

JOSÉ LUIS MARINO ALFONSO
Grupo i-Ge&ser, Universidad de Oviedo

Sites of Biogeographic Interest in the Arribes del Duero zamoranos: methodological proposal for their inventory and valuation

Arribes del Duero is known as the narrow, deep and prolonged river gorge opened by the homonymous river in its international section, that is, on the border between Spain and Portugal. Along the 120 km the Duero river progressively fits into the rigid paleozoic plinth until it deepens its channel 500 m above the topographic level of the Zamorano-Salmantina peneplain. However, the beginning of this great canyon can be located before the border area, immediately downstream from the city of Zamora (625 m), when the Duero river leaves behind the open countryside over the soft sedimentary materials of its tertiary basin, and it begins to break through the tough and hard plutonic and metamorphic rocks of the western flange of the Iberian Central Plateau. At an approximate rate of 3.5 m/km, the river deepens its notch until it reaches 125 m in Barca d'Alva, the last border town where the course acquires a parallel sense to finally enter Portugal in search of its Atlantic mouth.

This congested cleft causes a softening of the thermal regime, giving rise to an island of heat within the cold Castilian-Leonese region that has allowed the development of a thermophilic vegetation and typically mediterranean crops in open terraces on the steep slopes. This is how physical conditions play a role of great importance in the configuration of the plant landscape so that topoclimatic contrasts derived from the unique geomorphological configuration explain the presence of two bioclimatic floors: the mesomediterranean, below 700 m and assigned to the river throat; and the supramediterranean, above 700 m and linked to the peneplain. The influence on vegetation is so decisive that both landscape

units correspond to different biogeographic sectors: the Ribaduriense subsector and the Salmantino sector respectively.

Indeed, the warm and steep slopes of the river gorge host a thermophilic type vegetation rich in typically Mediterranean species, such as holm oak, juniper and terbinth. The limitation imposed on agricultural uses due to edaphic precariousness has favored the development and preservation of surprisingly dense masses, in a frank state of recovery after the reduction of the livestock burden. On the contrary, the cold plains of the peneplain enhance the development of a marching vegetation starring the overflow. However, the well-known process of fruiting the Mediterranean landscape has benefited the extension of the oak to the detriment of the latter. In any case, human action has played a key role in the organization of the plant landscape, through the breaking of land for cultivation and the generation of pastures and meadows, the loosening of the original masses or the selection of species themselves. Associated with agrarian abandonment, a scrub process has been generated that invades old cereal lumps and undergrowths of broom, genista, lavender, thyme, gum rockrose and grass.

In the areas of transition between the two domains, they are sheltered, under unique ecological conditions, gall oaks and cork oaks. The former are crowded on shady slopes, cold enough for the cork oak, fresh for the holm oak and temperate for the oak. The latter seek the moisture of the sedimentary substrate in which they settle, and their purity and density are due to the traditional use of cork. On the margin is the ash forest dotted

with willows, which, like gallery forests, are developed along the banks. Its degree of naturalness increases as the streams approach their mouth in the Duero River.

In short, the interaction of natural and human factors has given rise to a tremendously heterogeneous plant mosaic in terms of physiognomy, floristic composition, spatial articulation, modes of association and internal and dynamic structure. In the fieldwork phase, nineteen vegetation units have been recognized and established based on physiognomic, floristic and dynamic criteria. Each of them has been assigned its corresponding inventory, based on own inventories made in the field. The physiognomic and floristic analysis has allowed spatially synthesize the units resulting from the interaction with geographical factors, by mapping units of plant landscape at different levels. Thus conceived, the map allows to know the spatial distribution of the vegetation and its classification in the hierarchical categories in which various units are organized.

From the analysis of the map of elaborated vegetation, the biogeographic classification of the inventory is carried out. This classification is hierarchical and follows an ecological and landscape criterion. The basic element is the plant community, each of which is related to a plant formation headed by one or more species with territorial representativeness. Eleven plant communities have been differentiated: holm oak, juniper, cork oak, gall oak, terebinth, oak, ash tree, leguminous scrub, gum rockrose, lavender and grass. Each of them is identified by an alphabetical code and is accompanied by the series of vegetation to which it belongs and its local name.

Plant communities show discontinuities in the structure resulting from their own spatial variations in environmental conditions or derived from anthropic actions. Thus, the vegetation facies arise, subunits differentiated by physiognomic and floristic criteria. In some plant communities, several facies of vegetation can be distinguished, while in others a single facies represents the community itself. Similarly, each of these vegetation facies has been assigned a numerical code (Arabic) and indicates the physiognomic structure and floristic composition that characterizes it.

The vegetation facies placed in relation include larger units that provide context to the landscape, defining the large landscape units. It is a matter of moving from a level of detailed analysis and of great heterogeneity, to another on a smaller and homogeneous scale, in which the elementary pieces are spatially articulated to give the major units an entity. These large landscape units are determined by the incidence that the more general con-

ditioners have on the vegetation. Thus, two large units derived from the unique geomorphological configuration are distinguished, whose significance in the rest of the geographical factors has been sufficiently referred to. These two large units are the peneplain and the river throat and are linked to bioclimatic floors and differentiated biogeographic sectors. They are now identified by a roman numeric code.

For the selection of sites of interest, representativeness and uniqueness criteria have been considered, applied to biogeographic sites or elements. As a result of this combination, four types of Sites of Biogeographic Interest are generated: representative places, singular places, representative elements and singular elements. They will be places in the case of plant communities with a considerable spatial entity, while elements will be those of reduced or individualized extension. At the same time, they may be representative if they are typical or significant plant communities among many others with similar characteristics, or they will be unique if they are special or exceptional.

In accordance with this criterion of representativeness and uniqueness, ten places and elements of biogeographic interest have been selected, where all the hierarchical levels established in the classification phase of the vegetal landscape units are presently based on their cartographic representation. Each one stands out for specific biogeographical values, recognized in detail during the fieldwork phase.

After the selection, the space classified as a Site of Biogeographic Interest is characterized. It involves collecting all the essential aspects from the point of view of their biogeographical values, as well as those others added and related to their possible use and management. A descriptive file has been applied for this purpose that has been prepared for each of the ten Sites of Biogeographic Interest.

No. 1 is an extensive spot of quite pure and dense gall oak nestled in the shady slope of the deep and narrow valley opened by the Peña la Galga stream in its vertiginous descent from the peneplain to the Duero river. Its uniqueness is determined by being one of the few masses of this species in the Arribes del Duero zamoranos. No. 2 is representative of the large masses of oak that extend inland. It is a plant community profoundly altered by human intervention, where robust, sticky oaks spread between farmland. The No. 3 encompasses one of the best national representations of forest constituted by the juniper of the beetle, not in vain, it is considered the most extensive in Europe. It stands out for its unusual wooded

character and the arboreal bearing of a plant formation catalogued in principle as a tree shrub. No. 4 consists of a reduced mass of terebinth located on a gentle slope of the south-facing river gorge. Its peculiarity is determined by the infrequency with which this species is able to configure more or less pure spots, in fact, it is the only stand present in the Arribes del Duero zamoranos. No. 5 represents a frequent phenomenon at this biogeographic crossroads that are the Arribes del Duero. We refer to the mixed formations that are generated between the two species that most frequently mediate the steep slopes of the river gorge, the holm oak and the juniper. No. 6 corresponds to one of the typical ash forests with willows that run along the banks of the streams. In addition to its high degree of naturalness, it is flanked by a set of waterfalls, which creates a landscape of great beauty. No. 7 is a holm oak grove, representative of so many others that extend through the Zamorano-Salmantina peneplain. The No. 8 is located in the wide valley of the Setera stream, where an extensive holm oak grove develops that in its upper part intermingles with cork oaks, forming a peculiar landscape between granite bowling. No. 9 is one of the most unique places since the presence of the cork oak is linked to the meagre tertiary deposits that slightly upholster some sectors of the peneplain near the Tormes river. The exploitation of cork has favored the conservation of a landscape with deep cultural roots. And No. 10 represents one of the great holm oak formations that dominate the Arribes del Duero zamoranos, from the cacuminal parts of the peneplain to the banks of the Duero River. It has a great internal variety in terms of tree density and the floristic composition of the lower strata.

After the detailed description in their respective files, the evaluation is carried out. This should try to obtain the maximum possible objectivity from the integration of a triple assessment: scientific or intrinsic value, cultural or added value and use and management value. The intrinsic values evaluated were: plant diversity, floristic richness, representativeness, vertical structure, tree cover, maturity, plant uniqueness, threatened flora, ecological function and ethnobotanical value. In each value a scale of 1 to 5 has been established, and subsequently, the total score obtained on 50 points is calculated on 10 to compare with the other two types of values. Regarding the added or cultural values have been evaluated: landscape and aesthetic scalar consideration, heritage elements, cultural aspects, historical phases of use and occupation, pedagogical and educational content, educational levels, scientific areas with significant value, scientific representativeness, tourist contents and tourist attraction ca-

capacity. In this case, one point is awarded for each element present up to a maximum that varies between 5 and 10. The total score obtained over 70 points is weighted over 10. Finally, the use and management values considered have been accessibility, fragility, vulnerability, the intensity of use, degradation risk, impacts, observation conditions, acceptable exchange limits, services and equipment and economic potential. For its evaluation, a scale from 0 to 2 is used: 2 represents a positive value that facilitates the use and 0 a negative value that makes management difficult. The maximum figure up to 20 points is also weighted over 10.

The evaluation of the scientific, cultural and use and management values shows the relevance that the biogeographic heritage has in the Arribes del Duero Natural Park. This contributes, in the first place, to the enormous biodiversity that exists in this protected area, resulting from the interaction of the multiple geographical factors that intervene in the configuration of the vegetal landscape. Secondly, great cultural wealth is added, linked to the character of a marginal and marginalized area in which this territory is inscribed since a huge material and intangible heritage linked to the sustainable exploitation of natural resources has been preserved. Finally, the excellent state of conservation of the landscape offers a high potential for use and management as a scientific, didactic and ecotourism resource.

By places, the most outstanding and with the greatest potential are Sites of Biogeographic Interest No. 3, 5, 8 and 10, since they have high intrinsic and extrinsic values and medium-high use and management. However, five others (No. 1, 2, 4, 6 and 9) simply have a somewhat lower scientific value. All of them (90% of the total) are revealed as ideal places to materialize any type of proposal aimed at the interpretation of biogeographic heritage oriented to its educational and ecotourism use. It is important, therefore, to properly manage the flow of visitors and the intensity of use to avoid a loss of values. It is also proposed to correct some impacts present in any of the places, such as dumps, quarries and abandoned buildings. In the same way, it would be advisable to enable some steps in fenced areas linked to hunting grounds, as well as to improve accessibility at some points through more adequate signaling. Ultimately, it would be very interesting to create a center for interpretation of the biogeographic heritage of the Arribes del Duero zamoranos, in a municipal unit or integrated into the Park House itself in the Convento de San Francisco of Fermoselle. From here, interpretive itineraries could be established through the different biogeographic places of interest,

through guided tours, information brochures, or mobile applications.

The scientific, landscape, cultural, didactic and ecotourism interest makes the Sites of Biogeographic Interest in heritage resources that must be known, protected and disseminated and, ultimately, put into use and value as economic potentials linked to the sustainable development of rural areas depressed depending on the intrinsic, extrinsic and use and management values, some patterns of use have been determined, which in most cases involves the interpretation of the biogeographic heritage

oriented towards its didactic and ecotourism use. Thus, the work method applied for inventory and valuation has demonstrated its possibilities as a method of generating territorial resources of tourist, educational and environmental utility. The cataloging of ten Sites of Biogeographic Interest in the study area, a small portion of the Arribes del Duero Natural Park located in the region of Sayago, which does not represent 6% of the total extent of the protected area, reveal the enormous potential of both the natural area in question and the method of work itself.