

## SAPROXYLIC BEETLES IN THE GRÉSIGNE FOREST MANAGEMENT

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RÉSUMÉ. — *Les coléoptères saproxyliques dans la gestion de la forêt de Grésigne.* — La forêt domaniale de Grésigne (Tarn, France) a été incluse dans le réseau européen Natura 2000 pour son exceptionnelle richesse entomologique, en particulier de coléoptères saproxyliques. Parmi les espèces rencontrées, les trois listées dans la Directive Habitat, *Limoniscus violaceus*, *Cerambyx cerdo* et *Lucanus cervus*, sont caractéristiques de divers habitats (cavités au bas des arbres, arbres mourants et bois en décomposition) dont la conservation implique des contraintes de gestion spécifiques. Premièrement un plan de gestion (Docob) a été dressé en application de la Directive Habitat. Puis, un nouveau plan de gestion forestière (2004-2021) a été établi, incluant des mesures pour préserver ces espèces à forte valeur patrimoniale: mise en place d'un réseau de vieilles formations, accroissant le compartiment du volume de bois de mort, préservant les arbres ayant des cavités. Une partie de ces mesures sont financées par un contrat Natura 2000 sur la base d'un partenariat État français – Communauté européenne.

*Mots-Clés:* Directive Habitat, *Limoniscus violaceus*, conservation, sylviculture, bois mort.

SUMMARY. — The Grésigne State Forest (Tarn, France) has been included in the European network Natura 2000 for its exceptional entomological richness, especially with saproxylic beetles. Among the many species encountered, the three species listed in the Habitat Directive, *Limoniscus violaceus*, *Cerambyx cerdo* and *Lucanus cervus*, are characteristic of different habitats (cavities at the bottom of the trees, dying trees and decaying wood) whose conservation implies specific management constraints. First, a management plan (Docob) was drawn up in appliance of the Habitat Directive. Then, a new forest management plan (2004-2021) was established, including measures to preserve these high heritage value species: setting up a network of old stands, increasing the dead wood volume compartment, preserving trees with cavities. Part of these measures are financed by a Natura 2000 contract, on a French state-European Community joint basis.

*Keywords:* Habitat Directive, *Limoniscus violaceus*, conservation, silviculture, dead wood

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The purpose of this presentation is to show how the conservation of the saproxylic beetles and their habitats has been taken into account in the Grésigne Forest management. In the present volume, we have presentations about terminology, biology, distribution and even arts, so now we are going to focus on forest management.

It is the result of more than 10 years' works and partnership that have associated entomologist Hervé Brustel (lecturer and researcher at the Agriculture School of Purpan), and the manager of the forest, the Office National des Forêts (French National Forestry Board), where Jean-Jacques Ducasse, forest engineer, was in charge of the revision of the management plan of the forest.

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## AN EXCEPTIONAL FOREST

The Grésigne Forest, a State forest located in the south of France (in the department of Tarn), is a lowland forest, covering 3 500 ha. It is an exceptional forest:

— first, for its natural features: it lies on sandstones contrasting with the limestones all around. It is situated at a climatic and biogeographical crossroads of different influences (atlantic being the most important, mediterranean and continental) as shown in Figure 1. It is mainly composed of sessile oak (*Quercus petraea*), which is here at its south border line.

— second, for its faunistic richness, especially with beetles (developed below), but also with bats (20 species encountered), some rare forest birds, and an isolated and endemic population of White-legged crayfish.

— and third for its long history being an old forest sold to the king of France at the 13<sup>th</sup> century, then becoming a State forest at the French Revolution. So, during the centuries, the forest has always been exploited: it has known first a “picking” policy exploitation for house use (especially fuelwood) and glass industry, then a management to produce Navy wood, and today a multipurpose management, reconciling wood production and biodiversity conservation.

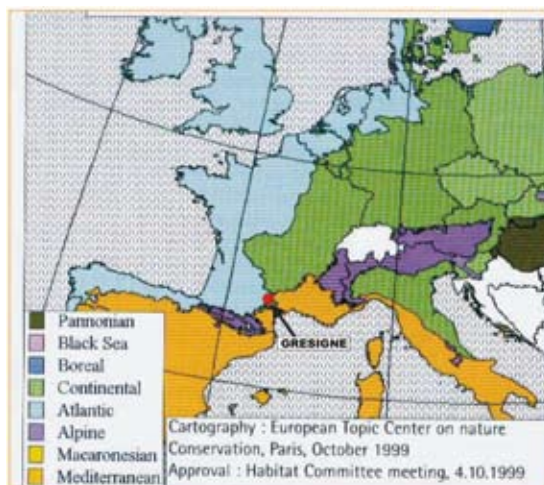


Figure 1. — European biogeographical regions and the Grésigne forest location (*in Rameau et al., 2000*).

## AN ENTOMOLOGICAL RICHNESS TO BE PRESERVED

### A LONG-TERM INVENTORY

The entomological richness of the forest was revealed by an amateur entomologist, named Jean Rabil, who published in 1992, a first list of 2375 beetle species, the outcome of 30 years of passionate and solitary inventory (Rabil, 1992).

This work was the starting point for further studies and a growing concern for both entomologists and the manager of the forest (the ONF), to preserve this exceptional heritage. In this context, Hervé Brustel has been asked since 1994, to carry out different researches that allowed him to select 35 species as entomological bio-indicators, and also to propose management rules to the ONF.

Today, the inventory figure is about 2500 species (Brustel & Clary, 2000; Brustel, 2001), placing the Grésigne Forest at the 3<sup>rd</sup> rank in Europe for the total number of beetle species, behind Fontainebleau Forest (3545 species: Cantonnet *et al.*, 1997), and Bialowieza (2884 species: Gutowski & Jaroszewicz, 2001).

### THREE SPECIES FROM THE HABITAT DIRECTIVE

Among the many saproxylic beetle species encountered in the Grésigne Forest, three are of special significance not only because they are listed in the 2<sup>nd</sup> annex of the Habitat Directive, but also because they are representative of three main types of habitats:

— The first one, *Limoniscus violaceus*, is an umbrella species characteristic of old forests, living in cavities at the bottom of the trees generated by fungi. In the case of the Grésigne Forest, there are no big trees, neither very old ones: the average age of the trees in the old stands is about 150 years, and the average diameter is about 50 cm, but we consider that it is the conversion of the old coppices into high forests that has generated the cavities favourable to the saproxylic beetles. This habitat is also home for other remarkable species such as *Podeonus acuticornis*, *Ischnodes sanguinicollis*, *Mycetophagus populi*, *Mycetophagus decempunctatus*, *Procræus tibialis*, etc.

— The second one, *Cerambyx cerdo* is a flag-ship pioneer beetle for dying trees and standing dead wood, snags, etc., habitats where it is followed by other rare species such as *Eurythya quercus*, *Ampedus cardinalis*, *Dermestoides sanguinicollis*, *Brachygonus ruficeps* and *Isorrhypis mamottani*, etc.

— And the third one, *Lucanus cervus* is a flag-ship beetle for decaying stumps and lying dead wood, habitats exploited by numerous other species such as *Lacon quercus*, *Aesalus scarabaeoides*, *Prostomis mandibularis*, *Akimerus schaefferi*, *Oxylaemus variolosus*, etc.

### PARTICULAR MANAGEMENT CONSTRAINTS

The preservation of those high biological value saproxylic beetles implies particular management constraints.

Actually, the aim of the silvicultural system is to produce and harvest wood when the trees reach their economic optimum (for the oak in Grésigne, it is towards 180 years). So the oak goes from seedlings, then saplings, pole wood, to high forest when it is harvested. Therefore, a great part of the saproxylic processes occurring during the dying and decaying phase of the natural cycle of the trees (phase represented in brown in Fig. 2) is eliminated. So the first constraint is to maintain the ageing phase, allowing trees to grow old beyond the harvest stage, on a significant surface.

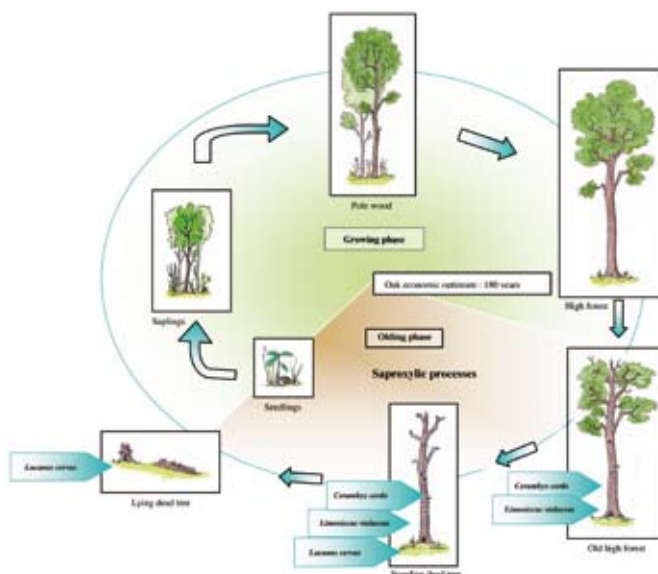


Figure 2. — Silvicultural system and natural cycle in an oak stand.

The second constraint is to preserve trees with cavities at the bottom of the trunk (habitat of *Limoniscus violaceus*) when they do exist in the stands, or to help them appear in the younger stands through management rules.

The third constraint is to preserve a significant dead wood volume (standing and lying dead wood) to allow the whole saproxylic phase to take place.

## MANAGEMENT OBJECTIVES

### TWO COMPLEMENTARY APPROACHES

How have these constraints been translated into forest management rules? The process has implied two complementary approaches:

— first, the European Habitat Directive (CEE n° 92/43 of May 21st 1992), whose goal is to contribute to biodiversity conservation (meant as natural habitats and habitats of species) through a European network (called Natura 2000) of Community interest sites. In France, an objectives document (or Docob) has then to be produced for each site, and approved by the State authority.

— second, the French Forestry Code, whose purpose is to implement a multipurpose management of the forests (therefore including in the same forest wood production, biodiversity and landscape conservation, and the welcoming of visitors), as part of a general goal of a land sustainable development. A forest management plan has then to be produced and, in the case of the public forests, to be approved by the Ministry in charge of the forests.

### THE MAIN ORIENTATIONS OF THE DOCOB

So, for the Grésigne Forest, a Docob was approved in June 2004, whose main orientations are:

— to preserve the saproxylic beetles habitats, through a network of old stands, the conservation of trees with cavities, and the increase of the dead wood volume up to 15 m<sup>3</sup>/ha;

— to preserve the natural habitats of remarkable interest (beech-oak forests, flood plain forests);

— to re-establish a cervidae-forest balance, the deers being responsible of great damages to the natural oak regenerations.

### THE FOREST MANAGEMENT PLAN (2004-2021)

Complying with the orientations of the Docob, a management plan was then established for a period 2004-2021. This plan distinguishes 3 main areas, called “series”:

— a first series or “Production series”, covering 2831 ha. The objective is to produce quality oak wood implying a half-intensive silviculture through a 190-year even-aged stand, but measures are included to preserve the saproxylic beetles habitats.

— a second series or “Conservation and production series”, covering 223 ha. The objective is to preserve ecologically fragile stands, implying an extensive silviculture through a 250-year uneven-aged stand.

— a third series or “Particular ecological interest series”, covering 476 ha. The main objective is to preserve the habitat of *Limoniscus violaceus* and the other remarkable natural habitats, implying to set up a 350-year uneven-aged stand. Harvests may occur to carry out the structure and the tree composition objectives.

## IMPLEMENTING ACTIONS

### A NETWORK OF OLD STANDS

The first action implemented, is to set up a network of old stands, that is composed of (Fig. 3):

- in the 1<sup>st</sup> series, plots of overaging trees that are delimited in the stands older than 100 years, during the thinning operations. Covering 5% of the management units, they will be maintained beyond the economic harvest age.

- the entire 2<sup>nd</sup> series, formed by pubescent oak stands, located on dry areas,

- the entire 3<sup>rd</sup> series composed of flood plain forests and old coppices under standards representative of all the ecological variability of the forest.

Figure 3 shows the different areas mentioned above:

- the 1<sup>st</sup> series is drawn in green: dark green for the stands where natural regeneration is in progress, purple spots represent the overaging tree plots already set up. Apple green, represents the more than 100 years old stands, and light green, represents the youngest stands.

- the 2<sup>nd</sup> series, is drawn in yellow.

- the 3<sup>rd</sup> series, is drawn in orange (regular management units). In pink is represented the Directed Biological Reserve of Montoulieu aimed at experimenting forest management rules to preserve biodiversity, and in red is represented the Integral Biological Reserve of St Clément aimed at constituting a reference plot as well as an observatory for the natural dynamics of the forest stands and of the saproxylic processes.

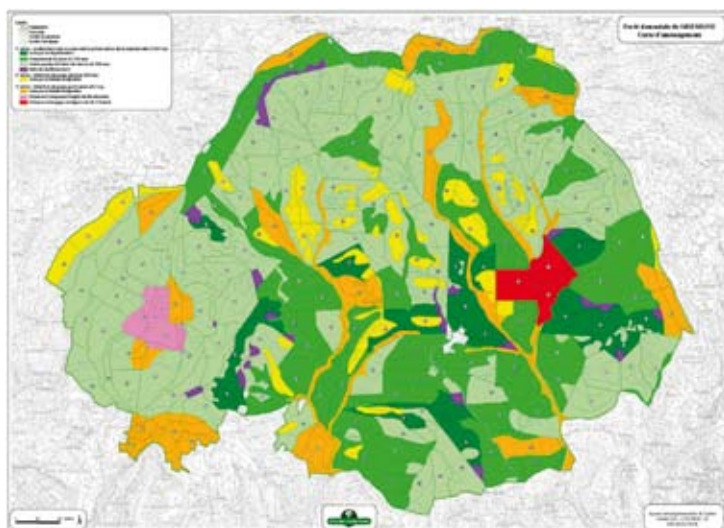


Figure 3. — Grésigne forest management objectives map.

### MAINTAINING DEAD WOOD AND TREES WITH CAVITIES IN THE PRODUCTION SERIES

The second main action implemented is to maintain dead trees and trees with cavities in the 1<sup>st</sup> series (Production series). Three measures are involved:

- in the stands older than 100 years, trees are selected and marked in the field during the thinning operations, to constitute later on, a compartment of at least 15 m<sup>3</sup>/ha of dead wood (standing and lying dead wood). Depending on the stands, already dying trees, trees with cavities, windthrows, are of course chosen in priority.

- 20% of the tree crowns are left on the ground after logging, constituting small sized dead wood.

— in the youngest stands, about 10 stems per hectare will be coppiced to generate later trees with cavities at the bottom of the trunk, or already injured trees will be maintained.

#### FINANCING SPECIFIC ACTIONS

Only the specific actions, financed by a Natura 2000 contract on a French State-Europe joint basis, are concerned:

— the dead wood compartment: 10 m<sup>3</sup>/ha stocked for 30 years, are financed by Natura 2000, while 5 m<sup>3</sup>/ha are financed by ONF in compliance with its biodiversity policy;

— the follow-up of the beetles: every 6 years a control survey of the beetles is carried out including baited traps and cavities monitoring;

— the communication and training: (i) a permanent exhibition will be set up for the public and pupils, (ii) a leaflet is going to be published for the professionals (forest managers and woodcutters), (iii) a report of the actions will be published every 6 years.

#### SYNTHESIS

So, through the exemple of the Grésigne Forest, we can define some basic principles required to preserve the saproxylic beetles habitats in a productive forest. These principles imply a dialogue:

— at the scientific and technical level, in order to establish a long-lasting partnership between entomologists and forest managers, compulsory to improve knowledge, to share experiences, and to propose consistent management rules;

— at the economic and social level, to reconcile the different functions of the forest, especially wood production and ecological role, compulsory to meet with all the needs, expectations and challenges of the human society;

— last and not least, at the political and financial level, to put in place financial tools to implement the conservation measures, compulsory to offset the losses of income due to unprofitable practices in a productivist (or capitalist) world.

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