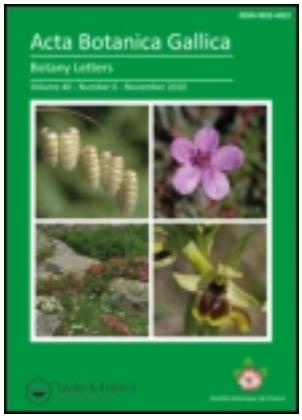

Acta Botanica Gallica
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tabg20

The management and preservation of communitarian interest habitats in the Natural Park of Serra da Estrela (Portugal)

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Published online: 26 Apr 2013.

To cite this article: Catarina Meireles , Rafael Neiva , Isabel Passos , Carlos Vila-Viosa , Rodrigo Paiva-Ferreira & Carlos Pinto-Gomes (2009) The management and preservation of communitarian interest habitats in the Natural Park of Serra da Estrela (Portugal), Acta Botanica Gallica, 156:1, 79-88, DOI: 10.1080/12538078.2009.10516143

To link to this article: http://dx.doi.org/10.1080/12538078.2009.10516143

Acta Bot. Gallica, ***156*** *(1), 79-88, 2009.*

The management and preservation of communitarian interest habitats in the Natural Park of Serra da Estrela (Portugal)

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Abstract.- In this paper we present the management and preservation strategy of communitarian interest habitats which can be found in the Natural Park of Serra da Estrela (PNSE), Portugal. After presenting a general characterization of PNSE, where the main biophysical aspects of the territory are signalled, the description of the main work carried out in this Protected Area, in terms of characterization, improvement, diffusion and management of habitats of communitarian interest to be found here, will follow.

Key words : Serra da Estrela - habitats - Natura 2000 - management and preservation.

Résumé.- On présente ici la stratégie de gestion et de conservation des habitats d'intérêt communautaire du Parc national de la Sierra de Estrela (PNSE), Portugal. Après une présentation générale biophysique de ce parc, vient la description des principaux travaux menés sur cette aire protégée en termes de caractérisation, amélioration, diffusion et gestion de ces habitats.

Mots clés : Serra da Estrela - habitats - Natura 2000 - gestion et conservation.

I. INTRODUCTION

Bearing in mind the goal of favouring the maintenance of biodiversity of its member states, in a sustainable development perspective, the European Union, started, in the late eighties, a process that would culminate in the creation of an european ecological net, commonly known as Natura 2000.

The selection of places to integrate the net of natural spaces, was made through two communitarian directives, known as Birds Directive and Habitats Directive, whose transposition into Portuguese legislation was made on 24th April 1999, through a single document, the law by decree (Decreto-Lei) nº 140/99, which in its turn was amended on 24th February 2005, by the law by decree (Decreto-Lei) nº 49/2005.

Acknowledging the importance of natural and semi-natural habitats to the preservation of european biodiversity, these have taken on an essential role in the process of selection of the places to integrate the future Natura 2000. Therefore, one of the selection criterion for these areas was the existence, at the site, of habitats which are contained in the Annex II of the Directive Habitats.

Due to its richness and biological diversity, made up of endemic species and very rare habitats nation wide, a large part of the massif of Serra da Estrela was included in the National Sites List and put forward for consideration to integrate the future Natura 2000 (Site PTCON0016).

Despite the fact that many botanists went through Serra da Estrela and there is work done on habitats, previously carried out in the scope of the Natura 2000 (Jansen, 1997), there was, until 2006, no habitat mapping of habitats that could allow, among other things, the integrated preservation and management of this biological heritage which exists in the ranked area. In this sense, one the most recent strategies of the PNSE, consisted in identifying and establishing boundaries for communitarian interest habitats present in its scope, done in cooperation with the Instituto Superior Agrário de Bragança (Agrarian Superior Institute of Bragança). Next, establishing a partnership with the Universidade de Évora (Évora University), a work of improvement, diffusion and proposals of management measures for the plant community heritage found here was carried out.

II. CHARACTERISATION OF THE NATURAL PARK OF SERRA DA ESTRELA

Located in Centre-East of Portugal, in the extension of the Central System through Portuguese territory, Serra da Estrela is a mountainous massif of national reference, for it includes the highest point of continental Portugal. Thus, many studies have been carried out in this territory (*e.g.* Henriques, 1883; Sampaio, 1910; Braun-Blanquet *et al*., 1952, 1956, 1964; Malato-Beliz, 1955; Duvigneaud, 1962; Rivas-Martínez, 1974; Pinto da Silva *et al*., 1976; Pinto da Silva & Teles, 1986; Jansen, 2002), having had their national importance been recognised in 1976 through the creation of the Natural Park of Serra da Estrela (PNSE), by the law by decree (Decreto-Lei) nº 557/76, dated of July 16th. At this time, the protection and the preservation of this mountainous system were defined as prime objectives, not only as far as natural values are concerned, but also for the maintenance and diffusion of traditional practices and local culture.

The PNSE is a vast protected area that extends for about one hundred thousand hectares, in the districts of Castelo Branco and Guarda. From the biogeographical point of view it is included, mainly, in the territories of the Estrelense sector, of the Carpetan–Leonese (Rivas-Martínez, 1987; Costa *et al*., 1998; Rivas-Martínez *et al*., 2002). Besides the most diffused natural values, as the snow and the very beautiful landscapes, Serra da Estrela also includes an enormous biological heritage.

The current diversity of fauna and flora found here is also due to several factors such as the geographical position, the topographical complexity, the geological history of the territory, the climatic peculiarities and the secular action of man. Among these, the great variety of physical environments, mostly when it comes to climate, takes on a particularly important role. Even though a great part of the area is under a climate of Mediterranean type, in the areas of greatest altitude and in the slopes more to the west, we can already see the transition to a climate of moderate influence. Besides this variation in latitude, there are also altitude related variations of the climate, by which it is possible to observe three

distinct bioclimatic levels. In the less high areas (until 850 metres) there is a basal level, hotter and drier, with bioclimatics belts of mesomediterranean or mesotemperate type. In this level the climatical vegetation corresponds to mixed woods of evergreen and decidouous *Quercus*, dominated by *Quercus suber* (in the area of Mediterranean influence), or decidouous woods of *Quercus robur* (in the area of atlantic influence). Above this level, between the (850) 900 metres the climate becomes the Supramediterranean or Supratemperate and the climatical vegetation corresponds to woods dominated by *Quercus pyrenaica*. Finnally, in the upper level, located above 1600 (1800 metres) and climatologically more severe (Oromediterranean or Submediterreanean orotemperate), we find the climatical domination of the juniper of *Juniperus communis* subsp. *nana*.

In geological terms, Serra da Estrela is a massif of recent formation, mostly granitic, holding evidence of the last great glaciations.

III. THE HABITATS OF COMMUNITARIAN INTEREST TO BE FOUND AT NATURAL PARK OF SERRA DA ESTRELA

Currently, there are 32 habitats of communitarian interest referenced for the PNSE, five of which are a priority as to preservation (Table I). Of these, mainly the ones found in the upper plateau, some of them of rarity or even exclusive to Portugal, stand out.

IV. CHARACTERISATION, IMPROVEMENT, DIFFUSION AND MANAGEMENT OF HABITATS IN NATURAL PARK OF SERRA DA ESTRELA

Having as the final goal the preservation and improvement of the habitats of communitarian interest in Serra da Estrela, in the last years, several studies, which allowed to know, map, improve and begin a work of management of this biological heritage, were carried out.

This process can be divided into four different phases. In a first phase the habitats found in the territory were identified and mapped. This process was carried out through cooperation between the PNSE and the Agrarian Superior Institute of Bragança, which lead to the attainment, in the end, of a mapping of the natural and semi-natural habitats, of communitarian interest found in the PNSE (Esteves *et al*., 2006). Besides this, a work of mapping the habitats of one of the most emblematic areas in the Park, the Glacier Valley of the Zêzere River, had previously been done. This work, carried out by Passos (2005), of the University of Évora, gave the knowledge, in detail, of the habitats found in this area.

Based in these mappings, as well as in the mapping of soil use, also made at the same time in a cooperation between the Agrarian Superior Institute of Bragança and the PNSE, the next step was taken: the territorial improvement of the PNSE, from the point of view of the plant community (Meireles *et al.*, 2006a). Such work had as prime objective the finding of territories and vegetable formations prioritary to preservation, in a perspective of territory management. The used methodology was that put forward by Maeza & Cadiñanos (2000). It gave the possibility of getting to a numeric value capable of translating the interest of preserving some of the main vegetable communities found in PNSE. The results show the « exceptional » value of some of the woods of the region, with a very rare and separate distribution presently. In this position we find the climatical oak-groves of *Quercus pyrenaica* (habitat 9230), the woods of *Prunus lusitanica* (habitat 5230*) and the

Table I.- List of habitats of communitarian interest to be found in the Natural Park of Serra da Estrela.
Tableau I.- Liste des habitats d'intérêt communautaire du Parc national de la Sierra de Estrela.

Code	Name	Code	Name
3130	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or Isoeto-*Nanojuncetea*	6410	Molinia meadows on calcareous, peaty or clayey -siltladensoils (*Molinion caeruleae*)
3150	Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation	6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	6510	Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)
3270	Rivers with muddy banks with *Chenopodion rubri p.p.*and *Bidention p.p.* vegetation	7140	Transition mires and quaking bogs
3280	Constantly flowing Mediterranean rivers with *Paspalo-Agrostidion* species and hanging curtains of *Salix* and *Populus alba*	8130	Western Mediterranean and thermophilous scree
4010*	Northern Atlantic wet heaths with *Erica tetralix*	8220	Siliceous rocky slopes with chasmophytic vegetation
4020*	Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*	8230	Siliceous rock with pioneer vegetation of the *Sedo-Scleranthion* or of the *Sedo albi-Veronicion dillenii*
4030	European dry heaths	8310	Caves not open to the public
4060	Alpine and boreal heaths	91E0*	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Pandion, Alnion incanae, Salicion albae*)
4090	Endemic oro-Mediterranean heaths with gorse	9230	Galicio-Portuguese oak woods with *Quercus robur* and *Quercus pyrenaica*
5120	Mountain *Cytisus purgans* formations	9260	*Castanea sativa* woods
5230*	Arborescent matorral with *Laurus nobilis*	92A0	*Salix alba* and *Populus alba* galleries
5330	Thermo-Mediterranean and pre-desert scrub	9330	*Quercus suber* forests
6160	Oro-Iberian *Festuca indigesta* grasslands	9340	*Quercus ilex* and *Quercus rotundifolia* forests
6220*	Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*	9580	Mediterranean *Taxus baccata* woods
6230*	Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)		

extremely rare groves of *Taxus baccata* (habitat 9580*). This improvement called attention to other tree vegetable communities such as the groves of holm-oaks, alder-groves and willows groves (habitats 9340, 91E0* and 92A0), certain communities typical to the upper plateau (habitats 3130, 4060 and 7140) and some communities associated to traditional practises, specifically the swamps and the *Nardus* grasslands (habitats 6230* and 6510).

The following step was the diffusion of this biological heritage. Therefore the edition of the *Guide to the Habitats of the Natural Park of Serra da Estrela* was made (Meireles *et al*., 2006b), made in cooperation with the University of Évora. Besides that, a video for diffusion on the main habitats found in this protected area was also edited (Meireles & Neiva, 2006). These two works were destined to the general public, and intended to be an important tool to give basic knowledge of the habitats of communitarian interest found in the PNSE. These publications were possible thanks to a Life-Nature Project, which occurred between 2202 and 2006, which was called *Serra da Estrela: Gestão e Conservação de Habitats Prioritários* (management and preservation of prioritary Habitats). This project, which had as main goal to contribute to the recovery of prioritary habitats found in Serra da Estrela, had as partners the PNSE and the University of Évora, among others (Meireles *et al*., 2004; Pinto-Gomes *et al.*, 2005, 2006).

Finally, through all these works and from the personal knowledge of the authors it was possible to define a set of specific management measures for the main habitats of this area, with the goal to preserve, recover and enhance the areas of occurrence, as well as its state of preservation.

V. PROPOSALS OF MANAGEMENT FOR HABITATS OF THE NATURAL PARK OF SERRA DA ESTRELA

Based in the works previously referred, it was possible to define measures of management for the main communitarian interest habitats found in the PNSE. In this process all the experience and results attained through the above-mentioned project Life-Nature was also fundamental. Thus, so as to propose future management measures, some geographical and inherent parameters of each one of the habitats were previously defined (distribution in Portugal, PNSE distribution, area of occurrence in the PNSE, preservation state in the PNSE and improvement). The *distribution in Portugal* was done based in the habitats files developed by the Phytosociology Lusitanian Association, in the scope of the Natura 2000 Sectorial Plan (ALFA, 2004). The *PNSE distribution* and the *area of occurrence* were made based in the above-mentioned habitat mapping, whereas the *preservation state* was made from the personal knowledge of the authors. The *area of occurrence* concerns the area where one can find the habitat and does not necessarily correspond to its area of effective occupation. Finally, the value which refers to *improvement* corresponds to the result attained in the phase of the improvement of the plant community heritage and which was defined in four categories (Exceptional, High, Average and Low) according to the preservation interest. Every time the improvement wasn't made for the habitat in question, the situation was referred to as « unknown ». The results are schematised in table II and were made for all the referenced habitats.

Next, there was the selection of the main habitats to be the target for a more profound analysis in terms of management. The selection was based in the general observation of the parameters found in table II, with particular attention to the national and local distribution, as well as the result of the improvement. Thus, 14 habitats were selected: 3130, 4010, 4060, 5230*, 6160, 6230*, 6510, 7140, 91E0*, 92A0, 9230, 9330, 9340 and 9580*.

For each of these habitats some parameters of ecological tendency and of management in reference to the PNSE (general tendency in the PNSE, main threats in the PNSE, future perspectives and management goals) were then defined. These parameters are in table III and were filled out according to the personal knowledge of the authors, having also been taken into consideration the information of the above-mentioned habitat files. The *general tendency* is in reference to the last years and the *future perspectives* are in reference to a set with no management.

Finally, the main guidance lines put forward for each of the habitats were defined, defining some sites of priority action, as well as some needed studies for their knowledge and monitoring (Table IV).

VI. CONCLUSION

The Mediterranean basin is undoubtedly an exceptional place in terms of biological variety. Just as to better explain we will stand out the fact that 24 000 species of flora, in an area

Table II.- Geographical parameters, preservation state and improvement of the main habitats found in the PNSE.
Tableau II.- Paramètres géographiques, état de conservation et amélioration des principaux habitats du PNSE.

Habitat	Distribution in Portugal	Distribution in the PNSE	Area of occurrence in the PNSE	State of preservation in the PNSE	Improvement
3130	Occasional and scarce in abundance (in several regions but some communities only exist in the upper part of the Serra da Estrela)	Occasional. Very well represented mainly in the Upper Plateau	< 100 ha	In good state in the upper plateau. Occasionally affected by local tourism.	High
3150	Frequent	Frequent	238 km	In good state	Low
3260	Frequent	Frequent	258 km	Generally in good state	High
3270	Frequent	Unusual	16,5 km	In good state	Unknown
3280	Frequent	Unusual	16 Km	In good state	Unknown
3290	Frequent	Unusual	unknown	In good state	Unknown
4010	Rare (only in the tallest and rainiest mountains)	Very rare	< 10 ha	In terrible state. Present in small areas generally very altered	High
4020	Unusual (mostly in the Centre and North)	Very rare	unknown	In bad state. Present in small areas generally very altered	High
4030	Very frequent	Very frequent	27 876 ha	In good state	Low
4060	Very rare (only in the upper part of the Serra da Estrela)	Rare (although locally very frequent over 1600 m)	1 362 ha	Generally in good state	High
4090	Unusual (occasional in the North and Centre)	Unusual	3 829 ha	Generally in good state	Average
5120	Very rare (only in the upper part of the Serra da Estrela and Serra de Açor)		4 600 ha	Generally in good state	Average
5230*	Very unusual	Very Rare	33 km	Generally in terrible state of preservation with very isolated and fragmented populations.	Exceptional
5330	Frequent	Unusual	136 ha	Generally in bad state of preservation.	Unknown
6160	Rare (only in some mountainous andcolder territories)	Unusual (although locally very frequent in the upper part of the Serra)	7842 ha	In some spots in good state of preservation. In the areas of better access and most commonly used for touristic or recreational purposes in bad state.	Average
6220	Frequent (although some communities are unusual)	Very frequent (although some communities are rarer)	34 312 ha	In some spots in bad state	Average
6230*	Unusual (only in some mountains of colder climate)	Unusual (although locally frequent over 1000 metres)	6 6915 ha	Generally in reasonable state of preservation, although locally fairly affected by natural and man action causes.	High
6410	Frequent (all over the rainier Centre nd North)	Frequent	unknown	In good state	Unknown
6430	Frequent	Frequent	unknown	In good state	Unknown
6510	Frequent in the Centre and North	Frequent	2 533 ha	In some spots in good tate of preservation although in general it doesn't have the desired conditions.	High
7140	Very rare (occasional only in some mountains of the Centre and North)	Rare (although locally frequent, mainly in the Upper Plateau)	1,5 ha	Generally in a reasonable state of preservation but affected in some spots by the touristic usage of the area.	High
8130	Rare	Unusual	1 592 ha	In good state	Average

8220	Frequent	Frequent	unknown	In good state	Average
8230	Frequent (although some formations only exist in the upper part of the Serra da Estrela)	Unusual	11 374 ha	In good state	High
8310	Unusual	Unusual	unknown	Unknown	Unknown
91E0*	Frequent but not very abundant	Unusual	33 km	In some spots in bad state of preservation.	Exceptional
92A0	Frequent but not very abundant	Frequent	82 km	Generally in bad state of preservation.	High
9230	Frequent (Centre and North)	Unusual	240 ha	Terrible state of preservation	Exceptional
9260	Frequent (Centre and North)	Frequent	3 138 ha	In good state	High
9330	Frequent although occasionally	Very rare	> 10 ha	In terrible state	High
9340	Frequent	Unusual	417 ha	Generally in good state	High
9580*	Very rare	Very rare	> 10 ha	In terrible state	Exceptional

of about 2,3 millions of square kilometres are referenced for this basin, that it 10% of known plants, in a small part of the world (Thompson, 2005). For the maintenance and improvement of this biodiversity it is essential to develop management measures and the preservation of its habitats, for which the Habitats Directive and its implement has greatly contributed.

This is why the PNSE strategy follows the Directive directives, developing studies in the location and mapping of the communitarian interest habitats found in the Park, as well as management actions and the recovery of the main habitats found in this Protected Area, having in mind the goal of preserving and improving biodiversity, duly associated with the economical and ecological sustenance.

Ackowledgements - We thank teacher Sandra Raposo for the translation.

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Table III.- Ecological tendency and management parameters, for the PNSE, of the main habitats found in this protected area.
Tableau III.- Tendance écologique et paramètres de gestion des principaux habitats de l'aire protégée du PNSE.

Habitat	General tendency	Main threats	Perspectives for the future	Management goal(s)
3130	Decrease	- Water dystrofication - Direct destruction - Disorderly tourism - Drainage - Global warming	Decrease of the area of occurrence	- Maintenance of the area of occurrence - Encouragement of the *Sparganium angustifolium* communities
4010	Decrease	- Fires - Direct destruction for the alteration of soil usage - Alteration of the hydric regimen	Decrease of the area of occurrence and maintenance of the preservation degree	- Encouragement of the area of occurrence - Improvement of the preservation state
4060	Decrease	- Direct destruction mostly by the creation of touristic support substructures (mostly associated to sky)	Maintenance/decrease of the area of occupation and occasional deterioration of the state of preservation	- Maintenance of the current area of occurrence and of the state of preservation
5230	Decrease	- Fires - Low cut - Invasion by exotic species	Decrease	- Increase of the current area of occurrence for twice the present
6160	Decrease	- Physical destruction for the construction of substructures - Decrease of grazing pressure	Decrease	- Preservation of the current area of occurrence - Improvement of the state of preservation
6230	Decrease	- Desertion of agro-sylvo-pastoral activities - Successional progression - Soil mobilization (in areas of less altitude)	Decrease	- Increase of the area occupied by the habitat – improvement of the preservation state
6510	Decrease	- Desertion of traditional agro-sylvo-pastoral activities and practices - Alteration in the usage of the soil	Decrease	- Maintenance of the area occupied by the habitat - Improvement of the general state of preservation
7140	Decrease	- Physical destruction - Water dystrofication	Maintenance	- Maintenance of the area occupied by the habitat - Improvement of the general state of preservation
91E0	Decrease	- Low cut - Alteration of the hydric regimen	Maintenance	- Encouragement of the area of occurrence - Improvement of the general state of preservation
92A0	Decrease	- Low cut - Fires	Maintenance	- Encouragement of the area of occurrence - Improvement of the general state of preservation
9230	Decrease	- Fires	Decrease	- Encouragement of the area of occurrence - Improvement of the general state of preservation - Fire protection
9330	Maintenance	- Low cut - Fires	Maintenance /Increase	- Encouragement of the area of occurrence

				- Improvement of the general state of preservation - Fire protection
9340	Decrease	- Low cut - Fires	Maintenance	- Encouragement of the area of occurrence - Improvement of the general state of preservation - Fire protection
9580	Decrease	- Fires	Decrease	- Encouragement of the area of occurrence - Improvement of the general state of preservation - Fire protection

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Table IV.- Management measures for the main habitats found in the PNSE.
Tableau IV.- Mesures de gestion sur les principaux habitats du PNSE.

Habitat	Proposed management measures	Places of intervention	Parameters to monitor / study
3130	- Interdiction to swimming in the ponds of the upper plateau - Spreading of the *Sparganium angustifolium* to ponds from where it has disappeared.	Upper Plateau	- Water quality - Communities of *Sparganium angustifolium* - Population of *Menyanthes trifoliata*
4010	- Insuring the maintenance of the soil usage - Implementing the selective cut of vegetation to stop the natural evolution into upper steps - Rectify the water drainage when necessary - Protecting the areas against fires (mainly at higher altitude)	Upper Plateau and "Unhais" Valley	- Thorough inventory of the cores and of their state of preservation
4060	- Insuring the non-expansion of substructures for its area of occurrence - Stopping the traffic in its areas of occurrence	Upper Plateau	- Extending the area occupied by the habitat - State of preservation - Population of *Lycopodium clavatum*
5230	- Protection of the areas against fires - Recovery of the areas affected by fires - Extermination of the exotic species of its areas of occurrence (mostly of *Pinus pinaster, Eucalyptus* sp.)	"Casal do Rei"and "Cabeça"	- Thorough inventory of the cores and of their state of preservation - Recovery of the post-fire areas
6160	- Insuring physical maintenance - Encouraging pastoral activity	Upper Plateau	- Capability of recovery of the areas after physical destruction
6230	- Selective cut - Installing small walls - Encouraging pastoral activity - Controlling the alteration in soil usage ("Videmonte").	Upper Plateau and "Videmonte" Plateau	- Area of occupation (with detailed mapping)
6510	- Encouraging traditional agro-sylvo-pastoral practices	Mainly Glacier of the Valley of the "Zêzere" River, "Mondego" and "Videmonte" Plateau	- Occupation area
7140	- Restoring favourable ecological conditions - Avoiding water drainage - Avoiding the use of fire in these areas	Upper Plateau	- Water quality
91E0	- Avoiding the low cut - Encouraging planting	Along "Zêzere" Valley	- Occupation area
92A0	- Avoiding low cut - Planting endemic willows in places where they disappear from	All over the Park	- Occupation area
9230	- Avoiding low cut - Fighting fires	In the few existent spots in the "PNSE"	- Occupation area
9330	- Avoiding low cut - Fighting fires	In the few existent spots in the "PNSE"	- Occupation area
9340	- Avoiding low cut - Fighting fires	In the few existent spots in the "PNSE"	- Occupation area
9580	- Avoiding low cut - Fighting fires	"Zêzere" Valley "Caniça" Stream "Beijames" Stream	- Occupation area - Recovery after fire - Growth rate - Genetic diversity of *Taxus baccata*