Niki Evelpidou · Tomás de Figueiredo · Francesco Mauro
Vahap Tecim · Andreas Vassilopoulos

Natural Heritage from East to West

Case studies from 6 EU countries

The publication originated within the Leonardo da Vinci Pilot Project "EduNatHer, Educational Strategies for the Promotion of Natural Heritage", supported by EU funds. The Leonardo da Vinci Pilot Project is one of the longest-running instruments of cooperation among educational organizations and researchers across Europe. The book is the result of cooperation among academic and research institutions from six countries – Greece, Romania, Portugal, Italy, Malta, and Turkey –, and its focus is on natural landmarks and monuments from those countries. The main objective is to help strengthening links between scientific organizations, and public and private sectors involved in preservation and management of natural sites. The case studies presented, distributed in Europe east to west, are of relevant environmental or educational value.

Msc Niki Evelpidou has a PhD in Geology and a PhD in Geoarchaeology. Covering the research topics of Geomorphology, Natural Hazards and GIS, she is teaching subjects of geomorphology and GIS in the University of Athens and has published 5 academic books and more than 100 research papers.

Tomás de Figueiredo, graduated and PhD in Agronomic Engineering, Professor in Geosciences at Instituto Politécnico de Bragança, Portugal, member of CIMO, Mountain Research Centre, Bragança, leading research group on Mountain Farming Systems, research in Erosion and Soil and Water Conservation.

Francesco Mauro, professor of Sustainable Development, Università Telematica Guglielmo Marconi, Italy. Doctoral degree in Biological Sciences, 1961. Scientific career in USA, UK, and Italy. Former director of ENEA Environment Dep. Experience in: radiobiology, analytical cytology, biodiversity, and environment.

Vahap Tecim, graduated in Economics (BA), Econometrics (MA), Systems Science (MSc) and Operations Research/Management Science (PhD). Professor in Operations Research at Dokuz Eylul University. Director of the department of GIS. IT, GIS, system analysis, project planning are the main research interests.

Andreas Vassilopoulos (Dr. in Geology, Dr. in Geoarchaeology) is research fellow at ISTA (Besancon University, France), at Remote Sensing laboratory (Athens University, Greece) and Professor on Geoinformation at Chalkis Technological Institute.

ISBN 978-3-642-01576-2

springer.com

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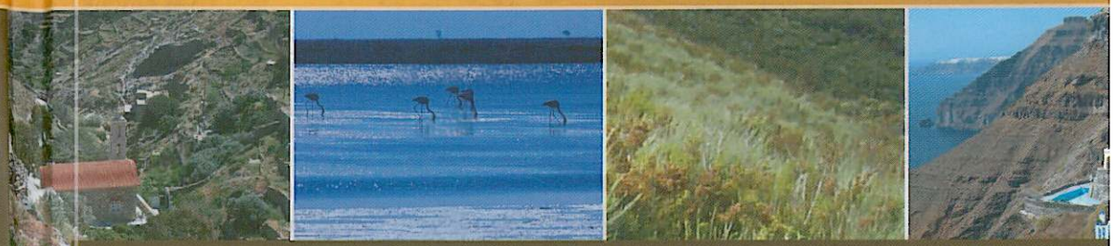

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Editors

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Editors
Dr. Niki Evelpidou
National and Kapodistrian
University of Athens
Faculty of Geology
and Geoenvironment
Department of Geography
and Climatology
Panepistimiopolis, Gr-15784
Athens, Greece
evelpidou@geol.uoa.gr

Dr. Tomás de Figueiredo
CIMO, Escola Superior Agrária
Instituto Politécnico de Bragança
E. S. Agrária
CIMO-Moutain Research Centre
Apartado 1172, 5301-855
Bragança, Portugal
tomasfig@ipb.pt

Dr. Francesco Mauro
Università Telematica
Guglielmo Marconi
Via Plinio 44, 00193
Rome
Italy
mauro_sustainability@yahoo.com

Dr. Vahap Tecim
Dokuz Eylül University
Faculty of Economics
and Administrative Science
35160, Buca/Izmir, Turkey
vahap.tecim@deu.edu.tr

Dr. Andreas Vassilopoulos
Geoenvironmental Institute
Flias 13, Maroussi
151 25, Athens, Greece
vassilopoulos@geoenvi.org

ISBN 978-3-642-01576-2 e-ISBN 978-3-642-01577-9
DOI 10.1007/978-3-642-01577-9
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2009932879

Cover design: Bauer, Thomas

The authors, in cooperation with their national coordinator (quoted below), take full responsibility on the originality and the copyrights of the provided material:
Greece: Evelpidou N., (National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Geography and Climatology, Panepistimiopolis, 15784, Athens, Greece),
Vassilopoulos A., (Geoenvironmental Institute, Flias 13, Maroussi, 151 25, Athens, Greece),
Italy: Mauro F. (Università Telematica "Guglielmo Marconi", Via Plinio 44, 00193 Rome, Italy),
Malta: Integrated Resources Management Company Ltd., Malta,
Portugal: de Figueiredo T. (Instituto Politécnico de Bragança, E. S. Agrária, CIMO-Moutain Research Centre, Bragança, Portugal),
Romania: Ioane D., Marunteanu C. (University of Bucharest, Romania),
Turkey: Tecim V. (Dokuz Eylul University, Faculty of Economics and Administrative Sciences, 35160 Buca, Izmir-Turkey)
Printed by SPRINGER

Education and Culture
Leonardo da Vinci e-duNatHer training web tools 4 everyone

The project is co-funded by the European community (75%)
The book doesn't necessarily reflect the views of the European Commission or the National Agency

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Montesinho Natural Park: General Description and Natural Values

J. Castro, Tomás de Figueiredo, Felícia Fonseca, João Paulo Castro, Sílvia Nobre, and Luís Carlos Pires

The Physical Environment

The Montesinho Natural Park (PNM, *Parque Natural de Montesinho*) is a protected area located in the municipalities of Vinhais and Bragança, in the administrative NUT Alto Trás-os-Montes (PT118), the mountainous region of northeast Portugal. It was created in 1979 and consists of 748 km^2 of natural wooded landscape and traditional mountain agricultural landscape, with highly variable gradients. PNM lies in the vast northeast Trás-os-Montes plateau, with average altitude around 750–900 m, which is part of the Iberian Meseta northern block (Medeiros, 1987; Ribeiro et al., 1987). However, in PNM elevation ranges more than 1,000 m, from the lowest point in the River Mente (436 m), its western border, to the top of Montesinho, at 1,487 m. The main altitudinal belts correspond also to the main landforms found in the area.

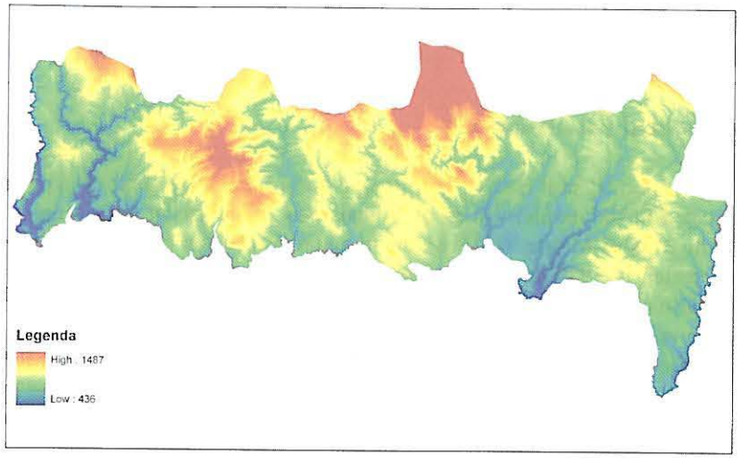
Cytisus spp and *Erica* spp vegetation in a mosaic between França and Aveleda, with *Serra de Montesinho* on the horizon (photo by T. de Figueiredo)

Most of the territory is in two areas, both below 1,000 m. The largest one is between 700 and 1,000 m, where most of the plateau lies. It is well defined in

J. Castro (✉)
Instituto Politécnico de Bragança, Apartado 1172, 5301-855 Bragança, Portugal
e-mail: mzecast@ipb.pt

N. Evelpidou et al. (eds.), *Natural Heritage from East to West*,
DOI 10.1007/978-3-642-01577-9_15, © Springer-Verlag Berlin Heidelberg 2010

the east, especially in Alta Lombada, a surface around 900 m elevation, whose "dark dorsal, poorly vegetated, with its regular outline, closes the horizon Bragança eastwards." (Taborda, 1987). In the west, the plateau is made of small platforms; these are transitional tracts between deep valleys and the neighboring highlands (Agroconsultores e Coba, 1991).



Hypsometric map of PNM

Most of the rivers in the area run below 700 m, and their valleys are the dominant landform in this area. Deep, with narrow bottom and steep slopes, i.e. V-shaped,

Tributaries of Sabor river in PNM: left) Onor crossing Rio de Onor, a village of communal traditions; right) Maçãs in Quintanilha, the eastern international border (photos by A. Suarez and A. Carvalho, respectively)

they strongly contrast with the planar or rounded crests in the interfluves. Also below 700 m, Baixa Lombada is a large, fertile, low-lying area north of Bragança (Gonçalves, 1980). It is a tectonic depression that contrasts with the high plateau of Alta Lombada, its eastern neighbor (Pereira et al., 2003).

In the mountains, above 1,000 m elevation, human occupation is almost nonexistent and hence cultivated land almost disappears, giving way to highland pastures (Agroconsultores e Coba, 1991). This contour bounds the mountain domains and surrounds the three highest peaks of the area, the southern edges of the Spanish Galician-Leonese mountains (Pereira et al., 2003): Corôa (1,272 m), Nogueira (1,318 m, in fact outside but close to the southern border of PNM) and Montesinho (1,487 m). The summits of these three mountains follow a morphological pattern found all over Trás-os-Montes: leveled hilltops, small areas of land corresponding to old erosion surfaces (Taborda, 1987).

Since it is an area of ancient rocks, some of the oldest in Portugal (see article by Meireles in this chapter), PNM reflects in its relief a remarkable morphogenetic activity, mainly due to the erosive action of running water, reshaping the surface and redistributing material in the landscape (Agroconsultores e Coba, 1991; IPB/ICN, 2006). Hypsometry and hydrography have thus been coupled in forming the land, on which plant communities have installed themselves, soils have deepened, humans have settled and which is finally opening to tourism and the interest of entrepreneurs.

Streams drain the whole area to the Douro River, more than 100 km to the south. The Douro is the Portuguese river with the largest drainage basin (though 4/5 of it is in Spanish territory), and it ranks second in total length (after the Tagus). The Douro drainage basin accounts for 1/3 of the Portuguese surface water resources and half of the energy generated in hydropower plants (Ferreira, 2005). Adding to its economic importance, the Douro drainage basin also hosts important terrestrial and aquatic wildlife habitats, including those of PNM.

Headwaters of two major tributaries of the Douro are in Montesinho, Tua and Sabor, the catchment divides being in fact across the border, in Spain. The Rabaçal and the Tuela, joining to form the Tua some 50 km to the south, are the largest rivers on the western side of PNM. The drainage basin of the Baceiro, a local tributary of Tuela, provides very significant examples of balanced land use in humanized landscapes (Gonçalves, 1980; IPB/ICN, 2006). The Sabor basin covers the eastern half of PNM and comprises the Sabor River itself (the largest in the area, with the largest drainage basin of Douro right bank tributaries), and the Maçãs, which drains the driest tracts of the Sabor basin.

In the area, as a whole, mean annual river discharge is 1/3 of precipitation; however, catchments have higher water yield in the west than in the east (Gonçalves, 1985). Following a common trend, explained by precipitation and vegetation cover decrease, inter-annual and seasonal variability of river discharge tends to increase from west to east (Henriques, 1985). Drainage density is high in the area, where stream networks are mainly controlled by geological fracture distribution (Pereira et al., 2003). The steep slopes of catchment surface and riverbeds, prevalent in this mountain domain, affect runoff and discharge, determining the habitat for aquatic species and stream ecology (see below). The effect of geological basement on catchment characteristics is clear when comparing drainage texture over granite and

schist areas, the two main lithologies prevailing in PNM (Figueiredo and Fonseca, 1997).

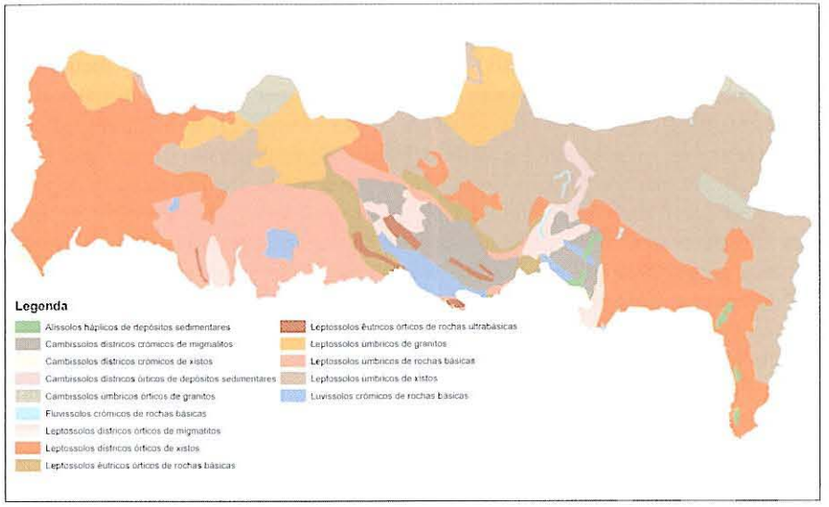
Climate in Montesinho is Mediterranean, although other influences, derived from the geographic position and the relief of this area, affect the general pattern (Gonçalves, 1985). Continental effects come from the inner Iberian Peninsula, as Atlantic influence is hampered by impressive mountain ranges (more than 1,500 m elevation in the west and more than 2,000 m in the north, in Sanabria, Spain, close to the border). They bring an increase in seasonal contrast (annual range is 15–20°C), in dryness, and in inter-annual variability (Gonçalves, 1985). Continental effects are relevant in the eastern tract of PNM but they are drowned out to the centre and west and where the mountain effects take their place. Altitude is in fact the factor that best explains spatial variations in temperature (most of the area is below 12°C) and precipitation (mostly over 800 mm) (Gonçalves, 1985; Figueiredo, 1990).

Regional climatology labels Montesinho as "Terra Fria" (cold land), as opposed to "Terra Quente" (hot land), typical of the southern depressions and valleys less than 400 m elevation (Gonçalves, 1991b). In "Terra Fria" (annual temperature, $T < 12.5°C$), there is almost no transition between a short and hot summer and a long lasting winter, with the largest frosty season in Portugal (from mid-October to mid-May) (Agroconsultores e Coba, 1991; Gonçalves, 1991a; Ribeiro, 1996). Expressively, "Terra Fria" in a regional saying is "Nove meses de Inverno e três de Inferno" (freely translated to "winter for nine months, hell for the other three"). Most of the area of PNM lies on a plateau landscape ("Terra Fria de

Snow cover in the top of Montesinho (photo by A. Suarez)

Planalto"), where annual precipitation is over 800 mm west of Bragança, although it is lower to the east. The mountain ("Montanha") and high mountain ("Alta Montanha") landscapes are the typical of these altitudinal domains (T 9–10°C and $T < 9°C$, respectively), where total yearly rainfall is 1,200 mm or more, rising above 1,400 mm in the highest crests, partly falling as snow in winter. Small patches of transitional conditions ("Terra de Transição", $T > 12.5°C$) are found in the valleys close to the southern boundary of PNM.

The history of a wide variety of outcropping rocks (e.g. schist, granite, mafic and ultramafic rocks, unconsolidated sedimentary materials) makes PNM such a striking territory (see article by Meireles in this chapter). From them, soils have formed bearing vegetation; and both have developed in a wide variety of topographic and climatic conditions.



Soil Map of PNM: Main Soil Units

According to the Soil Map of Northeast Portugal, 1:100,000 (Agroconsultores e Coba, 1991), which follows the FAO system of classification (FAO/UNESCO 1987), Leptosols are largely dominant in PNM (77% of the area. These are shallow stony soils with hard rock at less than 0.5 m depth, occurring in steep slopes and convex landforms, which reflect the incipient pedogenesis prevailing under such topographic conditions, much more prone to morphogenetic activity. The Cambisols rank second in area (20%), covering the slopes lower than 12%, where deeper but still poorly developed soils form over any parent material. The more developed soils are Luvisols and Alisols, covering 2% of the territory (1.2 and 0.8%, respectively). They are both confined to the gentle slope plateau landforms, the first one developed over basic rocks, the second one over sedimentary deposits of Tertiary clayey material with rounded gravel. Other relevant soil units are the Fluvisols, developing

along the few wider valley bottoms, over alluvial parent material. Regosols, above colluvial deposits, also occur in small patches, scattered all over the area. The former are deeper than the latter, they both make up the large group of incipient soils present in PNM.

In nearly half of the PNM the soils have a carbon rich surface (A) horizon (hence qualifying as umbric at secondary level). These are in well vegetated elevated areas, roughly above 900 m, where colder and wetter climatic conditions enhance the accumulation of organic matter. Soils are acid or very acid in most of the PNM area, either due to high organic content and or to parent material characteristics. In fact, soil units qualifying as eutric, which are non acid, cover only 4% of the area, strictly over basic lithology. Soils on the very steep slopes, in less than one tenth of the Park, qualify as lithic because hard rock is at very shallow depth (less than 0.1 m).

Soil properties reflect the processes and factors acting during soil formation and development. Although pedogenetic processes show incipient results, the influence of soil formation factors is clearly evident in major features of regional soils; this is true of PNM (Figueiredo, 2001). These effects have been implicitly mentioned, in part, above: the effect of climate on soil organic matter; of parent material on soil chemistry; of topography on soil depth. Other examples follow. Parent material also affects soil texture, since granite-derived soils are rich in coarse sand, those formed over schist are silt-rich, and those of basic rocks and sedimentary deposits have more clay. The combined effect of climate and topography on the content of rock fragments in the soil explains the presence of stony soils on gentle slopes in the drier areas; these are rarer in the wetter ones. Vegetation and land use affect carbon content. This is 3.5–4.5% on average in the A horizon of soils under forest, pasture or shrub cover, against 1% under annual and permanent crops. Even though this is an indication of the widely accepted detrimental effect of land use in soil resources, as explained later in this paper, Montesinho depicts striking examples of balanced farming systems in humanized landscapes, coming from traditional expertise in soil quality assessment and soil conservation principles based on good management practices.

Man and Land Use

The PNM includes 92 small villages inhabited by less than 8,000 people. Demographically the western part of PNM, although less populated, has many villages, most of them with less than 200 inhabitants; the eastern part villages are fewer in number but more populated, frequently over 300 inhabitants. Economically the PNM still produces grains, chestnuts and livestock, especially cattle and sheep. In recent years agriculture has declined, abandonment of the villages persists and the population is ageing. Most of the villages have too few children to keep the rural schools open. But it has been the traditional family livelihood of PNM inhabitants, which is based on small farming and sheep herding, that contributed definitely to the conservation of biodiversity in the region. For centuries, more than 50% of the

territory was communal land, an ancestral Portuguese and European system of land property and management. Most of that land was privatized or taken by the State in the nineteenth and twentieth Centuries and today only one third of PNM remains communally owned (IPB/ICN, 2006).

The western part of the Montesinho Natural Park lies in the northern half of Vinhais municipality, where good examples of rural and agricultural lifestyles combined with wildlife preservation are found. At present, sweet chestnut *Castanea sativa* plantations are the main driver of economic activity in Vinhais. Cattle husbandry of the local breed *Mirandesa* is also economically important but unfortunately it is declining. Upland meadows, marked by a good network of hedgerows dominated by ash *Fraxinus angustifolia*, elm *Ulmus procera*, alder *alnus glutinosa* and poplars *Populus* sp., together with heath lands and cropland, compose a very green landscape, typically associated with *Mirandesa* husbandry. Recently created is a Biological Park ("Parque Biológico de Vinhais"), in Cidadelhe Mountai, which aims to generate a better understanding of wildlife in this area.

Chestnut trees (*Castanea sativa*) in Vinhais area, economically a very important product; the fruits also form part of the PNM logo (photo by A. Borges)

"Mirandesa" autochthonous cattle breed: grazing meadow in Babe (photo by S. Nobre)

The eastern part of the Montesinho Natural Park corresponds to the northern part Bragança municipality. Here, forestry, sheep herding and agriculture also combine with wildlife preservation. The Natural Park took its name from the most northern mountain of Bragança municipality that reaches an altitude of 1,487 m. The vegetation is composed of scrubs of *Erica* spp., *Genista* spp., *Chamaespartium* sp. and *Salix* spp. *Montesinho* is the only village at such heights; agricultural activity has decayed over approximately 20 years but tourism and recreational activities have became more and more significant. For most of the year there are only about 200 sheep grazing; however, grazing can be very intense from May to August when about 5,000 sheep are transported from the surrounding lowlands to graze in the highlands during summer months. Consequently, this area is very often subjected to wild fires that are mainly induced by shepherds who wish to obtain better grazing (Geraldes and Boavida, 2003). *Serra Serrada* reservoir, built to supply water to the city of Bragança and to generate hydroelectric power, is located in this mountain.

Alta Lombada seen from Bragança: the eastern plateau and drier tract in PNM (photo by A. Carvalho)

Major Natural Values

The main native forest cover was oak (*Quercus pyrenaica*) and chestnut trees (*Castanea sativa*). After centuries of destruction, wildlife populations are now recovering in the region in response to lessening of human pressure coupled with the expansion of scrub areas, better protection laws, the positive action of the Park management authority and a slow change in the attitude of individuals towards wildlife. Biodiversity is currently high but the densities of wild populations are lower than in the past (some, such as bear and lynx, reduced to extinction), mainly because man has destroyed most of the native forests. At the beginning of the twentieth Century, deer were exterminated, but by 1989, they came back via populations in Spain (Alves, 2004).

Oak trees (*Quercus pyrenaica*) in winter: the original forest cover and a wildlife habitat rated as excellent natural value (photo by S. Nobre)

This Park has a high flora and fauna diversity and the latter expressively contributes to its emblematic biodiversity. All of the trophic levels are present and large carnivores and wild and domestic herbivores coexist in the region. A population of about 30 Iberian wolves (*Canis lupus signatus* Cabrera) lives in the Park and it is linked to a larger population of more than 120 wolves in neighboring regions in Portugal and Spain. Other carnivores include common genet and red fox (*Vulpes* vulpes). Wild boar (*Sus scrofa*), roe deer (*Capreolus capreolus* Linnaeus), deer (*Cervus elaphus* Linnaeus) and, as mentioned above, domestic herbivores such as cattle, goat and sheep regional breeds, all inhabit the Natural Park. Main aquatic mammal species is the European otter (*Lutra lutra*) (IPB/ICN, 2006).

Dense riparian vegetation along the Maçãs river in Quintanilha, the eastern PNM border (photo by A. Carvalho)

Stream banks in PNM are covered by dense riparian vegetation dominated by alder *Alnus glutinosa*, ash *Fraxinus angustifolia*, poplar *Populus nigra* and willows *Salix* sp., limiting the primary production in these systems where the food webs are energetically dependent on allochthonous inputs of organic matter (Teixeira and Cortes, 2007).

These streams and their dense riparian galleries represent key features for the high level of biodiversity preservation in the PNM. They are subjected to a reduced human pressure, which contributes to low impact on water composition. The fish community is dominated by native brown trout *Salmo truta* populations, but endemic cyprinid species are also present, such as the Iberian chub *Squalius carolitertii*, the Iberian nase *Chondrostoma duriensis*, *Squalius alburnoides* and *Barbus bocagei*. The brown trout are present in the upper reaches of these rivers, whereas the cyprinids cohabit with trout, although in low densities, in the lower ones (Teixeira and Cortes, 2007). The water temperature ranges from a winter minimum of 4ºC to a summer maximum of 20ºC and their ecosystem function is, as

already stressed, highly dependent of the input of allochthonous materials (Teixeira and Cortes, 2006).

Lower reaches include many old watermills, most of them abandoned or destroyed, but also with some good examples of structural and functional rehabilitation for tourism, recreation, and environmental and cultural education. They were essential to mill all cultivated cereals, mainly rye and wheat, the basis of human sustainability for centuries. The watermills required the presence of a succession of small artificial weirs creating the corresponding deep pools and riffles. The impact of human activities in these systems is limited because population is scarce and agriculture is extensive with low fertilizer input, thus contributing to the good water quality found all along the streams. However, an increase in fishing pressure, often using illegal procedures (poison, nets), is responsible for the gradual decrease of natural trout stocks and has lead local authorities to follow active management programmes, such as the implementation of stocking operations.

Remnant woodlands of Holm oak (*Quercus ilex)* represent also important spots of diversity in the PNM, in spite of covering only around 3,000 ha. Usually they are small in size and simple in shape, and occur close to each other, frequently located towards the bottom of very steep slopes, facing West Northwest and East Southeast, and relatively close to ephemeral streams. However, these woodlands intercept these streams in most of the cases. Their patterns do not change when woodlands are considered according to their development stage (Dias and Azevedo, 2008). Most

Ultramafic flora, as *Alyssum pintodasilvae* and *Santolina semidentata*, are qualified as excellent natural value, thus requiring conservation awareness (photo by C. Aguiar)

of these holm oak remnant woodlands are over mafic and ultramafic rocks derived soils that are frequent in this territory and have very particularly vascular indigenous or synantropic plant *taxa* (Aguiar, 2002, see also article by Sequeira et al. in this chapter).

Productive forests were introduced during the twentieth century and most of them are pure stands of several species, the most important being *Pinus pinaster* Ait. and *P. nigra* Arn., and the less represented *P. sylvestris* L. and *P. strobus* L. Every year those pine stands are severely attacked by *T. pityocampa*, a forest pest that field observations and experimental confirmation suggested preference for this host (Arnaldo and Torres, 2006). These plantations were promoted by the National Forest Service and included also *Pseudotsuga menziesii* as well as some deciduous species, *Betula alba* and *Quercus robur*, which are common in the highlands of Montesinho and Coroa mountains. Stands have approximately uniform tree density and natural thinning, natural regeneration and lack of management have created clearings of different sizes. A shrub understorey is composed dominantly by *Erica* spp., *Ulex* spp., *Cistus* spp. and *Cytisus* spp.

These plantations are common in the eastern part of PNM, where they have been an important winter habitat used both by red and roe deer. Distributions of red and roe deer populations overlap and have been recently expanding in PNM, partially due to favorable habitat changes and limited culling policies adopted by the Park management authority. Estimated densities of red and roe deer in the area are approximately of 0.03–0.04 and 0.01–0.02 individuals/hectares, respectively (Ramos et al., 2006). Deer rubbing of adult trees is thought to be an important source of economic losses in the area. Damage to trees, in orchards and agricultural crops, has been increasingly reported by farmers and foresters inhabiting the area.

Fauna and Flora Values Formally Recognized in the PNM

The Habitats Directive (Council Directive 92/43/EEC) and Birds Directive (Council Directive 79/409/EEC) form the cornerstone of Europe';s nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. The high value of biodiversity of Montesinho Natural Park gives it this special statute at international level.

A harrier (*Circus pygargus*) and a dove (*Streptopelia turtur*) are the highest naturalistically valued birds of PNM. Three mammals – the Iberian wolf (*Canis lupus*), a mole (*Galemys pyrenaicus*) and an otter (*Lutra lutra*) -, one reptile – a turtle (*Mauremys leprosa*) – and an invertebrate – a freshwater pearl mussel (*Margaritifera margaritifera*) – are also considered excellent natural values of PNM Fauna. Many flowering plants that occur in PNM are classified as excellent value such as *Dianthus marizii*, *Festuca brigantina*, *F. elegans*, *F. summilusitanica*, *Jasione crispa* ssp. *Serpentinica*, *Santolina semidentata*, and *Veronica micrantha*.

Meadow along a meandering stream with riparian corridor, near Babe (photo by A. Carvalho)

Many other species are classified as of good nature value such as the birds – *Anthus campestris*, *A. spinoletta*, *A. trivialis*, *Aquila chrysaetos*, *Asio flammeus*, *Bubo bubo*, *Caprimulgus europaeus*, *Ciconia nigra*, *Circus cyaneus*, *Emberiza hortulana*, *Falco peregrinus*, *Lanius collurio*, *Monticola saxatilis*, *Oenanthe hispanica*, *O. oenanthe*, *Pernis apivorus*, *Phoenicurus phoenicurus*, *Sylvia borin* -, the fishes – *Chondrostoma polylepis* and *Rutilus alburnoides* -, the invertebrate – *Unio crassus* – and the flowering plant – *Narcissus asturiensis*.

Natural and semi-natural habitats mixed in the PNM landscape gradients are essential to maintain all of these species. The habitats recognized as having global excellent value are the dry heaths and the oak woods with *Quercus pyrenaica*; many other habitats are recognized as of global good value such as the *Castanea sativa* woods, the endemic heaths with gorse, the hydrophilous tall herb fringe communities of plains and mountain, the lowland hay meadows, the pseudo-steppe with grasses and annuals, the *Quercus ilex* and *Quercus rotundifolia* forests, the rivers with muddy banks, the siliceous rocky slopes with chasmophytic vegetation, the temperate Atlantic wet heaths, and the water courses at all levels, from the mountains to the plain (http://eunis.eea.europa.eu/).

Photos By

A. Carvalho, IPB / ESA / CIMO, anacarv@ipb.pt
A. Borges, Arborea, Vinhais, aborges@arborea.pt
A. Suarez, IPB, atilano@ipb.pt

References

Agroconsultores e Coba. 1991. Carta dos Solos, Carta do Uso Actual da Terra e Carta da Aptidão da Terra do Nordeste de Portugal. Vila Real: UTAD/PDRITM.

Aguiar, C. 2002. Flora e Vegetação da Serra da Nogueira e do Parque Natural de Montesinho. Instituto Superior de Agronomia. Lisboa: Universidade Técnica de Lisboa: 661.

Alves, J. 2004. Man and wild boar: a study in Montesinho Natural Park, Portugal. In Galemys: Boletín informativo de la Sociedad Española para la conservación y estudio de los mamíferos 16 (1): 223–230.

Arnaldo, P. & Torres, L. 2006. Effect of Different Hosts on Thaumetopoea pityocampa Populations in Northeast Portugal. In Phytoparasitica 34 (5): 523.

Dias, R. & Azevedo, J. C. 2008. Distribution and spatial configuration of holm oak woodlands in the Montesinho/Nogueira site, Portugal. In Landscape Ecology and Forest Management – Challenges and Solutions. Proceedings of the International Conference IUFRO – 8.01.02 Landscape Ecology. Chengdu, China.

FAO/UNESCO. 1987. Soil Map of the World, Revised Legend, Amended Fourth Draft. Rome: United Nations Food and Agriculture Organization.

Ferreira, A. de B. (coord.) 2005. Geografia de Portugal: I – O Ambiente Físico (dir. C. A. Medeiros). Mem Martins: Círculo de Leitores.

Figueiredo, T. de. 1990. Aplicação da Equação Universal de Perda de Solo na estimativa da Erosão Potencial: o caso do Parque Natural de Montesinho. Bragança: Instituto Politécnico de Bragança: 87.

Figueiredo, T. de. 2001. Recursos pedológicos do Nordeste Transmontano. In II Seminário sobre Recursos Naturais do Nordeste Transmontano. Bragança: Instituto Politécnico de Bragança: 15.

Figueiredo, T. de & Fonseca, F. 1997. Les sols, les processus d'érosion et l'utilisation de la terre en montagne au Nord-Est du Portugal: Approche cartographique sur quelques zones du Parc Naturel de Montesinho. In Réseau Erosion 17: 205–217.

Geraldes, A. M. & Boavida, M. J. 2003. Distinct age and landscape influence on two reservoirs under the same climate. In Hydrobiologia 504 (1): 277–288.

Gonçalves, D. A. 1980. Parque Natural de Montesinho. Lisboa: Serviço Nacional de Parques, Reservas e Património Paisagístico.

Gonçalves, D. A. 1985. Contribuição para o estudo do clima da bacia superior do rio Sabor (Influência da circulação geral e regional na estrutura da baixa atmosfera). Vila Real: Instituto Universitário de Trás-os-Montes e Alto e Douro.

Gonçalves, D. A. 1991a. O clima e os ecossistemas Agro-Ecológicos do Parque Natural de Montesinho. In II Seminário Técnico sobre Conservação da Natureza nos Países do Sul da Europa, 4ª Secção – Climatologia. Faro: 18.

Gonçalves, D. A. 1991b. Terra Fria – Terra Quente (1ª Aproximação). Bragança: IPB/Centro de Agroclimatologia da UTAD.

Henriques, A. Gonçalves. 1985. Avaliação dos Recursos Hídricos de Portugal Continental: Contribuição para o Ordenamento do Território. Lisboa: Instituto de Estudos para o Desenvolvimento.

IPB/ICN. 2006. Plano de Ordenamento do Parque Natural de Montesinho: I – Relatório de Caracterização. Bragança: Instituto Politécnico de Bragança.

Medeiros, C. A. 1987. Introdução à Geografia de Portugal. Lisboa: Imprensa Universitária, Editorial Estampa.

Pereira, P., Pereira, D. I., Caetano-Alves, M. I. & Meireles, C. 2003. Geomorfologia do Parque Natural de Montesinho: controlo estrutural e superfícies de aplanamento. In Ciências da Terra (UNL) Special issue V: C61–C64.

Ramos, J., M. Bugalho, Cortez, P. & Iason, G. R. 2006. Selection of trees for rubbing by red and roe deer in forest plantations. In Forest Ecology and Management 222 (1–3): 39–45.

Ribeiro, A. C. 1996. Análise da ocorrência de geadas e estimativa da temperatura mínima na relva em condições de geada de radiação: estudo na bacia superior do rio Sabor. Vila Real: UTAD.

Ribeiro, O., Lautensach, H. & Daveau, S. 1987. Geografia de Portugal: I – A Posição geográfica e o Território. Lisboa: Edições João Sá da Costa.

Taborda, V. 1987. Alto Trás-os-Montes: Estudo Geográfico. Lisboa: Livros Horizonte (reed. Universidade de Coimbra, 1932).

Teixeira, A. & Cortes, R. M. V. 2006. Diet of stocked and wild trout, Salmo trutta: Is there competition for resources?. In Folia Zool 55 (1): 61–73.

Teixeira, A. & Cortes, R. M. V. 2007. PIT telemetry as a method to study the habitat requirements of fish populations: application to native and stocked trout movements. In Hydrobiologia 582 (1): 171–185.