ITER IPSICUM A.D. MIM

(Excursus geobotanicus per Hispániam et Lusitaniam, ante XLII Symposium Societatis Internationalis Scientiae Vegetationis Bilbao mense lubo celebrandum dici A.nn.)

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Some examples of these birch forests can be seen on the way down towards Truchillas. The descending sequence of the vegetation series is: 1. the humid-hyperhumid vegetation series of the melojures (Holco mollis-Querceto pyrenaicus-sigmetum), 2. the subhumid-humid vegetation series of the melojures (Genista falcatae-Querceto pyrenaicus-sigmetum) and 3. the vegetation series of the encinares (Genisto hystrix-Querceto rotundifoliae-sigmetum). The riparian geoseries riparia is again formed by the series of the ell (Arno muscati-Ulmno minoris sigmetum), poplar-arboreal willow (Populo nigrae-Saliceto neotrichae sigmetum), shrubbery willows (Saliceto lombardian-salifideal-sigmetum) and alder (Galio broterian-Aeluuto glutinosae sigmetum). This pattern is repeated in the landscape till Villafraanca del Bierzo.

(The vegetation of stretch Villafraanca del Bierzo-Pedrafita do Cebeiro-Liñares)  
JESUS I.E. SEVILLO & JAVIER A.M. VAZQUEZ

GEOMORPHOLOGY AND GEOLOGY

In Villafraanca del Bierzo, we leave the open landscapes of the Bierzo Depression, and begin the climb to the pass at Pedrafita do Cebeiro. Immediately after Villafraanca the road crosses the River Burbia, then goes through a short tunnel, then crosses the River Valcarce. The watershed up to the pass drains into this river, which drains into the Burbia; the Burbia then drains into the Sil, which in turn drains into the Mino, which flows into the Atlantic at the border between Spain and Portugal. Between Villafraanca (at 504 m) and the top of the pass (1099 m), the road climbs 595 m, with a mean gradient of 5.3% from Vega de Valcarce up.

Our route from Villafraanca - following the Way of Saint James, the traditional pilgrim’s route to Santiago - is representative of the topography of this region: the landscape is rugged, cut by deep lateral valleys, with steep slopes but peaks rounded as a result of their great age. In similar areas nearby, more than 60% of map area has class-6 slope (> 55%) (Izco, 1997).

The Pedrafita Pass marks the division between two watersheds. The River Nava has its source nearby; it runs initially towards the northwest, and eventually reaches the Cantabrian Sea close to the village of Nava (Asturias).

The town of Pedrafita do Cebeiro, just past the pass, still retains some traditional dwellings with roofs thatched with yew straw or broom (Cytisus scoparius). Here, our route leaves the main road (the N-VI) and continues via a local road (the C-335), westwards to the village of Liñares. A bit further is the San Rocio pass (1,275 m), the highest point of this stretch of the excursion, at the boundary between the watersheds of the Nava and the Loe (a tributary of the Sil). Looking north and west from this pass, we can see a high plateau at ca. 1,350 m, which is result of old erosion levels.

GEOLOGY

The Bierzo Depression is covered by very deep tertiary sediments, readily identifiable in view of their red colour; in the lower and less abrupt part of this depression, Tertiary sediments are covered by Quaternary material. Apart from these sediments, the northwestern part of the Iberian Peninsula (including the westernmost extreme of the Cantabrian Mountains, the Cordillera Cantabrica) is composed of Palaeozoic materials (Cambrian, Ordovician, in some cases Precambrian) that underwent violent folding during the Hercynian orogeny. All these materials are ordered in bands oriented SSE-NNW, forming part of the great Narcea Antiform (Antiforme del Narcea) which in turn forms part of the Asturian Arc (Arco Asturiano) (Anon., 1971).

The dominant materials are Cambrian and Ordovician slates, which break up easily. Intercalated with these slates are thin beds of calcareous materials (limestones and Vegadeo dolomites). Also present, though less frequent, are dykes of quartzite, which form prominent outcrops in valleys in which erosion has removed the softer materials (Anon., 1980). The limestones and dolomites are quarried for construction material, at some locations on an industrial scale. The traditional houses of the village of Liñares have limestone walls and slate roofs.

BIOCLIMATOLOGY

Between Villafraanca and Liñares the climate changes drastically. The higher precipitation and lower temperatures, due to the higher altitude, are clearly apparent. Villafraanca (504 m a.s.l.) has an annual mean temperature of 12.3°C and mean annual precipitation of 901 mm, while Pedrafita (1099 m a.s.l.) has an annual mean temperature of 8.0°C and mean annual precipitation of 1897 mm. The differences are even more marked if we consider the bioclimatic regimes prevailing in the two locations: Villafraanca is Mediterraneo, while Pedrafita is Temperate. This can be considered one of the most marked bioclimatic transition in a short space of Europe, in that Mediterranean and Temperate are the only two macrobioclimates (sensus Rivas-Martinez) present in the continent. The vegetation changes associated with this transition are evident during the ascent to Pedrafita.

The Bierzo Depression has a Mediterranean bioclimate with seasonal rainfall regime, and Villafraanca is situated in the Upper Subhumid rainfall belt (umbriopis). The Upper Mesomediterranean temperature belt (terrespius). Potential vegetation is evergreen Quercus rotundifolia woodland (Genisto hystrix-Querceto rotundifoliae). At higher altitudes, the increasing rainfall leads to replacement of the evergreen Q. rotundifolia with the deciduous Q. pyrenaica, in accordance with the pattern observed throughout the northwestern Iberian Peninsula (Izco et al., 1991). Note that this switch from evergreen to deciduous occurs at a lower altitude than the Mediterranean-Temperate transition. Furthermore, the severe deforestation and replacement of mature woodland with species-poor successional scrubland communities means that physiognomic interpretation of the landscape is difficult.

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There are no intermediate weather stations in the Mediterranean section of the territory. However, indirect models allow us to trace the gradual transition from Mesomediterranean to Supramediterranean, and from Upper Subhumid to Hyperhumid. The lower part of the zone in which the potential vegetation is Quercus pyrenaica woodland (Genista falcata-Quercetum pyrenaicae) is characterized by the presence of small villages, associated with intensive cultivation of chestnut and highly productive small river terraces and gently sloping hillsides. At altitudes above 750 m, the villages are very different: river terrace; are not present at these altitudes, and the villages are located on flat areas on hillsides suitable for vegetable cultivation. Their inhabitants have traditionally dedicated most of their labour to extensive livestock farming, which is currently in clear decline. From this altitude upwards, the potential vegetation is another Quercus pyrenaica woodland (Holco mollis-Quercetum pyrenaicae).

As is normal, the Mediterranean-Temperate transition does not take place at the watershed transition, but in fact somewhat earlier, on the Mediterranean side of the pass, influenced by topographic factors, at about 900 m. From this level to the Pedrafla Pass, and from here to Laires and the San Roque Pass, our route passes through the Upper Temperate belt, with Upper Hyperhumid to UltraHyperhumid rainfall regime. This territory, though it forms part of one of the best-conserved natural areas in Galicia, is severely deforested and shows marked human influence. The gently sloping mountains of the Montes do Rañadoiro are without woodland on their peaks and on their southern slopes, though relict stands remain on the northern slopes, interspersed with patches of meadow and scrub that reflect the characteristic land-use patterns in this area. There are also small areas of Pinus sylvestris plantation, comprising rather small individuals, the product of attempts at reforestation in the 1960s.

The potential vegetation of these Supramediterranean territories of O Cebreiro comprises both Quercus pyrenaica woodlands (meligos) of the association Linario triornithophorae-Quercetum pyrenaicae and Quercus petraea woodlands of the association Linario triornithophorae-Quercetum petraeae. In the altitudinal range between 900-1400 m beech forests (Ostryphaloides nitidae-Fagetum sylvaticum) occur as discontinuous patches in topographically favourable conditions, such as North-facing slopes.

**CHOROLOGY AND MIGRATION ROUTES**

The Bierzo Depression forms part of the Orense-Sanabriense Sector of the Carteto-Beirico-Leonese Subprovince of the Mediterranero-bero-Atlantica Province. The temperate territories form part of the Luciano-Ancares Sector of the Ooostuanica Subprovince of the Atlantic province.

The district (municipios) of Cebreiro, the only Galician district visited during this excursion, covers the area comprising the lower-altitude peaks of the Sierras Orientales (Eastern Mountains) of Lugo Province. These mountains, which constitute the boundary between Galicia and Leon, constitute a prolongation of the Cantabrian Mountains at their southwest extreme, and thus biogeographically form part of the Ooostuanica Subprovince. From north to south, the Sierras Orientales comprise the Sierra de As Osas (highest peak Pico Curiña, 1998 m), the Montes do Rañadoiro (Carballo, 1474 m) and the Sierras do Courel (Fornigueiros, 1654 m).

The beechwoods of the Sierras Orientales have been considered the westernmost populations of this species. These woodlands are located in the Supramediterranean belt at altitudes between 900 and 1400 m (minimum 1000 - 1250 m). By contrast with the extensive areas of beechwood located in eastern Spain, the end-of-range beechwoods of northwest Spain currently occur as small patches with a highly fragmented distribution, clearly reflecting environmental conditions and human activity; the recent history of the latter has been clearly illustrated by a study based on the analysis of various legal documents (wills, litigations, land transactions, etc.) (Guirán, 1996). In recent years, beeches have been found within Mesomediterranean woodlands of the association Blechnum spicantii-Quercetum roburis, at altitudes of 400 - 500 m upwards (Rodríguez-Gutiérrez et al., 1996a).

It has traditionally been speculated that beech reached the westernmost extreme of the Iberian Peninsula from Pyrenean nuclei, leaving the Pyrenees about 4000 years ago and travelling along the Pyrenean-Cantabrian chain to reach Galicia about 1000 - 1500 years ago, the period of maximum expansion of this species. This latter date is accepted by Janssen (1996). However, previously published pollen datings of beech in the Cantabrian Mountains imply a migration rate of 190 - 320 m/year (Rodríguez-Gutiérrez et al., 1996b), which is too slow to explain departure from the Pyrenees 4000 years BP and arrival in Galicia 1000 - 1500 years BP. On the basis of new analyses of pollen from 19 sites in the Cantabrian Range, these authors argue that beech was present in the northwest Iberian Peninsula at much earlier dates than those reported previously, and indeed earlier than the theoretical date for arrival in the western French Pyrenees. Specifically, they report data indicating the presence of beech in the northwest about 4000 years BP in Prado (Maldegem, 1994) and about 7500 years BP in Lagos do Marizinho (Ramil-Rego, 1993). All this leads the authors to suggest that "almost certainly, at least part of the Iberian populations of this species are autochthonous in origin, regardless of whether it is confirmed that Central European stocks arrived during the Holocene by way of the Pyrenees. Likewise, it seems likely that areas of refuge existed in various parts of the Iberian Peninsula, (...) providing bases for the recolonization of large parts of the territory previously occupied".

**VEGETATION**

1. From Villarfranca to Pedrafla

During this ascent, we cross territories corresponding to four vegetation series, which in order of appearance are:

- Genista hybrida-Quercus rotundifoliae Sigmatum: a Mesomediterranean Orense-Sanabriense holm oak woodland series whose disturbed stages include the Arbutus
The Quercus pyrenaica woodlands occur preferentially on south-facing slopes, though even with this orientation they rarely occur at altitudes of more than 1200 m. Their potential area is largely covered by broom scrub, the Cyttis scoparius-Genista pulchellae-Cytisus multiflorus subassociation that reflects a degree of summer drought within the Mediterranean region generalized in this territory. Oak woodlands dominated by Quercus x rossacea and with Q. pyrenaica occasionally present (Linaro-Quercus petraea) are predominant on sites not facing south, and even on south-facing sites at altitudes in excess of (1250) 1300 m. Mature woodlands of Linaro-Quercus petraea are likewise replaced by broom scrub similar to those already mentioned, but rather more moisture-loving, and probably assignable to Cyttis scoparius-Genista pulchellae-Cytisus multiflorus gallii. Occasionally, we find a distinct version of these woodlands, artificially maintained in a premature stage dominated by Betula celtiberica. These formations are known locally as bideofitos (from bide, birth in Galician), although taxonomically they can be interpreted as a variant of the typical climatic community (Linaro-Quercus petraea var. of Betula celtiberica).

The third vegetation series detectable in these mountains is closely at an extreme of its distribution, representing the westernmost spontaneous formations of Fagus sylvatica in Europe. It is found only in patches on north-facing steep slopes, often in areas of hard limestone outcrops. The relief nature of this forest is apparent from the fact that falling of the mature woodland gives rise to non-beech woodland (oakwood or birchwood) subsequently develops. The head of the series, Omphalodo myrti-Fagetum sylvaticum, has a recovery stage dominated by Corylus avellana, which in numerous parts of the Sierra Orientales (Ancares, Raxadouro, Cabeceiras) constitutes the only surviving evidence of the presence of beechwoods in the recent past.

In the Sierra de Ancares and the Sierra de O Courel, both chestnutwoods and Quercus petraea oakwoods may come into contact with mixed sycamore woodlands of the association Fagus sylvatica-Carpinus betulus-Carpinus betulus, a competitive community dominated by Quercus petraea. In the north of the region, this community is replaced by beechwoods dominated by Betula pendula as subassociation, with the addition of Fagus sylvatica and Quercus petraea. These formations are known locally as bideofitos (from bide, birth in Galician), although taxonomically they can be interpreted as a variant of the typical climatic community (Linaro-Quercus petraea var. of Betula celtiberica).

This group of mountains is located between the Sierra de Ancares and the Sierra de O Courel, both of which contain higher peaks.

2. Montes do Peñafora

This group of mountains is located between the Sierra de Ancares and the Sierra de O Courel, both of which contain higher peaks.
Riparian vegetation is scarcely present along our route, since only very young and fast-flowing streams are present, and often any aquatic vegetation has been removed to make way for Cynodon dactylon meadows along the banks. On north-facing slopes, and especially close to beechwoods, fragments of the subalpine Lusitanian-Anatolian community Fagetum giganteae-Fresnietae excelsiorae can be recognized. At altitudes below 800 m, when slopes become less steep in valley bottoms, older communities of the association Valerion pyrenaeicae-Aetheum githonii begin to occur; these are particularly vivid in the Mesothermic belt, and even persist several kilometres into the Mediterranean Orensesano-Santarhinoë territory.

3. Lihatara.

The most interesting feature of this zone is the contrast between the aciphyllous vegetation (characteristic of the region in general) and the vegetation associated with the outcropping of a band of limestone, which includes a patch of Omphalodos nitidae-Fagetum sylvaticae and calciphilous communities of the Rhinauno-Praetetum spinosae, Asplenietea richardii and Festuco-Brometum.

Along the short track leading to the beechwood from the village of Lihatara, on the banks beside the track itself, we can see more or less representative fragments of the calciphilous perennial pasture communities of the Heliocnemum cambricum-Brometum erecti (class Festuco-Brometum erecti). Various species of this association can be seen, forming small fragmented patches, notably Aster vanderplani subsp. alpestris, Ascobolus alpinus subsp. pygmaeus, Brachypodium pinnatum subsp. repens, Briza media, Dactylis glomerata subsp. varia, Hieracium umbellatum and Heliocnemum cambricum subsp. cambricum, in addition to various orchids. In the Sierra de Oeste, this community is at an extreme of its distribution, like the beechwoods, since it represents the extinction of the communities of the alliance Bromanetum erecti (and thus of the whole class) towards the south-west of the Atlantic Province.

The structure of the outcropping limestone band and local topography give rise to small ledges with lichens that favour the presence of psoralenophyllum calciphilous communities, assignable to the alliance Festucion bernatis (class Festuco-omniflorae strictonis). The association Koelerio vallentiniense-Ulmaria nivalis was described from this territory, though only a few members of this community reach Lihatara, and the association cannot be considered well-formed here. On the banks beside the track we can see Koeleria vallentina, Anemone grandiflora subsp. vallentana and Hippocrepis communis.

Where the track-side banks are steeper and stony, we find calciphilous riparious communities of the association Saxifragetum trifidaeae (Saxifrago-Equisetetum canaliculatae, class Asplenietea trichonisi), rich in endemics and well-represented in the nearby Sierra de O Covanet, in Lihatara. However, suitable fissured walls are lacking, and only a few of these species are present, notably Hunchula alpina subsp. aurantiaca, Crepis albidissima subsp. austriaca and Leonotis farinosa.

The Lihatara beechwood is a reasonably representative example of Omphalodos nitidae-Fagetum sylvaticae in the territory; it contains an acceptable number of the banal-loving geophytes characteristic of the Orocotan and beechwoods, such as Calluna vulgaris, Menyanthes trifoliata, Lilium martagon, Millium effusum, Purpurina quadrijuga and Lonicera nitida, though other aciphyllous species are also frequently present, particularly species whose optimum is in northwest Iberia, such as Omphalodes nitida, Saxifraga spathulata and Lathyrus lusitanicus.

Along the fringes of the beechwood, we see some woody and herbaceous communities that are typical of such beechwoods. One such community, characteristic of clay soils developed from limestone, is a metascope, thorny woody community. The most conspicuous species of this formation is Rosa villosa, Rosa canina, Cnidoscolus aconitifolius, and it is probably best considered an extreme form of Berberidion vulgaris (class Rheinauno-Praetetum).

On calcareous banks at the upper limit of the beechwood, we find a characteristic herbaceous community that contains species of the woodland-fringe community Triolo-Geranietae, alongside others characteristic of Festuco-Brometum or even Querco-Fagetetum. This community is typically dominated by the conspicuous species Iresine herbstii, accompanied by Lilium martagon, Fragaria vesca, Viola sempervirens, Ranunculus tuberosus and Mercurialis perennis. These species develop on soils of some depth and with marked depletion of calcium in the surface layers, as indicated by the extensive areas often occupied by Porzia aquatilis, which gives the community a rather misleading appearance. We have given this association the provisional name of Galio villosiatis-Triflolo-Geranietae sanguinii.

Finally, when the beechwood occurs on an acid substrate (such as phyllite), different substitutions communities occur. The shurb fringe is replaced by a community of Cytisus scoparius and Erica arborea, while the herbaceous fringe loses its xerophytic species (for example, Fragraea vesca, and gale species such as Saxifraga spathulata, Anagallis arvensis and Dactylis glomerata, forming a community assignable to Litoreon tridentinum (class Triolo-Geranietae sanguinii).

Above the beechwood, we climb gradually to the col at San Roque, the boundary between the two watersheds. Here the substrata is siliceous, and the scrub that covers these peaks is particularly aciphyllous; we see patches of the hoon scrub Cytisus saxifragae-Geranietae polygalophyllae, but the predominant shrub-community is a dense gorse heath. The shore of the lake is dominated by Ulex gallii and various low Ericaceae; this community can be assigned to the Santenaterme Ulmio-Ullochetae calliocalicis, class Calliocalicetum. Also present in these mountains, in other locations (i.e. at lower altitudes or on south-facing slopes), are heaths of the association Duboscia-Ericetum ericetorum (likewise a member of Duboscia) and the association Duboscia-Ericetum ericetorum, which includes Erica caucasia subsp. angelesiana and Genistella straminea and lacks Ulex gallii.
At the end of our walk we cross a calcareous dyke, quarried for stone, in which we again see the basophile substitution and permanent communities observed by the beechnutwood.

Of the remaining vegetation types present around Latarres, only meadows make an important contribution to the landscape. The most frequent such communities are meadows subjected to a mixed mowing and grazing regime. Soil nutrient levels and pH are both rather low, except where the meadow is located below a limestone hillside. In valley bottoms in the Sierra de Corder, meadows assignable to Arrhenatherion elatioris have been described; however, the more usual meadow communities in these mésogéens are of the alliance Cynodonietum cristate, within which the association that best defines floristic composition is Merendron pyrenaicae-Cynodonietum cristate. Also sometimes present in this territory are Subtempérare grazed mat-grass (Nardus stricta) pastures of the alliance Vipélieae, falling within the association Senecio acuminati-Brometum stricti; according to the degree of variability in grazing regime, transitions between this association and Merendron-Cynodonietum cristate may be observed.

PICTURE 29

Locality: Litarres, Ourense, Lugo, Galicia.
Altitude: 1,300 m
Date: 20-VII-1999
Biogeography: Subsector Asturias subsector (Lacian-Anxureno sector, Oviedoabrian subprovince)
Bioclimatic belt: Subtemperate (montane), hyperhumid.
Lithology: Mixed, calcareous and siliceous.
1. Ancarano beech forest (Omophalodo nitidum-Faguretae sylvaticae).
2. Spiny mantle of beech forest alternating with grasslands (Bréonio) and cupriculous communities.
3. Heathlands with gorse (broom-savagery) (Helioniea-Ulicion gallii).
4. Pítreau (Cytisae alpinae-Genetum polygalophyllae).
5. Abandoned crop-fields.
7. Basophile grasslands of Helianantho conobractii-Brometum erecti (Bromio) and the gopher community of Iris latifolia.
8. Megaphorbic higrophilous community of Cladothyra birta-Valerianetum pyrenaeicae.
Locality: Linares (Cebreiro), Lugo, Galicia.
Altitude: 1,250 m
Date: 20-VII-1999
Biogeography: Subsector Ancarense subsector (Laciano-Ancares sector, Orocentabrian subprovince)
Bioclimatic belt: Supratemperate (montane), hyperhumid
Lithology: Mixed sand, calcareous and siliceous.

1. Beech forest (Osmunda nitidae-Fegetum sylvestre).
2. Spiny mangle of the beech forest.
4. Grasslands of Festucio-Poetalia
5. Rupicolaous communities of limestone rocks with Crepis austriaca.
6. Corylus avellana community.
7. Megaphorhic community of Ino latifolia.
8. Pirineales on siliceous substra (Cytisus scoparius-Gentietum polygalphyllae).
LAND USE

The entire Sierras Oristales area is classified as a "high-mountain agriculture" zone. One of the most notable features of such areas has been the marked population decline over the last half-century, which has of course had profound effects on land use and consequentially on landscape.

The traditional rural settlement pattern in this region is based on small groups of houses, with labour mostly devoted to livestock rearing and relatively little cultivation of crops, these being destined mainly for own consumption. The land-use activities can be viewed as forming a series of concentric bands, at increasing distances from the nucleus constituted by the village itself:

1) The first band, adjacent to the houses themselves, contains small (often very small), vegetable plots, or terraces, for cultivation of cabbages and potatoes, and broad beans and onions if the climate permits (i.e. at lower altitudes in the Lower Supratemperate belt).

2) The second band, still very close to the village, contains the chestnut grove (sona), with a highly degraded understory as a result of frequent transit. The chestnut has traditionally constituted an important part of the diet, but nowadays sonas are often abandoned as a result of both changing dietary habits and the ageing of the population.

3) The third band, which may extend a considerable distance from the village, contains the meadows and pastures. These typically extend in ribbon-like fashion along the banks of rivers and streams, facilitating irrigation with the water that feeds into the watercourse. This band can also be considered as that containing the seanaz, plots for the cultivation of cereal (generally rye); unlike the meadows, these are generally located on dry and preferably sunny slopes.

4) The fourth band contains the devesa, the area of woodland used as a source of timber and firewood, and to some extent for hunting. Depending on its size, rights to the devesa might be shared by several villages in a parish (i.e. the administrative unit between village and municipio). Within this fourth band we should also include treeless moor, mostly gorse heath, generally held communally and periodically burnt to improve grazing for sheep or goats.

Around settlements in the Upper Supratemperate belt, this pattern is somewhat modified: there is no sona, and the village is typically closer to its devesa (as in the case of Liñares).

Historically and currently, there has been little industrial activity in this area. However, iron smelting (ferretería, in galician) was an important activity in the whole region between the 17th and 19th centuries, and the consequent demand for wood as fuel led to very considerable deforestation; indeed, over-exploitation of forest for fuel was perhaps the chief reason for the decline of this industry.

Mining has also been historically important in this region, dating back to the gold-mining activity of the Romans. Querning for marble and limestone has left its mark on a number of outcrops, but in recent decades slate quarries, including several large operations, have had much more devastating effects on landscape.