

Chapter 8

The Pyrenees

Josep M. Ninot, Empar Carrillo, and Albert Ferré

Abstract The Pyrenees is a large mountain system stretching over the Iberian isthmus, and thus encompassing three distinct vegetation regions: medio-European, Mediterranean and Alpine. It includes contrasting landscapes in accordance with this large-scale pattern and also with smaller scales related to continentality, bedrock type, landform and ancient anthropic land use. The northern side and the western edge of the Pyrenees are formed of short valleys with steep slopes. Being strongly influenced by Atlantic winds, these areas experience rainy bioclimates across the elevation gradient. Therefore, the vegetation is set according to the altitudinal zonation model found in other medio-European mountains. This starts with a submontane belt supporting mixed deciduous forests, acidophilous oakwoods and heaths, which at 900–1000 m gives way to the montane belt, best characterized by beech forests, and by fir forests, heaths and meadows.

The Iberian side of the Pyrenees extends southwards over secondary ranges—known as the pre-Pyrenees—and internal depressions, and shows a more complex zonation, since it changes from Mediterranean to montane and then to alpine landscapes. This transition is sharper in the central part of the Iberian side, where the submontane belt combines dominant units related to marcescent oakwoods with sclerophyllous oakwoods and xerophilous scrubland on steeper rocky landforms. From 1100 to 1300 m upwards, the montane belt still expresses some continental Mediterranean influence such as bearing widespread Scots pinewoods together with meso-xerophilous grassland and box scrub. Beech and fir forests and other mesophilous units are secluded on moister slopes.

High mountain landscapes develop from 1600 to 1800 m up to the highest summits (peaking at 3404 m with Aneto), with less pronounced differences between the main north and south sides. The potential treeline ecotone, found at 2200–2450 m, makes the transition between the subalpine and the alpine belts; the former bearing forests of mountain pine and related vegetation units, the latter formed by contrasting vegetation mosaics where rock units become dominant towards the highest elevations.

J.M. Ninot (✉) • E. Carrillo • A. Ferré
Institute for Research on Biodiversity (IRBio) & Department of Evolutionary Biology,
Ecology and Environmental Sciences, University of Barcelona, Av. Diagonal 643, E-08028
Barcelona, Spain
e-mail: jninot@ub.edu

8.1 Introduction

8.1.1 *The Physiographic Framework*

The Pyrenees is a mountain system that is more than 400 km long, stretching over the entire Iberian isthmus, and clearly distinct from the adjacent low-lying areas in both geological and biological aspects. According to physiographic and biogeographic criteria, however, the western and eastern edges form part of the Atlantic and Mediterranean low-mountain areas, respectively. Thus, they will not be included in this account, which focuses on the range running from the Roncal Valley in the west to the Canigó massif in the east. It is a complex mountain unit of some 300 km in length and at its central part it is more than 100 km wide. Over the highly diverse physiography and types of bedrock, the main subunits and highest peaks are set roughly along an east–west axis, the Pyrenean axis, which slopes downwards to the main valleys running northwards or southwards. This pattern is less clear in the eastern sector, where the axial unit including the peaks of Puigmal and Canigó is separated from the main axis by the Segre and Tet valleys, oriented NE to SW. Moreover, this eastern Pyrenean sector connects southwards with the northern Catalanidic system through mountains and plateaus that reach 1200–1500 m, all the way to the Montseny massif, which at its highest exceeds 1700 m. These south-eastern mountains, although not belonging to the Pyrenees according to geological and physiographical criteria, may be included in the Pyrenean province due to their biogeographic character (Fig. 8.1).

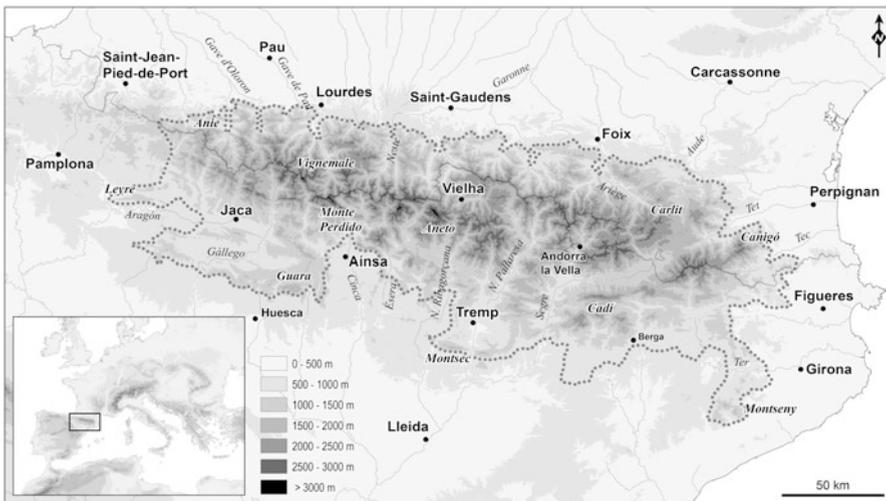


Fig. 8.1 Physiographic map of the Pyrenean area, which includes the Pyrenean mountains from some 500 to 700 m upwards, and also the northern Catalanidic mountains

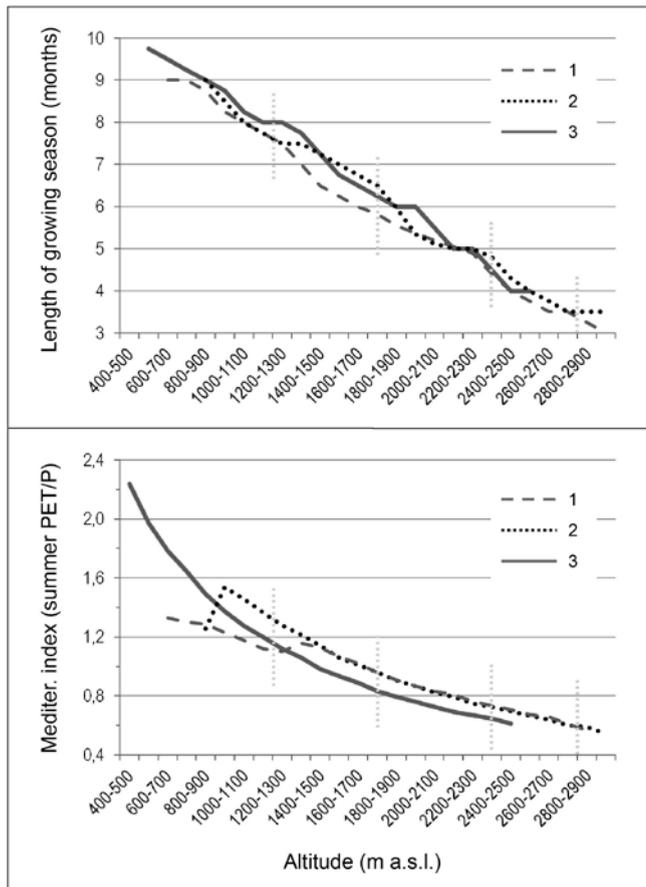


Figure 3. Altitudinal variation of key bioclimatic descriptors in distinct areas of the central Pyrenees: 1, Atlantic side (Aran valley); 2, Iberian side (Alta Ribagorça); 3, pre-Pyrenees (Tresp, Sort). Vertical dotted lines indicate the mean altitude for shifts between vegetation belts.

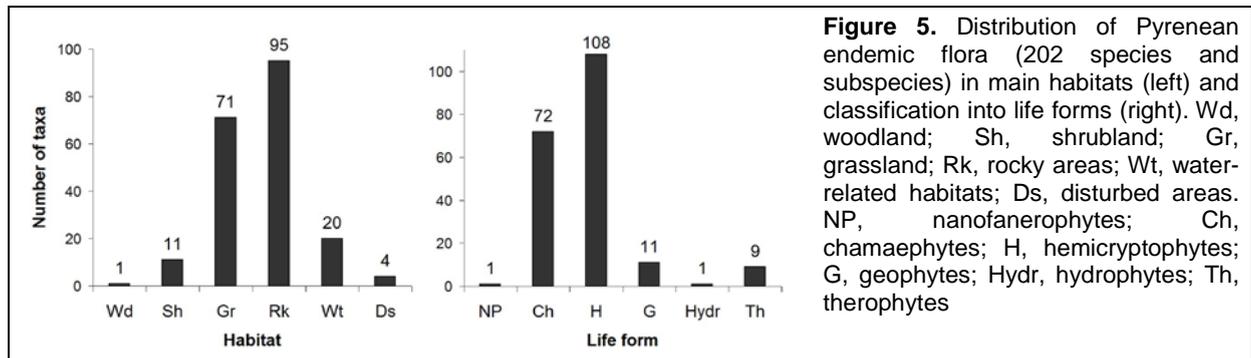


Figure 5. Distribution of Pyrenean endemic flora (202 species and subspecies) in main habitats (left) and classification into life forms (right). Wd, woodland; Sh, shrubland; Gr, grassland; Rk, rocky areas; Wt, water-related habitats; Ds, disturbed areas. NP, nanofanerophytes; Ch, chamaephytes; H, hemicryptophytes; G, geophytes; Hydr, hydrophytes; Th, therophytes

Figure 7 (below). Schematic location of potential associations (climatic and main permanent?) in the Pyrenees, according to the altitudinal belts. The Atlantic and Iberian sides of the axial Pyrenees differ in the lower levels (left and right) and progressively converge towards the high mountain; the Iberian pre-Pyrenees (trapezium) show some distinction between eastern and western parts. Associations in black lettering are indifferent to substrate, whereas blue means calcicolous (or eutrophic) and red means acidophilous units; light and dark shading stand for south-facing and north-facing exposures, respectively.

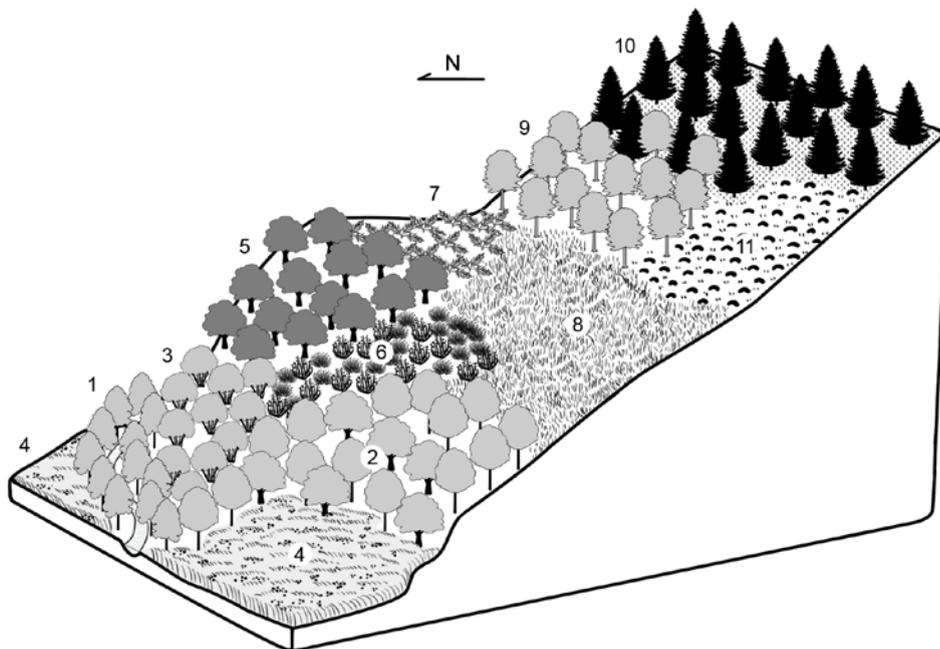


Figure 8. Main potential and seral units in a landscape at mid elevations (submontane and montane belts, ≈ 700 - $1,700$ m a.s.l.) representative of central Pyrenees, northern side. 1, *Alnion incanae*; 2, *Isopyro-Quercetum roboris*; 3, *Corylus avellana* seral thickets; 4, Arrhenatherion; 5, *Lathyro-Quercetum petraeae*; 6, *Cytision oromediterranei-scoparii*; 7, *Pteridium aquilinum* seral stands; 8, Bromion; 9, Scillo-Fagetum; 10, Goodyero-Abietetum; 11, Genisto-Vaccinion, Violion caninae (Drawing: Laura Fuentes).

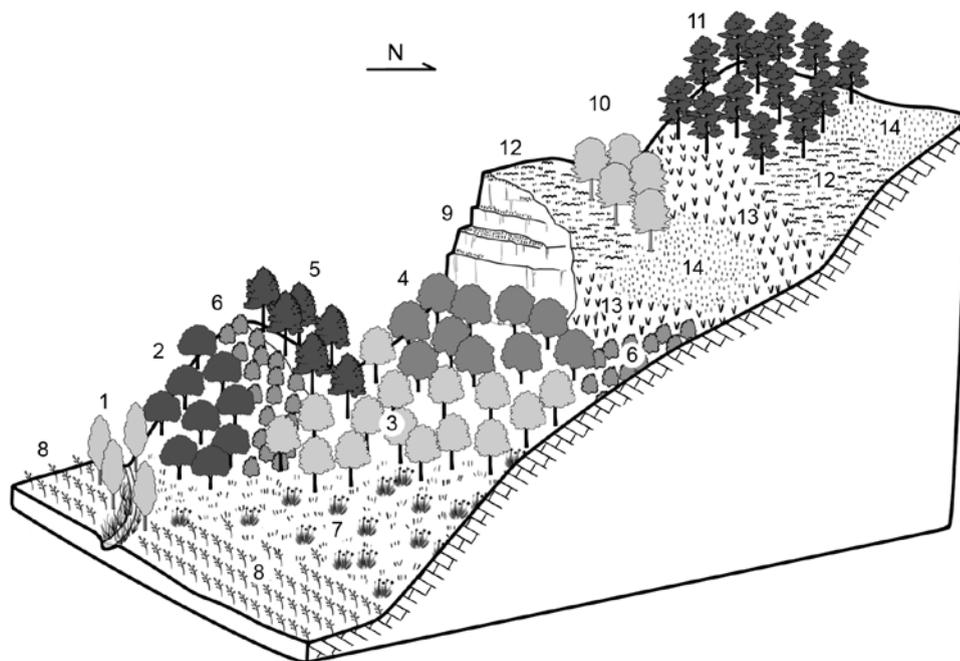


Figure 9. Main potential and seral units in a landscape at mid elevations (submontane and montane belts, $\approx 700-1,700$ m a.s.l.) representative of central pre-Pyrenees. 1, *Salicion discolori-neotrichae*; 2, *Buxo-Quercetum rotundifoliae*; 3, *Violo-Quercetum fagineae*; 4, *Buxo-Quercetum pubescentis*; 5, *Lonicero-Pinetum salzmannii*; 6 *Amelanchiero-Buxion*; 7, *Helianthemo-Aphyllanthion*; 8, sown fields; 9, rocky units; 10, *Buxo-Fagetum*; 11, *Primulo-Pinetum sylvestris*; 12, *Ononidion striatae*; 13, *Xerobromion*; 14, *Bromion* (Drawing: Laura Fuentes).

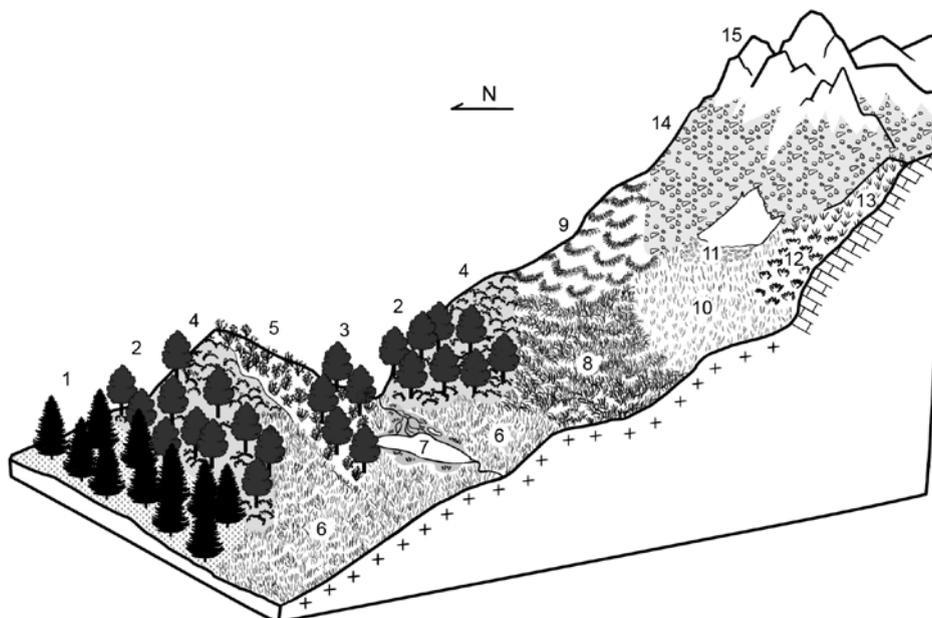


Figure 14. Main potential and seral units in a high mountain landscape (subalpine and alpine belts, $\approx 1,700-3,000$ m a.s.l.) representative of central Pyrenees. 1, *Rhododendro-Abietetum*; 2, *Rhododendro-Pinetum uncinatae*; 3, *Arctostaphylo-Pinetum uncinatae*; 4, *Rhododendro-Vaccinion*; 5, *Juniperion nanae*; 6, *Alchemillo-Nardetum*; 7, small lake surrounded of *Caricion fuscae*; 8, *Selino-Festucetum eskiae*; 9, *Festucion eskiae*; 10, *Festucion airoidis*; 11, *Salicion herbaceae*; 12, *Dryado-Salicetum pyrenaicae*; 13, *Oxytropido foucadii-Kobresietum myosuroidis*; 14, scree units (*Senecionion leucophylli*, etc.); 15, rocky units (*Androsacion vandellii*, etc.) (Drawing: Laura Fuentes).