

3rd International Meeting of Fire Effects on Soil Properties

Field Trip Guidebook

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1. Geographic Characterization

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Geology

From a lithologic perspective, the principal rock formations in the Portuguese northwest are granites, quartzites, slates, and other related formations. Holocene (floodplain formations) and plio-pleistocene (fluvial terraces) cover formations are also present in this region (Figure 1).

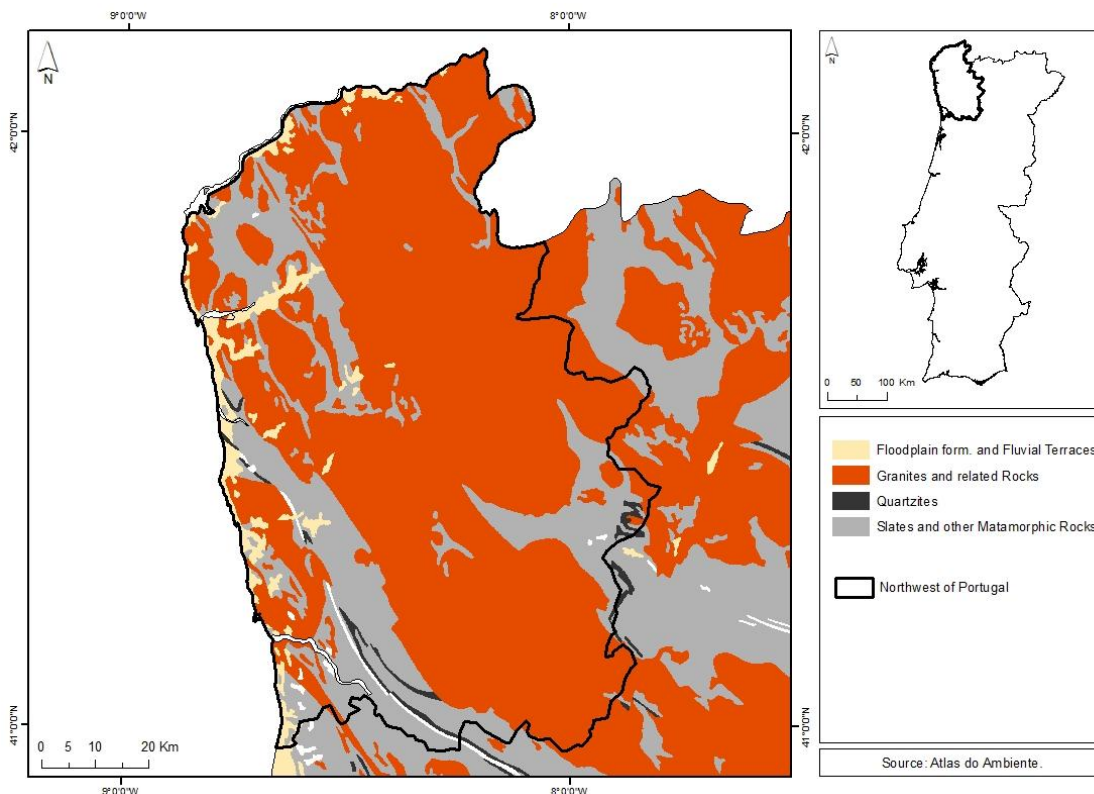
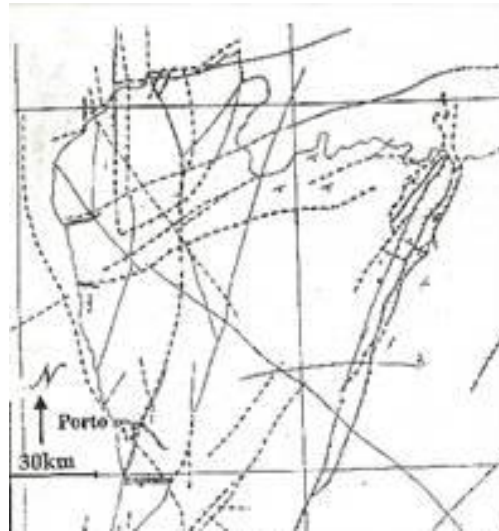


Figure 1 – Simplified Lithologic Map of the Portuguese Northwest

In the northwest the Hercynian orogenesis played a fundamental role in the regional geology. Most of the local granitoids, sin-orogenic, and late to post-orogenic granites are associated with the Hercynian cycle (N. FERREIRA *et al.*, 1987). However, “the existence of large fault scarps, sometimes exceeding 200 meters, either in the area of the *Peneda* and the *Gerês* or the area of *Monção* and *Arcos de Valdevez*, is sufficient proof that important tectonic movements occurred in the alpine cycle” (P. LEMA e F. REBELO, 1996).

The existing records on the tectonic evolution of the Portuguese territory during the Neogene and the Quaternary reveal that after a period of intense tectonic activity throughout the Miocene a calm period ensued afterwards during the Pliocene. Intense tectonic activity commenced again in the final phase of the Pliocene, continuing well into the Quaternary (Figure 2).



Source: J. CABRAL E A. RIBEIRO, 1988

Figure 2 – Part of the Neotectonic Map of Portugal

Relief

Besides being determined by the contemporary climate, the relief of the northwest still presents signs of past climates due to the great variability climatic conditions throughout its geologic history. However, geology and tectonics are the factors most responsible for the main characteristics of the regions relief.

The relief is scaled from West to East. In the proximities of the *Serra do Gerês* the relief is “lifted” from 0 to 1500 meters in less than 70 km. The main rivers of the region (*Minho, Lima, Cavado, and Ave*) present what P. B LEMA E F. REBELO (1996) designated as a “betic” orientation/direction (ENE – WSW) and are characterized by running through very wide and open valleys in the coastal areas and through very deep and narrow valleys in the mountain regions close to the coast.

As a result, it is not surprising that the most important mountains are separated by the deep valleys of the main rivers of the Portuguese northwest.

Climate

According to S. DAVEAU *et al.* (1985), the Portuguese northwest is characterized by fresh, wet winters cool winters and moderate to hot, dry summers. The average minimum temperature of the coldest month varies between 2 and 4°C and negative temperatures are registered for 10/15 to 30 days a year. The highest average temperature of the warmest month varies between 23 and 32°C. Temperatures over 25°C are recorded between 20 to 120 days a year. According to the *Atlas do Ambiente* (1975) the average daily temperature varies between 12,5 and 15°C.

Although the region exhibits Mediterranean features it is heavily influenced by the Atlantic. In effect, the climate reveals mild temperatures, with small thermal amplitudes, and

heavy average rainfall due to its geographic position, proximity to the Atlantic, and to the form and disposition of the main mountain ranges¹ which O. RIBEIRO (1986) designated as an “amphitheatre facing the sea”.

As a result, the high volume of precipitation, which is unquestionably the dominant climatic trait of the Portuguese northwest, registers an average annual total of rainfall of over 1400 mm, although unevenly distributed throughout the regional. The magnitude of this phenomenon is due to the frequent passage of surface fronts associated with the influence of the proximity of the mountain system to the coastline (“moisture barrier”).

Hydrography

As previously mentioned, the rivers expose the principal forms of the landscape. Accordingly, the *Minho* and *Lima* rivers are divided by the *Arga* (816 m), *Peneda* (1373 m), *Soajo* (1415 m), and *Castro Laboreiro* (1335 m) mountains; the *Lima* and *Cávado* rivers are separated by the *Amarela* (1361 m), *Gerês* (1548 m), and *Larouco* (1525 m) mountains; the *Cávado* and *Tâmega* Rivers are separated by the *Cabreira* (1261 m) and *Alturas do Barroso* (1279 m) mountains; and finally, the *Tâmega* and *Corgo* rivers are divided by *Alvão* mountain (1281 m) (Figure 3).

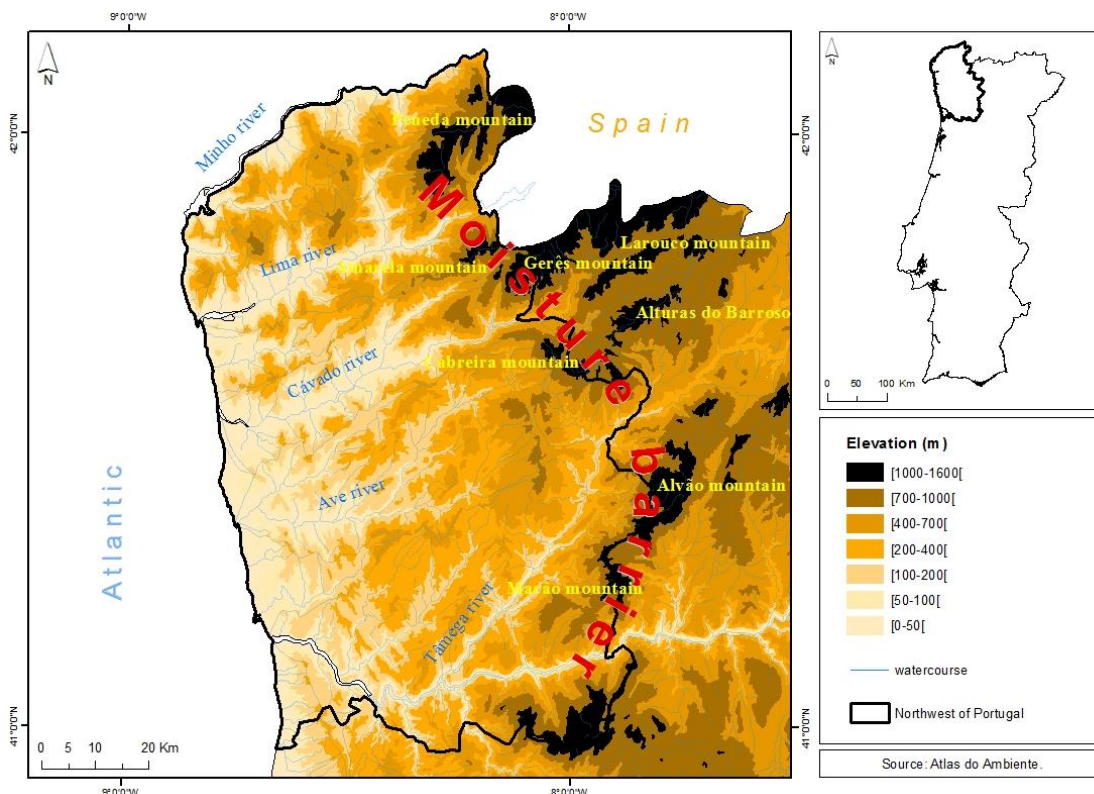


Figure 3 – Main Rivers and Mountains of the Portuguese Northwest.

The flow of the “Minho” region’s rivers presents a distinguishing quality from the national perspective. Due to its climatic and geologic characteristics as well as its particular orography, the regional rivers have extraordinarily high stream flows. More precisely, the *Cávado* registers 38 l/s/Km² (*Barcelos*), the *Lima*, 31 l/s/Km² (*Ponte de Lima*), the *Ave*, 26

¹ In the northwest, in a radius of 65 Km the average annual rainfall is 1374,2 mm in *Sto. Tirso*, at 28 m altitude, increasing to 1772,6 mm in *Fafe* at 330 m altitude and to 3071,1 mm in *Zebral/Serra da Cabreira* at 775 m altitude.

1/s/Km² (*Açude de Tougues*), and the *Minho*, 22 1/s/Km² (*Ponte de Felgueiras*) (S. DAVEAU, 1995).

Pedology

According to the Soil Map of Portugal, in the northwest region, there is a clear prevalence Cambisols which are moderately evolved and with a irregular fertility rates. Near the coast the Lithosols (incipiente soils, still developing due to rock degradation and rarely surpassing 10 cm in depth) are present, while the Rankers – i.e., shallow soils with reduced fertility – emerge in the higher altitudes.

Human Characterization

Regardless of the natural features of the region, human action (agriculture, pasture, silviculture, etc.) must be emphasized due to its profound influence in the regions physiognomy. To all intents and purposes, the prolonged activity of human beings in the region has contributed significantly to the degradation of the endogenous plant cover. Nevertheless, “even this human activity, particularly through the organization of the traditional agricultural systems, was dependent on the same physical factors that shape the natural systems” (P. T. GOMES e A. BOTELHO, 2004).

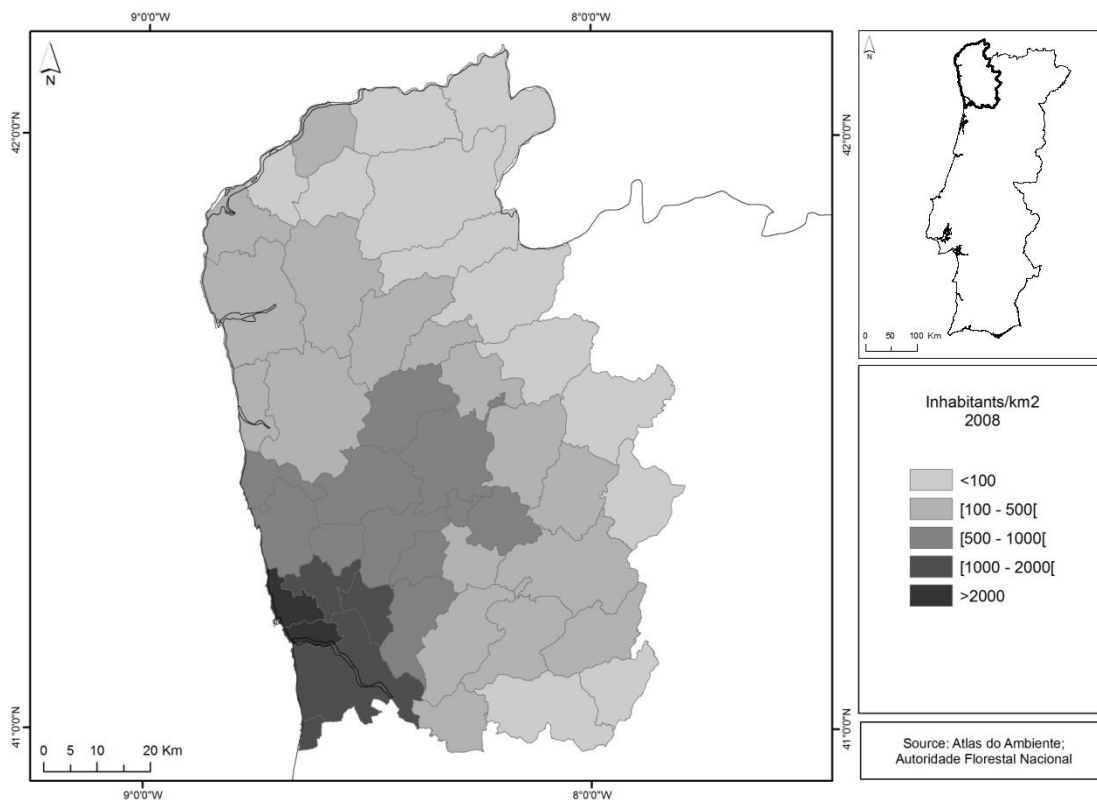


Figure 4 – Population Density by Municipality, for 2008, in the Portuguese northwest.

In effect, the Portuguese northwest has witnessed a significant demographic dynamic with high birth and nuptial rates.

The region has one of the densest concentrated populations in the Iberian Peninsula. Presently, the northwest has a demographic density that surpasses 360 inh./km² (369,1), a

value markedly superior to both the northern region of Portugal (175,1) and Portugal as a whole (112,9) (Figure 4)

Basic Landscape Units

The Portuguese northwest is a highly humanized region where the spatial organization reveals marked contrasts. However, this does not hinder the existence of a unitary ecologic system characterized by the physiognomy of the landscape, the group of species that inhabit it, and by the local adaptive strategies that differentiate the region from the rest of the country.

“Traditionally, two large biogeographic spaces in the Iberian Peninsula are identified. [...] At our latitudes, the hydraulic regime is the principal factor responsible for the physiognomy of the landscape and the division between the dry and wet Iberia, the climatic types (atlantcity as opposed to mediterraneaty), and the large phyto-corologic regions (Euro-siberian and Mediterranean) testify to this great division of the Peninsula” (P. GOMES e A. BOTELHO, 2004). In this context, the Portuguese northwest is part of the Euro-siberian region.

The referred to climatic characteristics are responsible for determining the local vegetation. With a minor summer aridity, in which the number of dry months rarely surpasses two, natural vegetation is typically evergreen, resistant to drought and fire-prone. Ecologically, the Portuguese northwest, with its climatic characteristics that directly influence the type of endogenous plant communities, is situated in the humid Iberia and distinguishes itself from the rest of the country.

Some plant species from middle Europe have the meridional limit of their expansion in the North of Portugal, where some of their most important settlements are located. This fact is due to the affect of the ocean which attenuates the heat and dryness of the summer months by conditioning abundant rainfall.

As a fundamental element of the landscape, the vegetation is an excellent testimony to the orographic and edafo-climatic conditions of a region as well as to the anthropic action.

Biogeographically, the Portuguese northwest is located in the Miniense Subsector and the Geresiano-Queixense² subsector (RIVAS-MARTINEZ, 1996), allowing for a correspondence between the *Minho* Lowlands and the transition described by O. RIBEIRO (1970, 1991) between the mentioned Lowlands and the *Trás-os-Montes* Highlands.

The Miniense Subsector is essentially a granite dominated area that is progressively corrugated as we head inwards. It presents a tempered hiper-oceanic or oceanic bioclimate, mainly positioned in the termo-temperate and meso-temperate belt, with a humid to hyper-humid ombroclimate. [...] The climatic vegetation is constituted by Gallic-Portuguese Alvarinho Oaks (*Quercus robur* L.) which survive in small, highly threatened pockets (J. C. COSTA *et al*, 1998).

From a biographic perspective, the Miniense Subsector corresponds to the Minho Lowlands (O. RIBEIRO, 1970, 1991), whose essential features are the dispersed and disseminated settlements in which the dwellings share a close relationship with the cultivated land and the landscape is highly compartmentalized due to the plethora of small estates which are fenced off by small port trees and bushes or vines in *ramada*. In the slopes with poorer and less irrigated soils we can find forests composed of a mixture of Maritime Pine Trees (*Pinus pinaster* Aiton.) and Eucalyptuses (*Eucalyptus globulus* Labill) with the manifestation of some spontaneous oaks and other corresponding fagaceas trees³.

² Both belong to the Gallic-Portuguese Sector, Sub-provincial Gallic-Asturiana, Provincial Cantabro Atlantic, Sub-provincial Atlantic, Sub-region Atlantic-Mideuropean, the Euro-Siberian region.

³ At the moment, forest fires and the changes in agricultural practices (due to social changes) altered significantly this setting, giving rise to large areas of shrubland instead of Pine Trees and vineyards, and orchards instead of the *ramadas* and corn fields.

The Geresiano-Queixense Subsector has a highly irregular relief where the Hercynian granites are largely prevalent. It is situated in the supra-temperate belt (Montano) with a hyper-humid (humid) ombroclimate according to its exposure in the altitudes above 600-800 m. The climatic vegetation is composed of Alvarinho Oaks (*Quercus robur* L.) in the more oceanic and hyper-humid areas or Pyrenean Oaks (*Quercus pyrenaica* Wild.) in the areas with a humid ombroclimate or in the higher and continental biotypes (J. C. COSTA *et al.*, 1998).

Biogeographically, the Geresiano-Queixense Subsector also corresponds to the transition between the Lowlands and the Highlands. Here we can verify a gradual shift in which the pine tree is substituted by Alvarinho Oaks (*Quercus robur* L.) and Birch Trees (*Betula alba* L.) and low creeping shrubbery (O. RIBEIRO, 1991) in the slopes due to the increase in altitude (colder and with more rainfall in the humid season).

In summary and considering the basic landscaped units, we can distinguish six different basic spatial uses in the Portuguese northwest (P. GOMES, 2001): the plain agricultural systems which comprise the lowland landscapes with dispersed settlements; the mountain agricultural systems in which the settlements are clustered; the urbanized systems, with its cities and towns; the uncultivated systems, composed primarily of more or less degraded shrubbery and bare or exposed rock; planted forests with a predominance of Maritime Pine Trees (*Pinus pinaster* Aiton.) and Eucalyptuses (*Eucalyptus globulus* Labill); deciduous forests, dominated by Alvarinho Oaks (*Quercus robur* L.) and Pyrenean Oaks (*Quercus pyrenaica* Wild.) which correspond to spontaneous or sub-spontaneous areas.

References

- Bento Gonçalves, A. (2006) – Geografia dos incêndios florestais em espaços silvestres de montanha. Tese de Doutoramento, Braga, Instituto de Ciências Sociais, Universidade do Minho, 439 p.
- Costa, J. C., Aguiar, C., Capelo, J. H., Lousã, M. e Neto, C. (1998) – "Biogeografia de Portugal Continental", Quercetea, Vol. 0, ALFA e FIP, Lisboa, p. 5-56.
- Daveau, S. (1985) – Mapas Climáticos de Portugal – Nevoeiro, Nebulosidade e Contrastes Térmicos, Memórias nº 7, C.E.G. Lisboa, 84 pp.
- Daveau, S. (1995) – Portugal Geográfico, Edições João Sá e Costa, Lisboa, 221 pp.
- Ferreira, N., Iglesias, I, Noronha, F., Pereira, E., Ribeiro, A., Ribeiro, M. L. (1987) – "Granitóides da Zona Centro Ibérica e seu enquadramento geodinâmico", Libro Homenaje a L. C. Garcia de Figueirola, Ed. Ruela, Madrid, p. 37-51.
- Gomes, P. T. e Botelho, A. (2004) – "Minho, Unidade Biogeográfica?" Área, 4, GeoPlanUM, Guimarães, p. 47-58.
- Lema, P. B. e Rebelo, F. (1996) – Geografia de Portugal, Meio Físico e Recursos Naturais, Universidade Aberta, 447 pp.
- Ribeiro, A. e J. Cabral (1988) - Mapa Neotectónico de Portugal, Ed. SGP, Lisboa.
- Ribeiro, O. (1986) - Portugal o Mediterrâneo e o Atlântico, João Sá da Costa, 4ª (1998 - 7ª ed.), 188 pp.
- Ribeiro, O. (1970) – Ensaios de geografia humana e regional. Trinta e cinco anos de estudos geográficos, Livraria Sá da Costa, Lisboa.
- Ribeiro, O. (1991) – Opúsculos Geográficos, IV Volume: o mundo rural. FCG; Lisboa.