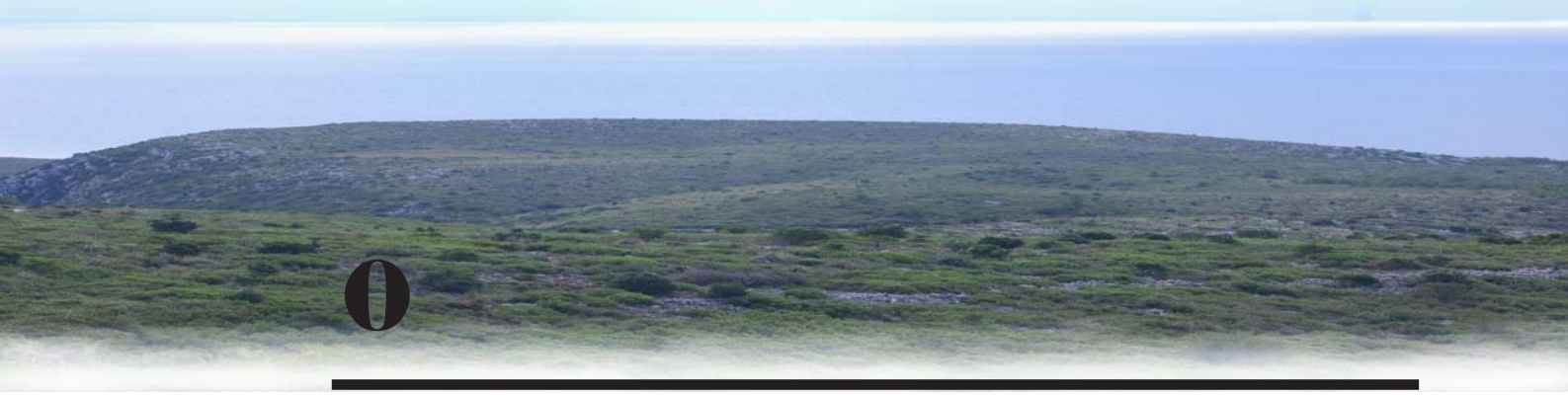

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Study Area: the massif of Collserola and the massif of Garraf

The study area was located in the southern sector of the Catalan Serralada Litoral (North east of the Iberian Peninsula). The Serralada Litoral runs parallel to the coast of the Mediterranean Sea from north (Aigüamolls de l'Empordà) as far as the river Gaià in the south of Catalonia. This is a modest formation that never rises above 800 m and that in our study area (surrounds of Barcelona city) constitute two differentiated massifs: Collserola (512 m) and El Garraf-Ordal (658 m).

The massif of Collserola actually constitute the Collserola Park, with over 8,000 hectares. The massif is a true green island in the middle of one of the most densely populated urban areas on the Mediterranean coastline. Since 1987, Collserola has had a "Special Plan for Regulation and Protection of the Natural Environment", which gives it a park statute, in accordance with current city-planning legislation. This plan has the following priority objectives: to maintain the stability of the ecosystems, to conserve the biological diversity, to conserve the cultural and landscape heritage, and to offer new opportunities for leisure and learning. The Collserola mountain range forms the northern barrier to Barcelona's expansion. The valleys of the rivers Llobregat and Besós, together with the plain of Barcelona and the Vallés basin, mark the geographical boundaries of the Collserola massif.

Biogeographically, two worlds come together in the mountain range: the Euro-Siberian and the Mediterranean; this, in conjunction with Man's use of the terrain since prehistoric times, conditions a natural heritage formed by a complex mosaic of landscapes, where we find from forests of Aleppo pines and nut pines, evergreen oaklands, riverside copses, maquis

and scrublands, to brush and Savannah grasslands. In the park, around thirty plant communities have been catalogued.

In the north-facing slopes and shaded areas of the massif a variety of forest ecosystems can be found. The forest usually form a a dense layer of vegetation well-adapted to summer droughts, with perennial coriaceous leaves that hardly change with the passing of the seasons. The most abundant forest is the coastal Holm Oak forest (encinar litoral) with a dense canopy and dark interiors, where only large bushes and lianas can reach the light and few small shrubs and herbs thrive. This forest is largely dominated by the coastal Holm Oak (*Quercus ilex ilex*), and the main associated species are *Viburnum tinus*, *Pistacia lentiscus* (lentisc), *Rhamnus alaternus* (Mediterranean Buckthorn) and lianas include *Hedera helix* (Ivy), *Smilax aspera* (Prickly Ivy) and *Lonicera implexa*. In depressions and shaded valley bottoms where thermal inversions are common, small patches of sub-Mediterranean forest developed with dry deciduous oaks (Q. pubescens) which are transitional forest between dry Mediterranean and wetter more central European habitats. More open valleys contain other kind of woodland, comprising fast-growing trees which shoot up straight and grow to great heights. An important part of the massif is dominated by Mediterranean pinewoods, principally by Aleppo Pine (*Pinus halepensis*). Normally these arboreal formations are secondary forest which has taken the place of the old vineyards which were cultivated until the beginning of the XX century. The great ability of pines to colonise and their high seed production often enable them to occupy disturbed areas. The structure of pine forest is highly variable and depends on the dominant species, age and whether timber extraction is still underway. Pines never create a totally shaded habitat and so low shrubs abound, with time and when disturbances end, pinewoods tend to be replaced by evergreen oakwoods.

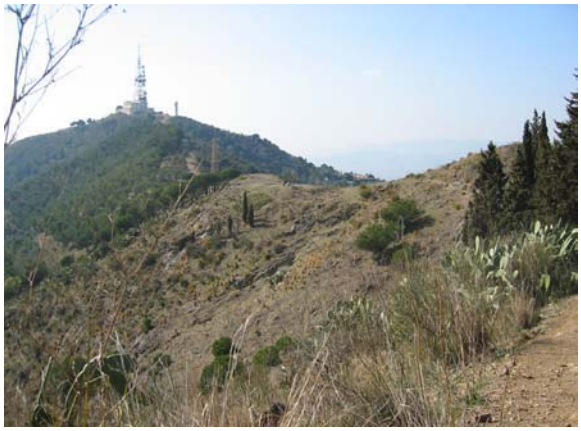
In contrast to the gentle north-facing slopes the south-facing are very steep and the differences in aspect are reflected in the land use and in the vegetation. In the sunny south-facing meadows and Mediterranean shrubs are the dominated vegetation structure. Many of these shrublands are succesional stages that will revert to forest communities. Many have originated from the fairly recent abandonment of crops, explained by the soil degradation and lack of soil moisture of the former vine cultivation areas, whereas others are natural communities limited by soil structure and aridity. These low shrublands are variable in density

and height but generally not dense enough to impede the sunlight from reaching the ground. The plants are specially adapted to the drought conditions, being dry and thorny. Garrigue vegetation is found in areas with alkaline soils.

The massif of Garraf is situated to the south-west of Barcelona, approximately a half hour's drive from the city (30 km). Like Collserola, the area was declared a Natural Park in 1986, forming part of a green belt that surrounds the strongest urbanized sector in Catalonia. Its limits are the lower valley of the river Llobregat, the Mediterranean sea and the Penedès Depression. The massif of El Garraf reach the sea and form a rocky coastline with alternating cliffs, bays, small beaches and inlets. The massif has two different geological regions: limestone and conglomerates. The limestone scenery is spectacular, with dolines, potholes, gorges, limestone pavements and river resurgence at the coast.

Most of the Garraf offers a characteristic southern Mediterranean landscape. The vegetation is of African origin characterized by the presence of the European Fan Palm (*Chamaerops humilis*) and a North African coast grass "carritx" (*Ampelodesmos mauritanica*), which probably arrived in the Garraf from seeds dropped by migratory birds. Garraf is the most northerly area of Europe where this type of vegetation grows. It can be categorized as Garrigues (typical Mediterranean xerophytic vegetation found on limestone) or brolla, (a variety of shrub land found on south-facing slopes). Where the underlying rock is permeable, such as limestone, Garrigues vegetation is found. Garrigues usually develop on calcareous soils and are communities dominated by Kermes Oak (*Quercus coccifera*). They are monotonous and impenetrable formations that frequently contain rock outcrops almost devoid of vegetation. Kermes Oak is accompanied by many aromatic species such as rosemary and lavender. The vegetation on the coastal slopes tends to be Maquis - a dense tangle of undergrowth usually found in impermeable areas or where soils are damper. Maquis formations are either succesional or permanent communities that are limited by aridity and largely occur south of the Llobregat river. Maquis are dense formations dominated by thorny plants and the European Fan Palm. They are less continuous than Garrigues and patches of dense vegetation alternate with rocky zones, devoid of vegetation.

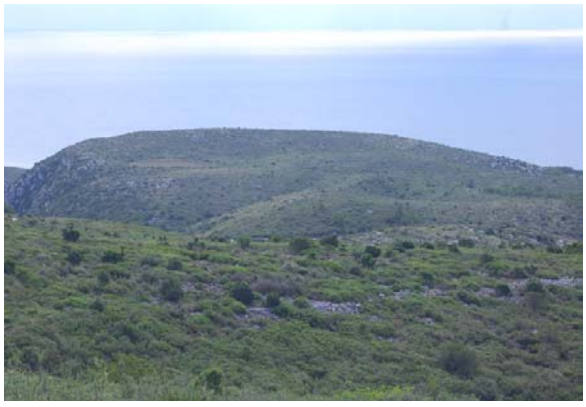
In the drier and hotter interior of the Garraf, the Holm Oak and laurestine dominate in the damper valleys. The lack of vegetation cover in parts of the interior is due to past human


A


B


C


D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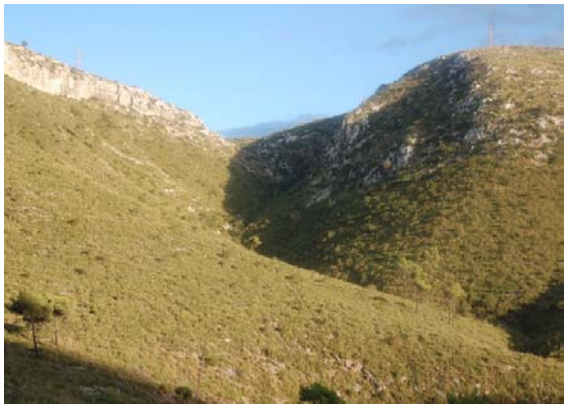
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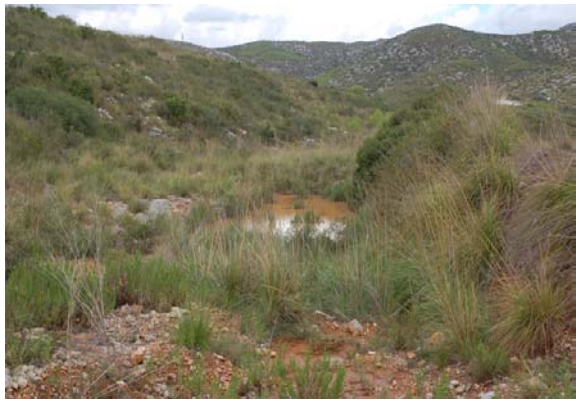

I

Fig 1.- Views of Collserola (A, B, C, D) and Garraf (E, G, H, I)

activity on the Garraf — the grazing of goats and growing of crops. There is much evidence of the terraces or 'Feixes'. Overgrazing and over-cultivation led to soil erosion that removed the soil essential for tree regeneration. Actually part of these areas are dominated by pinewood and low shrublands as consequences of the recurrent fires that block the succesional process to oakwoods. In general vegetation has adapted to the dry, hot conditions and poor soils where water drains away rapidly. Where the shrubs have leaves, these are evergreen, which enables the plants to make full use of the relatively short periods favourable to growth in spring and autumn. Adaptations such as leathery leaves, long roots and the ability to close the leaf around the stomata helps survival through the summer drought. Rural depopulation has left many farmhouses and villages in the region deserted.

The study area lays under the domain of a Mediterranean climate, characterised by dry summers, short mild winters and by markedly irregular rainfall during the spring and autumn seasons. The region can be consider as a sub-arid coastal Mediterranean climate where winters are mild than in the north section of Catalonia or the continental region (Catalan Central Depression), and with longer arid periods than in the north but shorter than in the continental region. Annual rainfall is below 600 mm distributed irregularly across the seasons. The two rainfall peaks are during spring, and especially at the end of summer (September) and early autumn with heavy and irregular storms.

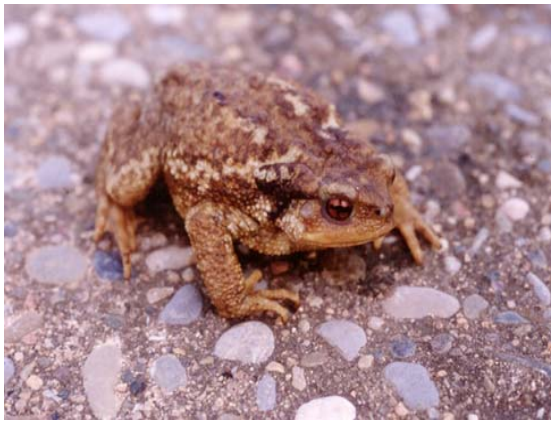
The community of native amphibians is the same in the two areas, and is formed by a total of 8 native species: 1 urodela (*Salamadra salamandra*) and 7 anura (*Alytes obstetricans, Pelodytes punctatus, Pelobates cultripes, Bufo bufo, Bufo calamita, Hyla meridionalis* and *Rana perezi*). Due to their proximity to the city of Barcelona, two introduced newts (*Triturus marmoratus* and *Triturus helveticus*) are present in a well visited pond in Collserola. In Collserola, amphibians are found in watercourses, marshes, and permanent and temporal ponds. Garraf, have not surface waters except for temporal rain ponds and agricultural reservoirs.

Salamandra salamandra

Alytes obstetricans

Pelodytes punctatus

Hyla meridionalis



Bufo bufo

Rana perezi