the prehistoric Neolithic period, at the end of the VIth millennium and early Vth before Christ (BC). The original dwellers were progressively settling in the area as farmers, approaching to the fertile plains surrounding the mountains. Archaeological evidences of this period have been documented in nearby fields of Albodoluy, Abrucena, Nacimiento and Paterna del Río, among others.

Some archaeological remains form the cultures of Los Millares and El Argar from the IIIrd millennium BC onwards, appear scattered between the coast and the southern slope of Sierra Nevada, a territory known as La Alpujarra.

The Roman occupation of the Iberian Peninsula started in the year 218 BC and lasted seven centuries. Sierra Nevada was part of the Roman Baetic Province from the year 27th BC. Remains of Roman roads and bridges (Tablate or Mecina Bombarón), thermal baths (Lecrín) or mining grounds (El Conjuro, la Estrella, Huéneja or Alquife) are testimonies of the Roman presence in this area.

After the political turmoil of the Visigoth world, in the VIIIth century AC, the Arabs arrived to the Iberian Peninsula starting a domination which lasted eight centuries. The creation of the Caliphate and later the Nasrim (or Nazarite) Kingdom of Granada were the most important periods of splendour known in the lands surrounding Sierra Nevada.

During the Arab domination, the best known network of hydraulic engineering was developed. Along with irrigation ponds, water channels (locally called *acequias*), firstly to collect water from melting snow and later for irrigation, and the creation of small plots for mountain agriculture, made the slopes of Sierra Nevada to become a true orchard.

Mulberry tree cultivation, silkworm rearing and the textile fabrics of silk, cotton and linen made the local dwellers of these mountains to thrive. The magnificent products manufactured here were an enormous source of wealth for the Muslim kingdom firstly and for the Christian kingdoms afterwards. In 1492 the Catholic Monarchs conquered Granada to the Moorish king and some years later the Moorish people was expulsed and replaced by Christian settlers, which inherited this rural landscape.

The cultural heritage of Sierra Nevada and surrounding areas is rich and diverse. It is a living testimony of historical processes resulting from the different cultures settled across the time and particularly from the Al-Andalus culture.

4.1.2 - The architectural heritage

The historical ensembles

The Sierra Nevada National Park and Nature Park has three Historical Ensembles scheduled as Cultural Interest Asset, in the Poqueira Gorge: Pampaneira, Bubión and Capileira. They constitute the paradigm of the Alpujarra traditional architecture, notwithstanding the urban agglomeration of the remaining villages.

Additionally, the Historic Site of the Middle Alpujarra and La Tahá gathers a

heterogeneous set of elements like irrigation channels (*acequias*), mines, industrial remnants, city centres, farmlands, archaeological sites, towers and churches, farmsteads, baths, natural areas and historic trails.

Both adjacent Cultural Interest Assets together make up the largest territory of European protected heritage.

The labyrinthine streets of the village centres, along with the construction typology, are clear examples of adaptation to the geographic, climatic and socio-economic conditions of the area. The famous "*terraos*" (flat roofs covered with impermeable clayish gravel), "*tinaos*", chimneys and stone eaves, are traditional elements of the architecture in the Alpujarra.

The defensive constructions

The defensive systems are present across the whole area of Sierra Nevada, as Medieval castles or fortresses (La Calahorra, Lanjarón), or watchtowers. The remains of fortresses are cultural attractions in Sierra Nevada that can be found in many villages like Abla,Abrucena, Alboloduy, Bayárcal, Beires, la Calahorra, Canjáyar, Fiñana, Fondón, Laujar de Andarax, Paterna del Río, Aldeire, Dólar, Ferreira, Jeres del Marquesado, Lanjarón, Lanteira, Lecrín and Pampaneira.

The hydraulic constructions

The traditional farming activity in Sierra Nevada has left a rich and varied ethnologic legacy which is highly appreciated as a cultural attraction. The infrastructures of Arab origin constructed to collect water (qanats and mines), for water storage in ponds, pools and cisterns –like the existing in Lanteira or the Abla castle- and for water transport and distribution to the users by means of channel (*acequias*) networks, still functioning, constitute singular elements characterising the agricultural landscape of this territory.

The principle "sowing for harvesting water" maintain its important ecological role, since beyond its cultural footprint, also provides hydric resources to the wild mountain ecosystems and feeds the agricultural grounds of the foothills and surrounding areas, often quite far from the origin. The Administration and the irrigation communities maintain this secular knowledge and tradition and maintain these infrastructures according the ancient methods, tools and materials

The still existing water mills are the material testimony of the hydraulic knowledge of the Arabs, allowing them to benefit from the water energy to move mills and other hydraulic devices for different purposes (*batanes*, *trapiches*, flour mills, ...). The Arab Baths of Ferreira, Aldeire, Jéres del Marquesado, Huéneja and La Zubia are also manifestations of their hydraulic skills.

4.1.3 - The anthropological heritage

Arts and crafts

The artisanal tradition derives from social and economic needs of the earliest settlers in Sierra Nevada. At present, the traditional rural culture has been evolving and some of the usual activities identifying these villages have got lost. However, in most villages of the Sierra Nevada several artisan works still reproduce the original forms and styles in many products that the visitor may buy. This is an added value offered by this natural area.

Traditional products made of esparto, pottery with Nasrid drawings, leather or the famous fabrics ("*jarapas*") manufactured in old looms, are a few of the craft elements still being produced in the Sierra Nevada rural area.

Gastronomy

The richness and quality of the Sierra Nevada farm products, the Moorish and Castilian heritage and the conservation of traditional cooking techniques assure the gastronomic excellence in these villages.

This rich and varied gastronomy is based in the meat products derived from the pork, along with agricultural and horticultural products of the site, without neglecting the precious wines produced in the mountain slopes. Plates like bread or semolina crumbs, fennel stew, the gipsy potatoes pot, the chestnut pottage, the orange and olives salad or the delicious sweets of Moorish tradition can still be tasted in the villages of Sierra Nevada.

Popular knowledge and tradition

In the rural areas of Sierra Nevada magnificent examples of ancestral activities and of knowledge inherited from early dwellers and from characteristic cultural mix, have been maintained across the time.

Legends, couplets, ballads and proverbs are being transmitted from generation to generation and can still be heard to the oldest dwellers. Any time is good to tell a legend or to say a proverb.

Some historic events are major elements to enjoy during the local festivals of Moors and Christians that still can be witnessed in several villages of Sierra Nevada, like Trevélez, Válor or Béznar.

The Alpujarra Traditional Music Festival wisely gathers the regional folkloric richness. Each year it is held in a different location during the second Saturday of August. Reciting “trovos”, the most genuine artistic manifestation, traditional music and dances like the “robao y la mudanza”, the “cortijero”, the “candle dances”, etc. can be enjoyed this day.

Some villages are well known for its peculiar celebrations aiming at recovering ancient tales and legends. For example Soportújar offers a number of popular activities during the whole year as “the village of the witches” and Dílar as the “village of the elves”.

4.2 Socio-economic context

According to the Spanish legislation on National Parks, besides the area formally designated as such the declarative Law also defines the so-called Socio-Economic Influence Area. It is made up by the aggregation of Municipalities where the National Park is placed, contributing with their territory. This is not a category of protection, but rather the area where the Administration of the National Park must favour with more emphasis the institutional relationship. This concept has also been applied to the Nature Parks. For the case of Sierra Nevada, the Socio-Economic Influence Area is formed by 60 Municipalities, 37 in Granada province and 23 in Almería province.

The Sierra Nevada National Park and Nature Park, with an average elevation of 1.736 m.a.s.l., include very few urban areas and, in consequence, a small amount of people live in the protected area, mostly in a few isolated farmsteads, sometimes abandoned, scattered in the landscape, mainly in the Alpujarra area.

According to the population data of 2022, a total of 98.368 dwellers in the 60 Municipalities of the Socio-Economic Influence Area of the Sierra Nevada Natural Space. Most of them (88.551) live outside the protected area, whereas only 9.837 live inside.

At overall level, it is relevant to underline that after a few years of recession, the population tends to stabilise, or even to show a slight increase for the whole area. The demographic structure of the Socio-Economic Influence Area, is characterised by an inverted pyramid, with people aged over 65 representing 25,4 % of the total population, whereas youngsters under 19 years of age are 19,8 % of the population.

The local economy is mostly based on livestock and forest exploitation, since the agriculture is marginal and is being progressively abandoned. Livestock still persists, but is also declining. It has always been an itinerant activity, moving the animals (mostly cattle and sheep) to feed on high-mountain pastures in summer, to bring them back to the villages or even to the coast during the winter. In consequence, there are not intensive uses linked to the local economy of the Sierra Nevada protected area, and neither in its Socio-Economic Influence Area.

According to data of 2022, provided by the Institute of Statistics and Cartography of Andalusia, the pandemics of 2020 and the subsequent economic crisis has made the economic activity of the area to decrease. During the recent years, the relative weight of the economic sectors is the following:

- Services: 69,3 %
- Farming: 17,4 %
- Industry: 7,3 %
- Construction: 6 %

Within the “services” economic sector, tourism is especially important. During the last years hotel places have increased to 73,53 places per 1.000 inhabitants in 2020, although there are differences among districts. The global entrepreneurial activity did not increase significantly, however the increasing number of tourism enterprises is really significant.

A consultation has been made to the local entrepreneurs to know their assessment concerning the influence of Sierra Nevada on their activity. In general they welcomed the economic activity generated by the Parks but not so much the management of the protected area. In any case a majority of them recognised the influence of the proximity of Sierra Nevada in relation to their entrepreneurial results.

In relation to the estimation of the economic impact on the protected area territory throughout the time, a high percentage (about 20 %) is directly attributable to the National and the Nature Park, in terms of direct effective production. Most touristic villages are mainly benefited, even more than the municipalities of the Granada Metropolitan area and of the rest of the Municipalities of the Sierra Nevada.

Tourists are mostly national and andalusian, mainly from the Granada and Almería provinces. Foreigners are only a 20 % of the total. Tourists are mainly motivated by making acquaintance with the area, being in contact with nature, spending leisure time, walking around, enjoying the landscape, resting and sunbathing. The cultural tourism is also very important in this territory albeit hiking is the most practised activity by the visitors.

The tourism is quite seasonal, since a majority of visitors come in May and June, followed by April, December, July and March. February, January, September and August are relatively less frequented months.

Some properties devoted to the primary sector, both to the agriculture and livestock, have recently found in the eco-tourism an important economic source of income and this is being revolutionary. The farming activity, in general social and culturally isolated from the big urban areas, is progressively being more open to this public. The conservation of local cattle breeding, like the “*pajuna*” cow, and of the traditional agriculture with local producers, is a rising activity and

with good forward-looking, thanks to the eco-tourism. This responsible tourism can provide a great impulse to the economy of all the villages of Sierra Nevada and serve as socio-economic development driver, helping to prevent the rural depopulation.

Main socio-economic targets of the protected area:

The main task of the Sierra Nevada Administration is to serve as catalyst of this process, by helping to facilitate contacts and supporting all the entities participating in the equation: Producer and Consumer

- Promoting socio-economic conditions avoiding the rural communities to lose their roots and allowing their progress, strengthening the economic and social use of the territory compatible with the conservation of the natural resources;

- Place value on the natural and cultural heritage of Sierra Nevada from an integrated perspective as a potential resource to support the sustainable development policies. Promoting its wise use as an instrument of cultural and economic development, conditioned to the conservation of natural and cultural resources.

5. Educational and scientific interest

Sierra Nevada has always aroused curiosity among naturalists and scientists. The occurrence and abundance of particular species, both animal and plant, raised their interest in improving knowledge on the assets of this territory. The earliest scientific expedition that can be considered as such dates from 1754 and it was made by Antonio Ponz. He is the precursor of a consolidated scientific tradition of naturalists and specialists in different disciplines (often from Mid-European countries) which since the 19th century have left important testimonies on its natural wealth and diversity, based on these initial studies, continuing with the intellectual curiosity of the pioneer naturalists.

The Sierra Nevada Global Change Observatory (https://obsnev.es/en/) is an innovative joint institutional initiative whereby the scientific community and the decision makers responsible for the management of the Sierra Nevada National Park and Nature Park, work together. The overall aim is to generate the necessary knowledge to be used in improving the strategies, programmes and projects for the long-term conservation of this protected area. This common platform has generated a number of tools to automate the management of huge amounts of information. At this point it is relevant to mention the application "Biblionevada" (https://biblionevada.obsnev.es/), which has been designed to gather all documents published containing information of any kind on these mountains.

This platform of joint cooperation has been possible thanks to the proximity of Sierra Nevada to Universities (in particular the Universities of Granada, Almería, Murcia and Jaén) and research centres, mostly belonging to the Superior Council of Scientific Research (Consejo Superior de Investigaciones Científicas – CSIC), interested in this privileged scenario, owing to its geographical situation, where high altitude can be achieved an low latitudes.

It is particularly worth to highlight the role of this protected area as natural laboratory for studies on the impact of climate and global change on the natural ecosystems, functions and ecosystem services they provide. The components of the ecosystems are also a matter of interest, particularly on singular species like the Mountain Goat, whose Sierra Nevadan population (the most numerous) has the largest genetic diversity. These issues, among others, motivate the interest of the scientists for this massif and its natural assets.

The participation of Sierra Nevada in international research projects is also a consequence of this strategic approach. The Sierra Nevada Observatory of Global Change, through the University of Granada, has been involved in projects like ECOPOTENTIAL (http://www.ecopotential-project.eu/), or most importantly LIFEWATCH ERIC (https://www.lifewatch.eu/), a European Research Infrastructure Consortium designed to provide e-Science research facilities to scientists investigating biodiversity and ecosystem functions and services in order to support society in addressing key planetary challenges. It is also relevant the participation in long-term international biodiversity monitoring projects like EUBON, EUROGEOSS, LTER, etc.

According to the regulations of Sierra Nevada, a permit is obligatory to carry out research activities in the protected area. The following table summarises the number of permit requests per year received in the Administrative Centre since 2010. The average is 36, with a maximum value of 64, achieved in 2022, and a minimum of 20 in 2013.

Year	Number of research permit requests
2010	36
2011	45
2012	32
2013	20
2014	25
2015	27
2016	28
2017	29
2018	31
2019	24
2020	43
2021	48
2022	64
2023	56

The national Ministry responsible for the environment (at present Ministry for the Ecological Transition and Demographic Challenge), maintains a few responsibilities on the existing 16 Spanish National Parks, in particular those established to maintain the coherence of the National Park Network. A very important issue still kept by the national authorities is the periodic call for research proposals through the Autonomous Body of National Parks (Organismo Autónomo Parques Nacionales – OAPN).

As a proof of the interest that Sierra Nevada arouse among the scientists, the number of requests of research projects per year is very high. The following table summarises the results of these calls for proposals. The years 2016, 2018 and 2019 these subsidies were not called.

Year	**Research projects requested**	**Number of projects awarded**	**Amount (€)**
2010	29	1	90.014,00 €
2011	16	3	366.143,00 €
2012	14	7	605.747,00 €
2013	19	6	314.442,00 €
2014	6	0	0 €
2015	10	2	104.714,00 €
2017	24	8	564.467,00 €
2020	43	1	60.419,00 €
2021	14	9	751.508,90 €
2022	7	4	391.393,30 €
2023	11	8	705.523,39 €

It may be relevant to mention in this section that one of the most important research topics in Sierra Nevada is the astronomy. Its geographic situation, the altitude and the high quality of the air layers have long ago attracted the scientific institutions to build their infrastructures in these mountains. At present there are three operating facilities of this kind:

- Observatory of Mojón del Trigo peak, belonging to the University of Granada
- Radio-telescope of 30 meters in the Loma de Dílar (2.850 m.a.s.l.), belonging to the Institute of Milimetric Radio-Astronomy (Instituto de Radio Astronomía Milimétrica – IRAM), a Spanish-French-German consortium. This facility is one of the most advanced of the world.

- Observatory of the Institute of de Astrophysics of Andalusia (Instituto de Astrofísica de Andalucía – IAA/CSIC). It is located near the radio-telescope in Loma de Dílar and develops a cutting-edge research activity at world scale.

Sierra Nevada is also a very attractive area for University students to complete their practical training. In order to provide the students with legal protection and coverage it is necessary to subscribe formal Cooperation Agreements between the concerned University and the Regional Administration responsible for the protected areas management. During the last 10-15 years many Agreements have been signed or renewed with Universities from Alicante, Almería, Córdoba, Granada, Jaén, Málaga, Autónoma de Barcelona, Extremadura, León, Murcia or Politécnica de Madrid. Some Erasmus-granted students have also been received in Sierra Nevada by virtue of Agreements with Centres of the Superior Council of Scientific Research (CSIC).

On average, about 5 students per year carry out their practical training in some of the departments of the Sierra Nevada National Park and Nature Park, either the Conservation Area, the Public Use Area (education and attention to visitors) or the Warden Corps. The training period ranges from April to September. According to the experience gained, more students are not advisable, in order to assure providing the pupils with the necessary attention and a survey of quality during this crucial phase of their academic education.

Since the declaration of Sierra Nevada, firstly as Nature Park and later as National Park, 35 and 25 years ago respectively, an Environmental Education and Training Programme is being implemented by the Sierra Nevada Public Use staff, along with the educative community of the surrounding area. The different Primary Education Centres and High-School Institutes of the 60 Municipalities with territory in the National or the Nature Park (Socio-Economic Influence Area), have participated in activities implemented either in their own Centres or in itineraries in Sierra Nevada, in which the natural assets and the environmental problematic have been addressed. Each year, about 1.300 pupils participate in these activities.

Aiming to optimise efforts and results, the different Study Centres of Teaching Staff of the two provinces affected by Sierra Nevada (Granada and Almería) are involved in education activities with the Public Use Area of Sierra Nevada. In total 7 centres with an average of 100 teachers per year participate in this initiative.

6. Site description

6.1. Vulnerability

Sierra Nevada is a protected territory provided with efficient legal and administrative instruments for its long-term conservation and management. However, some vulnerabilities can be identified. The most significant are the following:

1. **Climate change** is by far the most threatening factor with capacity to dramatically modify the structure and functions of ecosystems, ecosystem services and biodiversity. Medium-term climate scenario (1971-2022) foresees an increase of average temperatures of 0.36°C per decade. As a matter of fact, average temperature has risen 1.85°C from the beginning of the 1970 decade. Regarding precipitation patterns, a decrease of 131.7 mm has been detected from 1950. This implies a reduction of 25.3 mm per decade from mid 20th century. Predictive models foresee for this area an increase of the minimum temperatures between 1.81 and 4.38°C to the end of the present century and of 2.56 to 6.22°C for maximum temperatures in the same period. Additionally, a reduction of the precipitation and an increase of extreme weather events, like droughts and torrential rainfall, are expected. In other words, this means an increase of the aridity. These predictions are being fulfilled, since at present the whole Iberian Peninsula is under an intense pluri-annual drought and record warm temperatures are broken year after year across the four seasons. The most vulnerable natural elements are the species adapted to alpine biotopes and those needed of soil and air moisture. At present these species are moving upwards, to find colder and wetter conditions, but the available sites are limited.

2. **Desertification** is a natural risk in wide areas associated to features inherent to specific parts of the territory, like for example soft or unstable grounds, steep slopes, abandonment or bad design of agricultural practices, wildfires, etc. These factors can obviously be worsened by climate change.

3. **High biodiversity and geodiversity**. Occurrence of many endemic and relic species whose knowledge is still incomplete. The uncertainty about the real consequences of the global change makes more necessary to count on accurate information to assure their conservation.

4. **Changes of the traditional farming methods** towards the intensification or the abandonment of the compatible systems of livestock breeding. A significant proportion of the biodiversity is linked to farming activity. The use of chemical products to increase productions, to prevent cattle diseases and pests and/or for other purposes is causing the non-natural mortality of invertebrates. For example coprophagous beetles are massively killed by the use of ivermectine to prevent and remove parasites in cattle. When they are eaten by predators the poison continues acting in a deadly chain. The continuous population reduction of the red-billed chough (*Pyrrhocorax pyrrhocorax*) is thought to be a consequence of this chronic toxicity. The problem of the pollinator mortality by neo-nicothinoids and other chemicals is a problem worldwide and Sierra Nevada is not an exception.

5. **Reduction of the hydric resources** caused by water extractions for farming, for mini hydropower plants and for the artificial production of snow in the ski resort.

6. **Risk of big wildfires**, especially in big surfaces occupied by reafforestations with conifers made some decades ago. Big surface areas have been planted with different species of pine between the 40s and the 50s, to a total of about 40.000 hectares. The densities of trees are very high, mainly by lack of silvicultural treatments. Eventual wildfires are a very

worrisome risk.

7. **Increasing demands** of soil, water and supplies for urban developments and the ski station. The progressive increase of living standards requires more and more resources that the local environment often cannot supply at the demanded level.

8. **Emergent diseases and pests**. The progressive warming temperatures are modifying the climate conditions and many pest species are moving to areas where previously did not occur. The same can be said about pathogens, which are also moving around because of goods traffic and other factors and provoke damages in different wild and domestic species of fauna and flora. This factor is under follow-up by the Sierra Nevada Global Change Observatory

9. **Lose or deterioration** of cultural assets, landscapes, traditional tools and practices, constructions, etc. The important heritage elements existing in Sierra Nevada, often quite old, need continuous revisions and restoration in some cases. The lack of sufficient financial resources of different competent Administrations and private owners prevent to adequately cover these needs.

10. **Poaching** and illegal fishing. The presence of the best population of mountain goat (*Capra pyrenaica*), and to a lesser extent of wild boar (*Sus scrofa*) raise the desire of trophies by illegal hunters. At the same time, common trout (*Salmo trutta*) inhabit many of the mountain rivers of Sierra Nevada, where occupies the southernmost distribution area. Fishing trout is allowed under permits, but the captured fishes cannot be killed and they must be returned to the river. The Sierra Nevada population is relatively small, older age classes do not appear and the species is very vulnerable to illegal fishing.

11. **Overcrowding emblematic sites by visitors**. At present there are no limits to walk around the Sierra Nevada, with some exceptions if conservation or security reasons recommend prohibiting entering some area. Mountaineering is a very popular activity in Sierra Nevada and many visitors enjoy the highest peaks in summer, attracted by the Mulhacén and Veleta peaks, the highest of the Iberian Peninsula and two of the highest in Europe. There are specific moments when these areas are extremely crowded and create confusion, noise, rubbish and trampling in very sensitive areas with high proportion of endemic plants and invertebrates. In view of the increasing impact of this situation, increasing efforts are being made to study and design some control measures.

6.2. Protection status

Sierra Nevada is a protected territory since 1986 and has been designated under different national and international protection categories. In chronological order of their respective legal declarative regulations, these are the following:

- **Sierra Nevada Biosphere Reserve.** UNESCO, April 1986. In 2012 the zonation of the Biosphere Reserve was modified to adapt the boundaries of the Nucleus, Buffer and Transition Zones to the National Park and Nature Park boundaries and zonation.

- **Sierra Nevada Nature Park**. Surface area: 172.238 hectares. (Regional) Law 2/1989, of 18th July 1989, approving the Inventory of Natural Protected Areas of Andalusia and establishing additional measures for their protection;

- **Sierra Nevada National Park**. Surface area: 85.883 hectares. (National) Law 3/1999, of 11th January 1999, on the creation of the Sierra Nevada National Park, which extends its

protection over the highest areas, previously belonging to the Nature Park. Therefore, the surface area of the latter is reduced to the current 86.355 hectares;

- **Padul Peatlands and Wetlands Ramsar Site.** Surface area: 309 hectares, placed in the SW side of the Nature Park. Approved by Agreement of the Spain's Council of Ministers of December 2005;

- **Sierra Nevada Natural Space**. Decree 24/2007, of 30th January 2007, declaring the Sierra Nevada Natural Space and regulating the management and participation instruments of Doñana and Sierra Nevada. This measure is basically of administrative scope, with no translation to the territory.

- **Sierra Nevada Special Protection Area**. Surface area: 172.238 hectares. Pursuant to Directive 79/409/CEE on the protection of wild birds, replaced by Directive 2009/147/CE of30th November. Designated in October 2002. Natura 2000 code: ES6140004;

- **Sierra Nevada Community Important Site** of the Mediterranean Biogeographic Region. Surface area: 172.238 hectares. Pursuant to Directive 92/43/CEE on the conservation of natural habitats and of wild species of flora and fauna). Decision of the European Commission of 19th July 2006. Natura 2000 code: ES6140004;

- **Sierra Nevada Special Conservation Area** of the Mediterranean Biogeographic Region. Surface area: 172.238 hectares. Pursuant also to Directive 92/43/CEE. Decree 493/2012, of 25 September, whereby specific Community Important Sites are declared as Special Conservation Areas of the European Ecological Network Natura 2000 in the Andalusia Autonomous Community Natura 2000 code: ES6140004;

- **Sierra Nevada Natural Space IUCN Green List of Protected and Conserved Areas**. Surface area: 172.238 hectares. Declared during the IUCN World Park's Congress held in Sydney (Australia) in November 2014. At the date of this dossier, the renewal process is underway.

Apart from these designations, there are two declarations as Natural Monuments:

- **The Nigüelas Fault Natural Monument**, declared in 2001, formed in the contact between the Padul Tectonic Depression, which progressively descends, and the Sierra Nevada massif, which progressively rises.

- **The Padules Channels Natural Monument**, declared in 2019. It is a spectacular gorge where a person can touch the Sierra Nevada with the left hand and the Sierra de Gádor, with the right hand.

6.3. Ownership

Sierra Nevada National Park and the Nature Park (Sierra Nevada Natural Space):

The total surface area is 172.238 hectares. According to the data from 2022, the ownership is distributed as follows:

- Public: 103.495 hectares (approximately 60 % of the total)
- Private: 68.743 hectares (approximately 40 % of the total)

The public ownership belongs to three types of Administrations:

- Municipal Administration: 79.457ha (46 % of the total)
- Regional Administration – Junta de Andalucía: 20.171 ha (12 % of the total)
- National Administration - Autonomous Organism of National Parks: 3.867 ha (2 % of the total)

The ownership distribution differs between the National Park and the Nature Park.

Sierra Nevada National Park:

- Public: 64.964 ha (75,65 % of the total surface area of the National Park)
- Private: 20.919 ha (24,35 % of the total surface area of the National Park)

The public property is distributed as follows:

Total surface area of the National Park:		**85.883 ha**
Municipal Administration	50.067 ha	58,3 %
Regional Administration – Junta de Andalucía	11.030 ha	12,85 %
National Administration - Autonomous Organism of National Parks	3.867 ha	4,5 %

Sierra Nevada Nature Park

- Public: 64.964 ha (76 % of the total surface area of the Nature Park)
- Private: 20.919 ha (24 % of the total surface area of the Nature Park)

The public property is distributed as follows:

Total surface area of the Nature Park:		**86.355 ha**
Municipal Administration	29.390 ha	34 %
Regional Administration – Junta de Andalucía	9.141 ha	11 %

6.4. Documentation

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7. Site management

7.1. Management plans

There are three different Management Plans in Sierra Nevada. All of them have been legally approved by means of the Decree 238/2011, of 12th July, of the Regional Government (Junta de Andalucia) establishing the ordination and management of Sierra Nevada.

- **Master Plan of Natural Resources** (Plan de Ordenación de los Recursos Naturales – PORN). It covers the whole territory of the National Park and the Nature Park. After a description and a diagnosis, this Plan establishes the general regulation of authorised and non authorised uses and activities and the general zonation of both Parks.

- **Sierra Nevada National Park Management Plan** (Plan Rector de Uso y Gestión – PRUG). This document only concerns the National Park and established the objectives and management criteria, defines the four zones established in the PORN, develops in detail the rules for the protection of the National Park, defines the compatible and non compatible activities, design the guidelines of the Public Use System, establishes the activities to be implemented during the period of validity of the Plan and the indicators of fulfilment.

- **Sierra Nevada Nature Park Management Plan** (Plan Rector de Uso y Gestión – PRUG). This document is equivalent to the previously described, but covers only the Nature Park. The structure of both documents is very similar. The main difference with the PORN is the degree of development of its provisions

Other planning instruments concerning specific issues are also operative in the protected area:

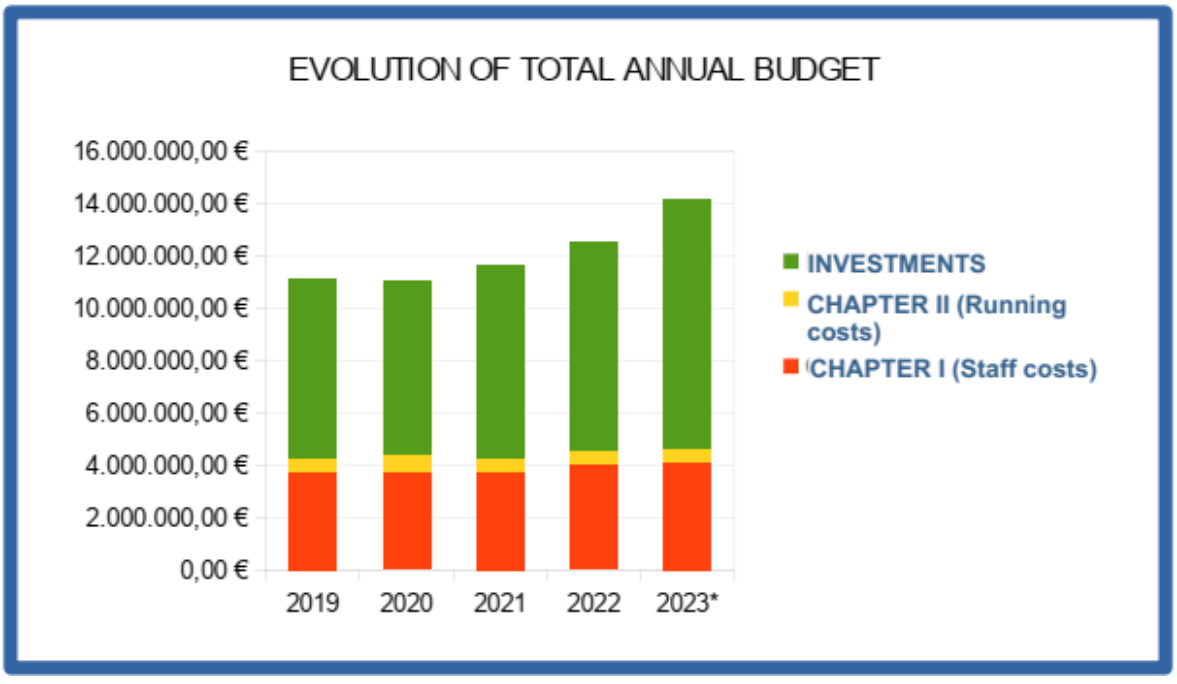
- The Sierra Nevada Public Use Sectoral Plan
- The Sierra Nevada Livestock Sectoral Plan
- The Sierra Nevada Sustainable Development Plan

At national level there is also a regulatory instrument considered a Management Plan: the Master Plan of the National Park Network[2]. It has been approved by the Royal Decree 389/2016, of 22nd October. It also applies to Sierra Nevada National Park.

7.2. Budget and personnel

During the last 5 years, the budget of the Sierra Nevada National Park and Nature Park has been as follows:

YEAR	CHAPTER I (Staff costs)	CHAPTER II (Running costs)	INVESTMENTS	TOTAL BUDGET
2019	3.741.200,00 €	499.551,00 €	6.885.349,00 €	11.126.100,00 €
2020	3.763.394,81 €	676.660,69 €	6.609.883,00 €	11.049.938,50 €
2021	3.755.029,53 €	505.553,71 €	7.393.004,00 €	11.653.587,24 €
2022	4.070.549,00 €	472.477,00 €	7.947.036,00 €	12.490.062,00 €
2023 (Provisional estimated expenditure)	4.100.000,00 €	540.209,00 €	9.500.000,00 €	14.140.209,00 €



[2] https://www.miteco.gob.es/es/parques-nacionales-oapn/red-parques-nacionales/gestion/plan-director.html

At the end of 2023, the total permanent staff in Sierra Nevada is 104 persons, either civil servants (66), employees (33) or external support staff (5). This amount can be split in the following categories:

Executive Team: 3
Surveillance and law enforcement staff: 65
Technicians of the Conservation Area: 6
Public Use technicians and Guides:7
Administration staff:18
External support team: 5

8. Map of the site

8.1. Physical map:

National map number	scale	projection
IGN-1010	1:25.000	UTM ETRS89
IGN-1011	1:25.000	UTM ETRS89
IGN-1012	1:25.000	UTM ETRS89
IGN-1026	1:25.000	UTM ETRS89
IGN-1027	1:25.000	UTM ETRS89
IGN-1028	1:25.000	UTM ETRS89
IGN-1029	1:25.000	UTM ETRS89
IGN-1041	1:25.000	UTM ETRS89
IGN-1042	1:25.000	UTM ETRS89
IGN-1043	1:25.000	UTM ETRS89
IGN-1044	1:25.000	UTM ETRS89

Reference to availability of boundaries in digitised form

https://portalrediam.cica.es/descargas?path=%2F07_PATRIMONIO_NATURAL%2F01_ESPACIOS_PROTEGIDOS%2F01_RENPA%2F01_EENNPP%2FEENNPP_2023_05%2FInfGeografica%2FInfVectorial

8.2. Map of designated sites described in 6.2

Maps enclosed to this document:

- Situation of the Sierra Nevada National Park, Nature Park and Biosphere Reserve
- Boundaries of the National Park, the Nature Park and the Biosphere Reserve
- Zoning of the Sierra Nevada National Park and Nature Park

8.3. Aerial photograph(s) included:

	X
Yes	No

Aerial photographs are not included because the size of the site is too big (172.238 ha) for aerial pictures to show relevant features in a certain detail. The Sierra Nevada Master Plan of Natural Resources (see section 7.1) published in the Official Journal of the Junta de Andalucía, contains between pages 172 to 256 all aerial photographs of the whole area of the National Park and the Nature Park, in a scale equivalent to 1:10.000. This document can be downloaded from:

Part 1: https://www.juntadeandalucia.es/boja/2011/155/fasciculo-2.pdf

Part 2: https://www.juntadeandalucia.es/boja/2011/155/fasciculo-3.pdf

9. Photos

Number	Place	Subject	Copyright
1	Mulhacén Peak: 3.479 m.a.s.l.	Highest summits landscape	Guillermo Rodríguez
2	Mulhacén and Alcazaba peaks	Highest summits landscape	Sierra Nevada
3	Lavaderos de la Reina	Ice and snow melting	Sierra Nevada
4	Highest summits	Alcazaba, Mulhacén, Cerro de las Machos and Veleta	Sierra Nevada
5	Laguna Seca in winter.	High-mountain landscape	Sierra Nevada
6	Laguna Seca in summer	High-mountain landscape	Sierra Nevada
7	Acequia Alta de Pitres	Irrigation channel (acequia)	Jose Miguel Barea
8	Prados del Piornal	Wet high-mountain meadows (*borreguiles*)	Sierra Nevada
9	Rioseco lagoon	High-mountain lagoons	Jose Miguel Barea
10	Vacares lagoon	High-mountain lagoons	Jose Miguel Barea
11	Balsa del Almiar	Contact woodlands *Q. rotundifolia* and *Q. pyrenaica*	Sierra Nevada
12	Alayos del Dílar	Dolomite sands and limestone	Sierra Nevada
13	Cuerda del Trevenque	Dolomite and limestone grounds	Jose Miguel Barea
14	La Dehesilla	Native pine forest	Pablo Galdo
15	Polarda. Marquesado	Pine reafforestations	Sierra Nevada
16	River Trevelez	Mountain river	Jose Miguel Barea
17	Rambla de los Yesos	Arid landscape	Jose Manuel Castilla
18	Alboloduy	Badlands	Jose Manuel Castilla
19	Borreguiles ski area	Ski resort	Sierra Nevada
20	Track Diagonal de Cauchiles	Ski track	Sierra Nevada
21	Loma Pelada	Garnets in micaschist	Miguel A. Díaz Puga
22	Peñones de San Francisco	Amphibolite stone	Miguel A. Díaz Puga
23	Alto del Chorrillo	Crystals of andalusite	Miguel A. Díaz Puga
24	Loma Pelada	Fibrous-radiated aggregate of amphibole	Miguel A. Díaz Puga
25	Collado de las Sabinas	Outcrop of serpentinite	Miguel A. Díaz Puga
26	Cerro del Almirez	Texture pseudo-spinifex of ultramaphic rock	Miguel A. Díaz Puga
27	High summits	Endemic orthopter *Baetica ustulata*	Jose Miguel Barea
28	High summits	Endemic orthopter *Pycnogaster inermis*	Jose Miguel Barea
29	High summits	Endemic orthopter *Eumigus rubioi*	Jose Miguel Barea

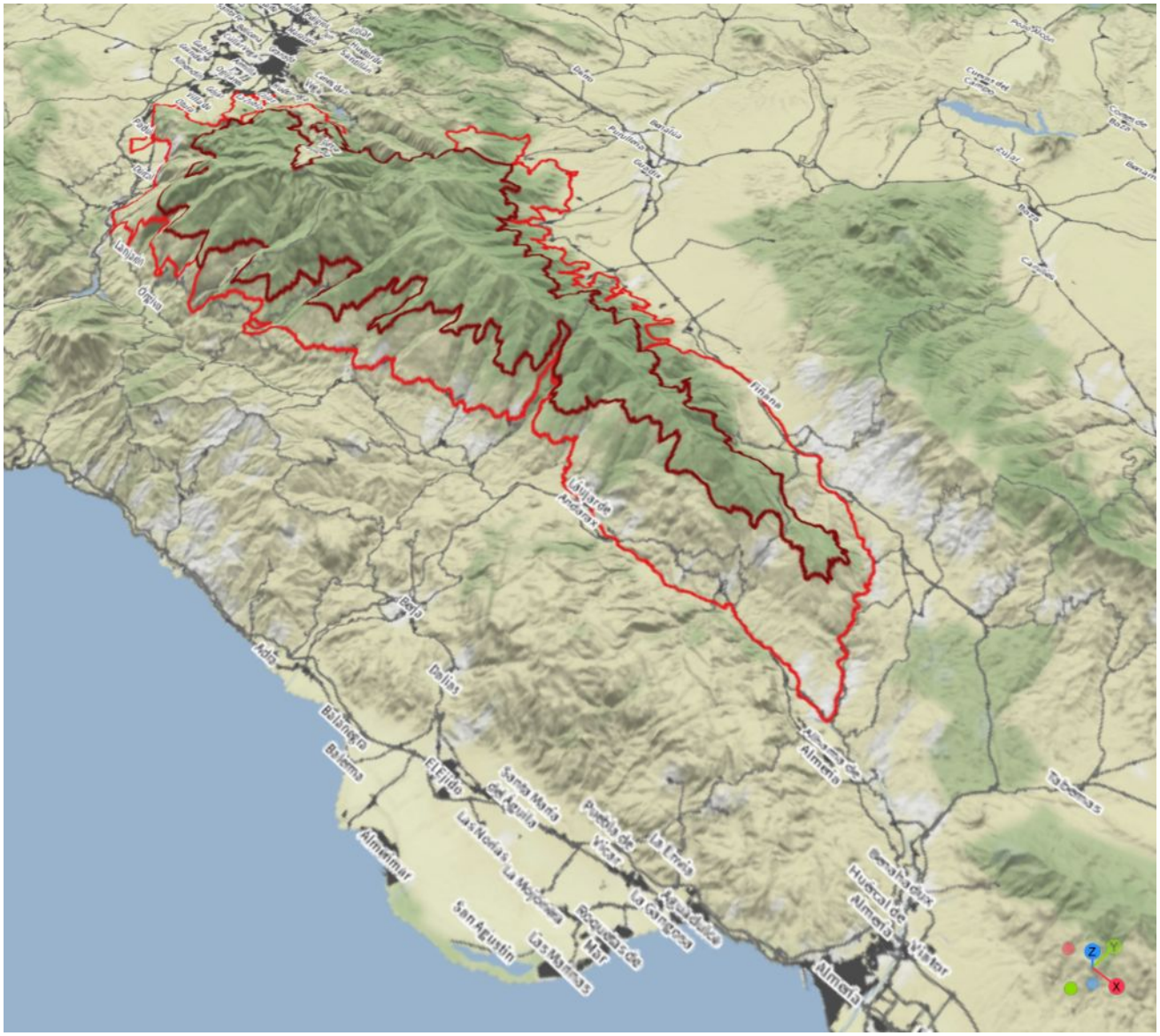
30	River Genil	Damselfly *Calopteryx virgo* (female)	Jose Miguel Barea
31	Dehesa de Teatinos	Dragonfly *Libelulla depressa*	Jose Miguel Barea
32	High summits	Mountain apollo butterfly *Parnassius apollo* subsp. *nevadensis*	Jose Miguel Barea
33	Cortijuela del Trevenque	Marsh fritillary butterfly *Euphydryas aurinia*	Jose Miguel Barea
34	High summits	Sierra Nevada blue butterfly *Polyommatus golgus*	Jose Miguel Barea
35	High summits	Endemic lycaenid *Agriades zullichi*	Jose Miguel Barea
36	Purche	Giant peacock moth *Saturnia pyri*	Jose Miguel Barea
37	Hoya de la Mora	Endemic *Iberodorcadion lorquini*	Jose Miguel Barea
38	Pico del Caballo	Endemic *Iberodinodes baeticus*	Jose Miguel Barea
39	Rio Seco lagoon	Endemic earwig *Eulithinus analis*	Jose Miguel Barea
40	High summits	Endemic opilion *Roeweritta carpentieri*	Jose Miguel Barea
41	La Gabiarra	Endemic midwife toad *Alytes dickhilleni*	Jose Miguel Barea
42	High summits	Alpine accentor *Prunella collaris*	Sierra Nevada
43	High summits	Adult bearded vulture *Gypaetus barbatus*	Jose Miguel Barea
44	Tranco del Dornajo	Young male mountain goat *Capra pyrenaica*	Jose Enrique Granados
45	Lanjarón Valley	Herd of mountain goat *Capra pyrenaica*	Jose Enrique Granados
46	Cascajares del Veleta	Male mountain goat *Capra pyrenaica* equipped with collar for monitoring	Jose Enrique Granados
47	Peñones de San Francisco	Two male mountain goats fighting on heat. *Capra pyrenaica*	Jose Enrique Granados
48	Peñones de San Francisco	Two male mountain goats fighting on heat. *Capra pyrenaica*	Jose Enrique Granados
49	Monte Santillana	Photo-trapped wild cat *Felis sylvestris*	Jose Miguel Barea
50	High summits	Snow vole *Chionomys nivalis*	Jose Miguel Barea
51	High summits	Juniper *Juniperus communis* subsp. *nana*	Jose Miguel Barea
52	High summits	*Artemisia granatensis*	Jose Miguel Barea
53	High summits	*Viola crassiuscula*	Sierra Nevada

54	High summits	*Gentiana sierrae*	Jose Miguel Barea
55	High summits	*Sempervivum minutum*	Sierra Nevada
56	High summits	*Eryngium glaciale*	Sierra Nevada
57	High summits	*Carduus carlinoides*	Sierra Nevada
58	High summits	*Hormatophylla spinosa*	Sierra Nevada
59	High summits	*Chaenorrhinum glareosum*	Sierra Nevada
60	High summits	*Arenaria tetraquetra*	Sierra Nevada
61	Lanjarón Valley	*Genista umbellata*	Sierra Nevada
62	Loma del Chullo. Bayárcal	Holm oak (*Quercus rotundifolia*) woodland. On top, pine reafforestation	Jose Miguel Barea
63	Lanjarón Valley	Flowering holm oak *Quercus rotundifolia*	Sierra Nevada
64	Cáñar Oakwood	Oak (*Quercus pyrenaica*) leaves	Sierra nevada
65	Lanjarón Valley	*Thymus mastichina*	Sierra Nevada
66	Dehesa de Teatinos	Birch *Betula fontqueri*	Sierra Nevada
67	Trevélez Valley	Agriculture in terraces	Jose Manuel Castilla
68	La Tahá de Pitres	Threshing floor	Jose Manuel Castilla
69	Acequia Bérchules-Trevélez	Irrigation channel collecting snow melting water (*acequia de careo*)	Jose Miguel Barea
70	Cortijo de la Piuca	Traditional construction	Sierra Nevada
71	Poqueira Valley	Alpujarra village - Capileira	Jose Miguel Barea
72	Alboloduy	Alboloduy village and Nacimiento river	Jose Manuel Castilla
73	Lacalahorra	Marquesado villaje and castle from Renaissance	Jose Manuel Castilla
74	Alpujarra	Traditional architectural elements: witch chimneys	Jose Manuel Castilla
75	High summits	Meteo station near Veleta peak	Sierra Nevada
76	High summits	Maintenance winter control of meteo station near Veleta peak	Sierra Nevada
77	Cáñar Oakwood	Meteo station	Manuel Pacheco
78	High summits	High-mountain bird census	Sierra Nevada
79	Genil River	Electric fishing for trout (*Salmo trutta*) census	Gonzalo Muñoz
80	Genil River	Sampling aquatic macro-invertebrates	Gonzalo Muñoz
81	Rinconada de Nigüelas	Snow vole (*Chionomys nivalis*) census	Rogelio López
82	High summits	Vegetation inventory of GLORIA international project	Cristina P. Sánchez

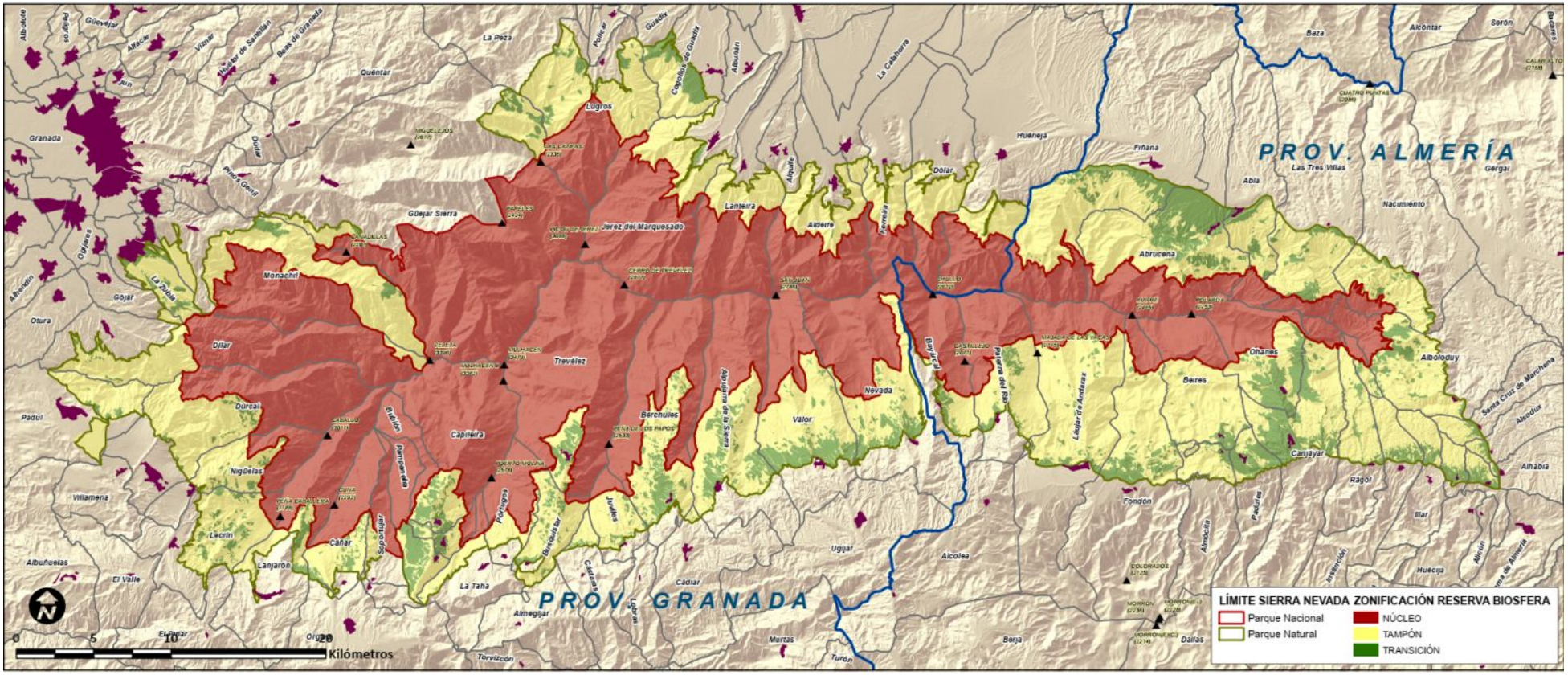
CARTOGRAPHY OF THE SIERRA NEVADA NATIONAL PARK, NATURE PARK AND BIOSPHERE RESERVE

SITUATION OF THE SIERRA NEVADA NATIONAL PARK AND NATURE PARK

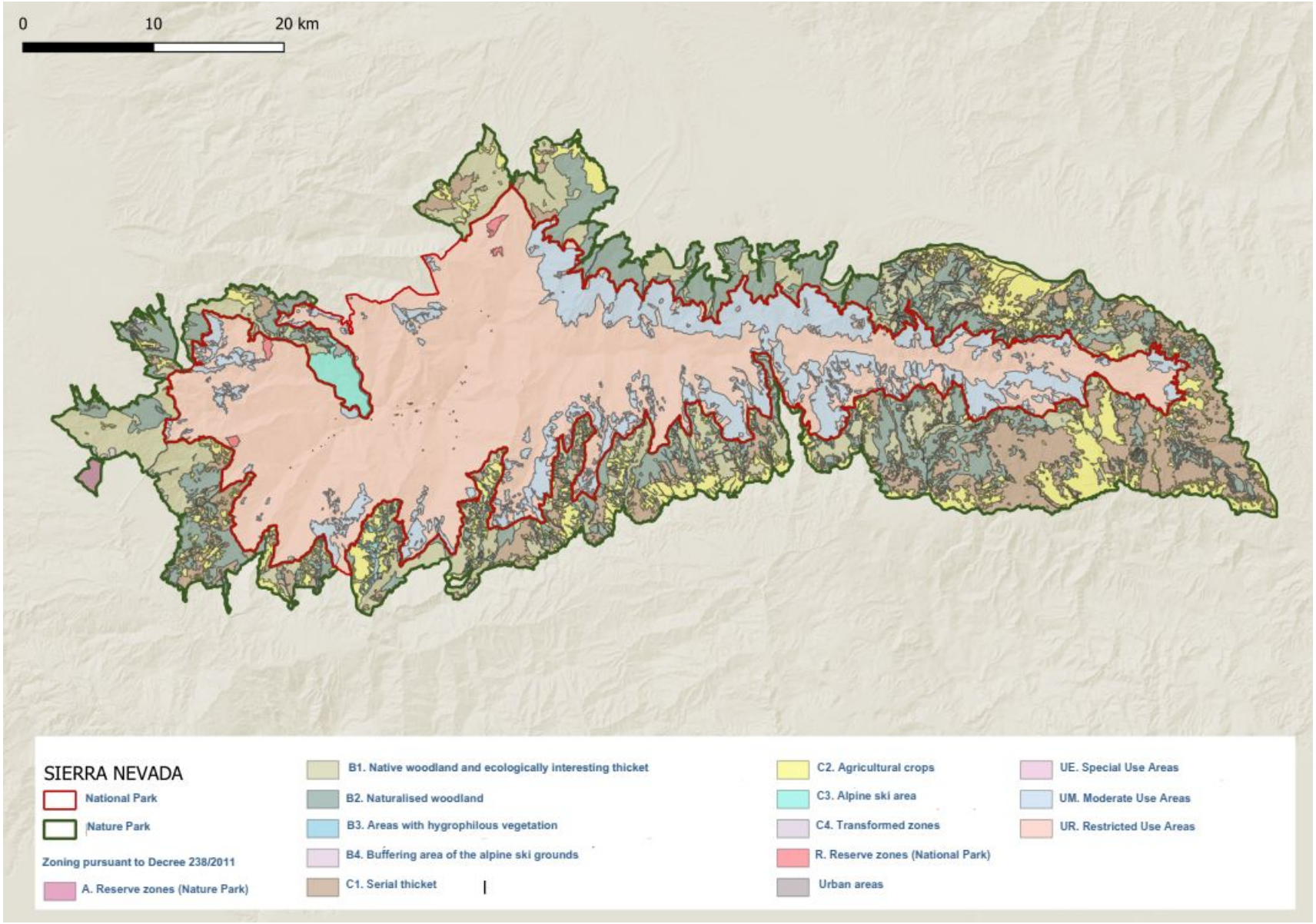
SITUATION OF THE SIERRA NEVADA NATIONAL PARK AND NATURE PARK WITHIN THE EAST-ANDALUSIAN GEOGRAPHICAL CONTEXT



MAP OF THE SIERRA NEVADA NATIONAL PARK, NATURE PARK AND BIOSPHERE RESERVE.



ZONING OF THE SIERRA NEVADA NATIONAL PARK AND NATURE PARK



SIERRA NEVADA NATIONAL PARK, NATURE PARK AND BIOSPHERE RESERVE
CANDIDATURE TO THE EUROPEAN DIPLOMA FOR PROTECTED AREAS

PHOTOGRAPHIC ANNEX

Picture 1 - Mulhacén Peak: 3.479 m.a.s.l.

Picture 2 – Mulhacén and Alcazaba peaks

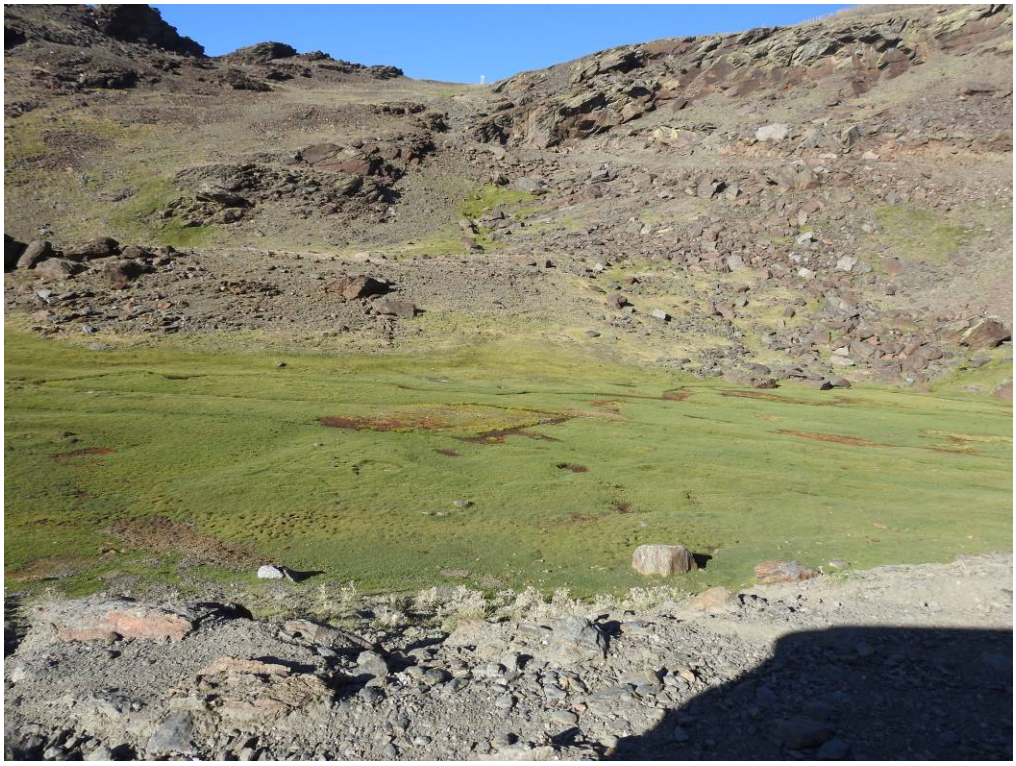
Picture 3 – Ice and snow melting at Lavaderos de la Reina

Picture 4 – Highest summits. From left to right: Alcazaba, Mulhacén, Cerro de las Machos and Veleta

Picture 5 – Laguna Seca in winter. Southern slope of the Chullo peak (Almería)

Picture 6 – Laguna Seca in summer. Southern slope of the Chullo peak (Almería)

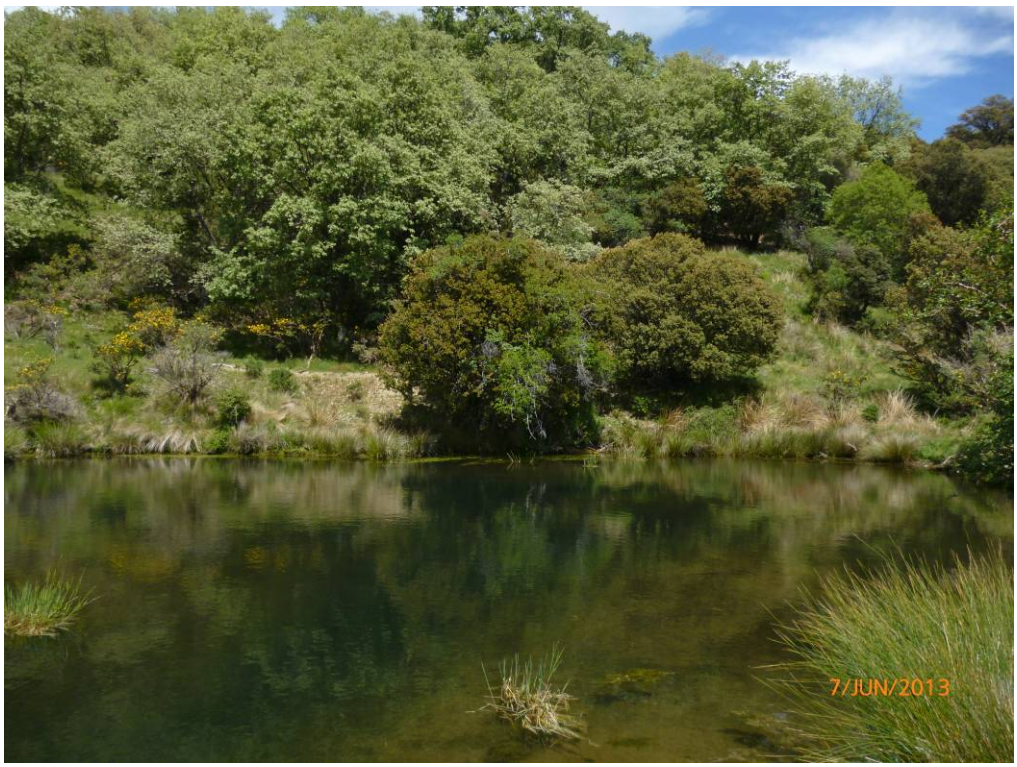
Picture 7 – Irrigation channel Acequia Alta de Pitres



Picture 8 – Wet high-mountain meadows (borreguiles)

Picture 9 – High-mountain lagoons. Laguna de Rioseco

Picture 10 – High-mountain lagoons. Laguna de Vacares



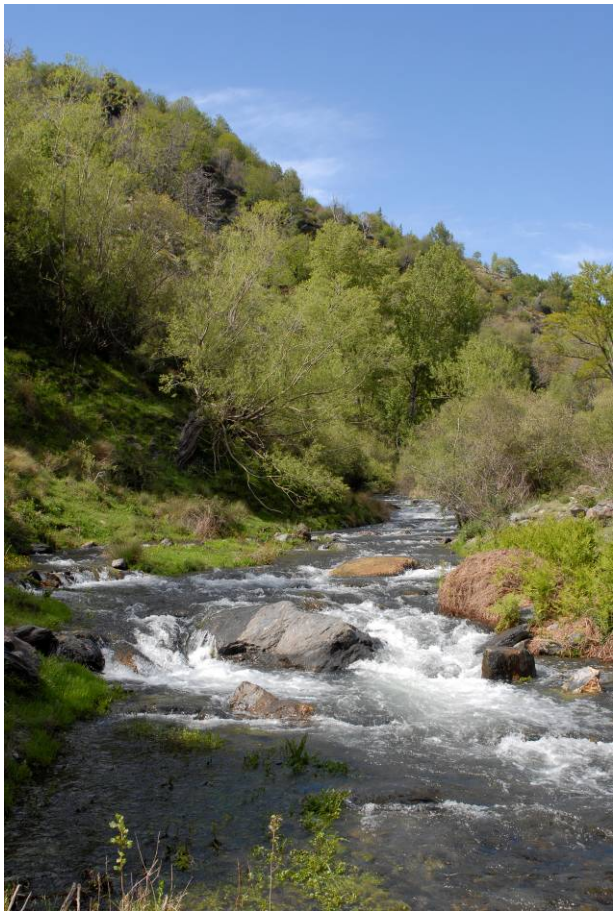
Picture 11 – Contact between *Quercus rotundifolia* and *Quercus pyrenaica* woodlands. Balsa del Almiar

Picture 12 – Dolomite sands and limestone. Alayos del Dílar

Picture 13 – Dolomite and limestone grounds. Cuerda del Trevenque.

Picture 14 – Native forest of *Pinus pinaster* subsp. *acutisquama*

Picture 15 – Pine reafforestations. Marquesado area



Picture 16 – Mountain river. Río Trevélez

Picture 17 – Arid lands. Rambla de los Yesos (Almería)

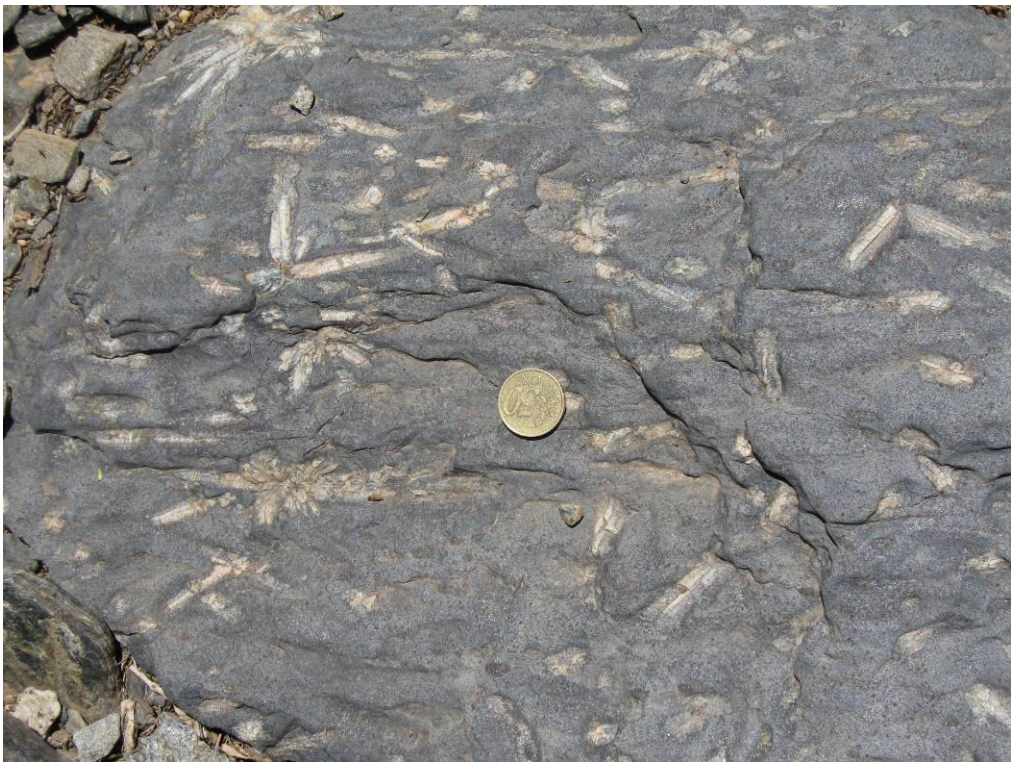
Picture 18 – Badlands. Alboloduy (Almería)

Picture 19 – Ski resort. Borreguiles Area

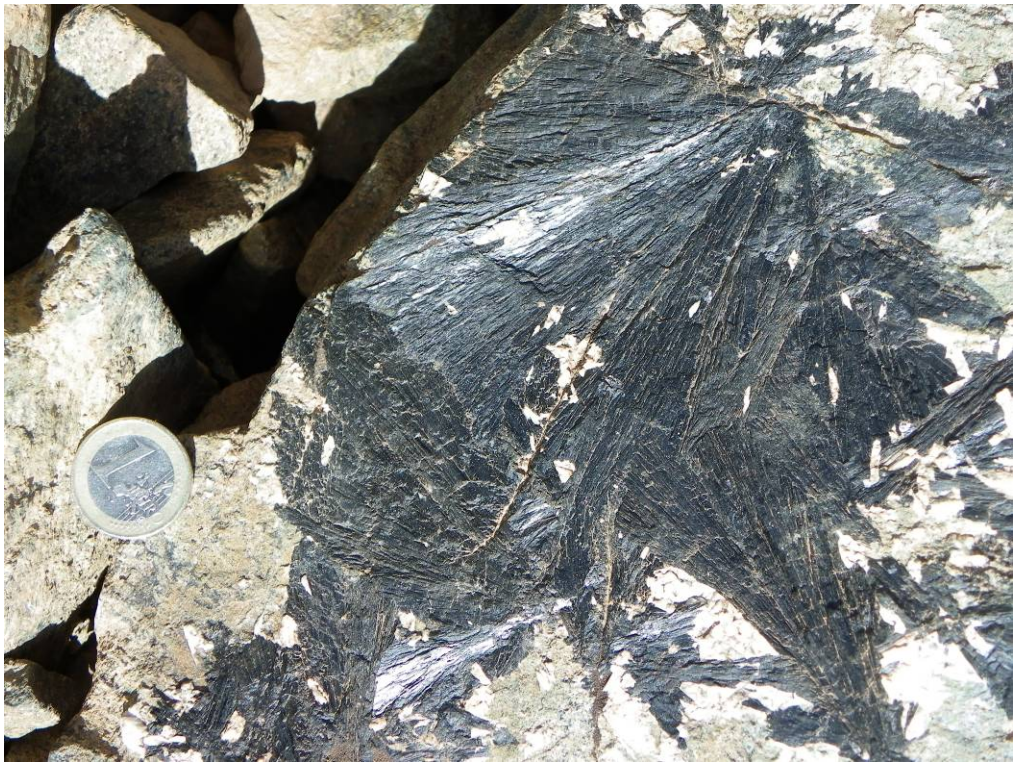
Picture 20 – Ski track. Pista Diagonal de Cauchiles

Picture 21 – Garnets in micaschist

Picture 22 – Amphibolite stone



Picture 23 – Crystals of andalusite



Picture 24 – Fibrous-radiated aggregate of amphibole

Picture 25 – Outcrop of serpentinite

Picture 26 – Texture pseudo-spinifex of ultramaphic rock

Picture 27 – Endemic orthopter *Baetica ustulata*

Picture 28 – Endemic orthopter *Pycnogaster inermis*

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Picture 31 – Dragonfly *Libelulla depressa*

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Picture 33 – Marsh fritillary butterfly *Euphydryas aurinia*

Picture 34 – Sierra Nevada blue butterfly *Polyommatus golgus*

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Picture 43 – Adult bearded vulture *Gypaetus barbatus*

Picture 44 – Young male mountain goat *Capra pyrenaica*

Picture 45 – Herd of mountain goat *Capra pyrenaica*

Picture 46 – Male mountain goat *Capra pyrenaica* equipped with collar for monitoring

Picture 47 – Two male mountain goats fighting on heat. *Capra pyrenaica*

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Picture 51 – Juniper *Juniperus communis* subsp. *nana*

Picture 52 – *Artemisia granatensis*

Picture 53 – *Viola crassiuscula*

Picture 54 – *Gentiana sierrae*

Picture 55 – *Sempervivum minutum*

Picture 56 – *Eryngium glaciale*

Picture 57 – *Carduus carlinoides*

Picture 58 – *Hormatophylla spinosa*

Picture 59 – *Chaenorrhinum glareosum*

Picture 60 – *Arenaria tetraquetra*

Picture 61 – *Genista umbellata*

Picture 62 – Holm oak (*Quercus rotundifolia*) woodland. On top, pine reafforestation

Picture 63 – Flowering holm oak *Quercus rotundifolia*

Picture 64 – Oak (*Quercus pyrenaica*) leaves covered by pubescence as defence against desiccation. Robledal de Cáñar

Picture 65 – *Thymus mastichina*

Picture 66 – Birch *Betula fontqueri*. Dehesa de Teatinos

Picture 67 – Agriculture in terraces.

Picture 68 – Threshing floor. Era del Trance. La Tahá de Pitres

Picture 69 – Irrigation channel collecting snow melting water (*acequia de careo*). Acequia Bérchules-Trevélez

Picture 70 – Traditional construction. Cortijo de la Piuca

Picture 71 – Alpujarra villaje Capileira (Granada). Poqueira Valley

Picture 72 – Alboloduy (Almería) and Nacimiento River

Picture 73 – Marquesado villaje Lacalahorra. On top, castle from the Renaissance

Picture 74 – Traditional architectural elements: witch chimneys

Picture 75 – Meteo station near Veleta peak

Picture 76 – Maintenance winter control of meteo station near Veleta peak

Picture 77 – Meteo station in Cáñar Oakwood

Picture 78 – High-mountain bird census

Picture 79 – Electric fishing for trout (*Salmo trutta*) census

Picture 80 – Sampling aquatic macro-invertebrates

Picture 81 – Snow vole (*Chionomys nivalis*) census

Picture 82 – Vegetation inventory of GLORIA international project