

# **RESEARCH IN FOREST RESERVES AND NATURAL FORESTS IN EUROPEAN COUNTRIES**

Country Reports for the COST Action E4: Forest Reserves Research Network

Edited by Jari Parviainen, Declan Little, Marie Doyle,  
Aileen O'Sullivan, Minna Kettunen and Minna Korhonen

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## **1. HISTORICAL PERSPECTIVE OF FORESTS AND FOREST MANAGEMENT IN BELGIUM**

There are no natural forests remaining in Belgium. Species composition and stand structure is very different from the potential natural vegetation, due to human impact over the millennia.

### **1.1. Evolution of forest stands and species composition**

In historical times, forest area gradually diminished. After an initial period of rapid decline during the early Middle-ages, a period of stabilisation and even forest expansion followed – especially in the Flanders – lasting from the 14th century up to the end of the 18th century. After this remarkable period of forest expansion the trend of deforestation recurred, so that the area of forest reached its lowest point around 1850. At that time, forests occupied only 450,000 ha, which is 14% of the total area of the country.

**Management depended on the owner and the area.** Small and middle sized forests were mostly owned by farmers and communities and were generally managed as coppice or coppice with standards (with a limited number of standards). Management was very intensive, as the forest provided all kinds of goods, i.e. firewood, charcoal and construction wood, acorns (for pigs), and even litter and brambles were thoroughly removed for agricultural fertilisation and domestic use. Grazing was also a common practice in forests.

On sandy soils, which were mostly located in commonage, intensive use of forests lead to accelerated degradation and eventually, to virtually complete deforestation. This resulted in the occurrence of vast heathland areas.

The remaining large forest entities were primarily owned by the nobility and by the church. Management in forests owned by the nobility was secondary to the main

objective, which was hunting. They were generally well protected and most were managed as coppice with standards, though occasionally as high forest, favouring important woods for construction purposes, such as oak and beech at the expense of secondary species like lime and ash. The forests owned by the church were generally well-managed, using coppice-with-standards.

During the Austrian occupation (1750-1800 approx.) forest management was strongly influenced by Central European forest systems, i.e. shelterwood and group felling. They also introduced a more respectful attitude towards the forest. It was no longer seen primarily as a resource merely to be exploited and more attention was paid to forest perpetuation and sustainability. This influence made its impact latterly in the management of high forests.

During the 19th century, forest area continued to diminish, especially due to secularisation and exploitation of forests formerly owned by monasteries and the nobility, in addition to an increasing demand during famines for more agricultural land.

At the end of the 19th century, when agriculture became increasingly intensive and the need for self-sufficiency in this area became less important, a period of forest expansion began, which lasted for more than 100 years. There was a strong demand for more wood, especially from industrial sources and the developing coal-mining industry. In 1970, forest area had increased by 150,000 ha. In the Flemish region this reforestation occurred, particularly on the sandy soils of the Campine region. On the other hand, valuable old forests continued to disappear due to urbanisation. In addition, the two world wars had disastrous effects on old forest stands.

During the last 2 to 3 decades a new phase of forest expansion took place in Flanders – estimated at about 15% of the area – some by further extension of new forests on sandy soils, but mainly by afforestation of marginal meadows.

These modern plantations were mostly established in an ‘industrial way’, i.e. even-aged monocultures. On sandy soils Scots pine (and later also Corsican pine) were predominantly planted. In Wallonia, the forest area almost doubled and the predominant tree species here was Norway spruce. The more recent plantations on meadow land consisted of fast growing Poplars.

The above historical account outlines the principal developments in forestry, which explain current species composition and forest-age distribution in Belgium. The following table illustrates tree species composition in Flanders and Wallonia.

The map on the following page make it possible to compare forest area around 1770 (Ferraris-maps) to the situation existing currently (Fig. 1). A substantial increase in the forest-area is evident, however, most of these plantations have been established using monocultures of Norway spruce in Wallonia and Pine in Flanders.

Forest area in Wallonia is much higher than elsewhere; in Flanders it is about 9%, while in Wallonia it is about 30%. The principal reason for this is that urbanisation and industrialisation is much lower in Flanders than in Wallonia. In addition, it is important to recognise that over half of the forests in Belgium are privately owned. In Flanders, this number is even higher, i.e. 70% is private forest.

Another important aspect of Belgian forestry is its fragmented nature; this applies not only to the forest area itself, but also to its ownership status. Private parcels of 1 ha or less are very common.

**Table 1.** Species composition and area of forest in Flanders and Wallonia.

| Species composition       | Flanders (ha) |       | Wallonia (ha) |       |
|---------------------------|---------------|-------|---------------|-------|
| Oak                       | 11 500        | (8%)  | 85 000        | (17%) |
| Beech                     | 5 000         | (4%)  | 37 000        | (8%)  |
| Mixed/other               | 33 000        | (25%) | 118 000       | (24%) |
| Poplar                    | 25 000        | (17%) | -             | -     |
| Total Broadleaves         | 74 500        | (54%) | 240 000       | (49%) |
| Scots Pine                | 40 000        | (30%) | 20 000        | (3%)  |
| Norway spruce             | 3 000         | (3%)  | 200 000       | (41%) |
| Other                     | 19 000        | (13%) | 27 000        | (5%)  |
| (of which Corsican pine:) | 11 000        |       |               |       |
| Total Coniferous          | 62 000        | (46%) | 247 000       | (51%) |
| Total forest area         | 136 500       |       | 487 000       |       |

With respect to species composition, about half of the land area in Belgium is occupied by young to middle-aged coniferous stands. In addition, the area occupied by poplar plantations is very significant in Flanders.

However, there is an appreciable amount of broad-leaved stands, a significant proportion of which are considered ‘old forest stands’. Evidence for their status as old growth stands comes from old topographical maps and by investigation of the herb layer, where of old forest indicator species persist.

The composition and structure of the tree layer considerably altered in general, however, the natural value and potential of these forests is nonetheless, quite high. Central-European forest management systems have been favoured and consequently practised in many of these forests. In Flanders the most important forest vegetation types are the following:

- On sandy soils: Atlantic oak-birch and oak-beech-forest  
Sub-Atlantic oak-birch and oak-beech-forest
- On richer loamy soils: on acid loam: *Milio-Fagetum*  
on rich loam: Atlantic mixed oak-and beech-forest  
(*Endymio-Carpinetum* / *Endymio-Fagetum*)  
Sub-Atlantic oak-and beech-forest  
(*Stellario-Carpinetum*)
- Alluvial areas: *Alno-Padion*
- Swamp-areas: *Alneta*, especially *Carici elongatae-Alnetum*
- Some rare forest types: Fontinal Ash-Alderwood  
(*Carici remotae-Fraxinetum*)  
Atlantic oligotr. Alderwood  
(*Carici laevigatae-Alnetum*)

In Wallonia, these forest-types also occur, however, the most widespread type is *Luzulo-Fagetum* (and its degradation stadium *Luzulo-Quercetum*). In addition, on rich

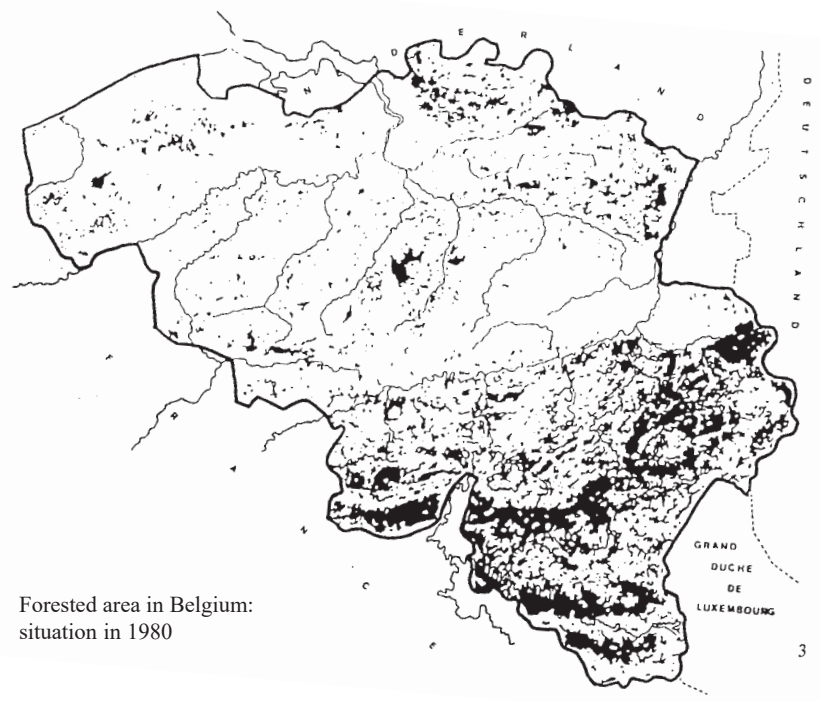
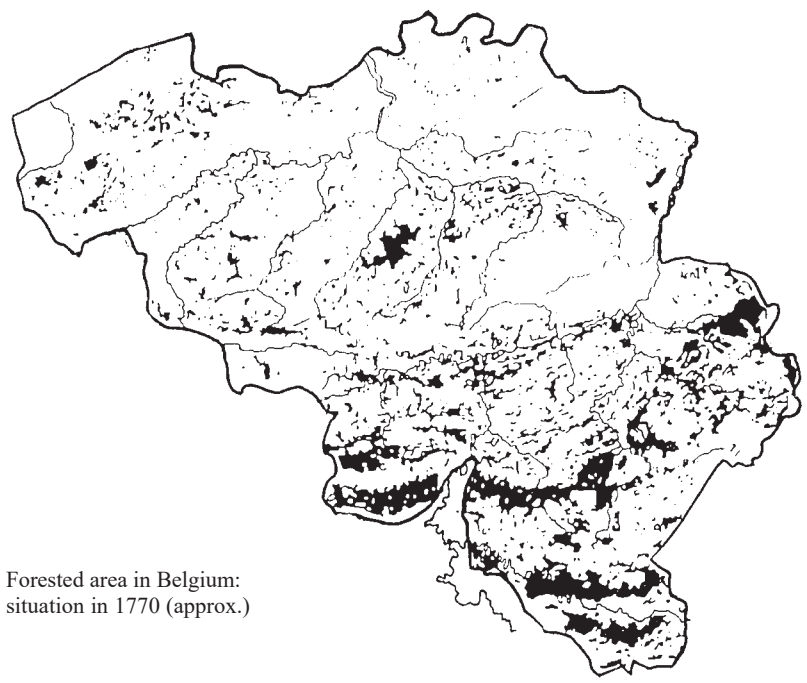


Figure 1. Forested area in Belgium – situation in 1770 compared with 1980.



calcareous soils *Melico-Fagetum* occurs. Some special rarer forest types here are: *Carici-Fagetum*, *Stellario-Alnetum*, *Aceri-Fraxinetum*.

## 1.2. Ecological function in forest-management and legislation – development of forest-reserves

As mentioned previously, the most significant impact on forests in the past was deforestation. Hence, traditionally, most forest legislation has been focused on protection, especially against illegal felling and deforestation, and regulations governing rights of use by local communities. This trend was continued in the Forest Act of 1854, which regulated the exploitation of State forests, deforestation in the private sector and outlined legislation pertaining to poaching, wood theft, etc.

No regulations about nature protection in forests were included and over-exploitation was still possible in private forests. The latter was addressed under a special law on private forests in 1931.

The first official initiatives on nature protection were taken in 1957, when two Nature reserves were created, and the enactment of a law on country planning in 1962, which endeavoured to halt the uncontrolled expansion of industry and urbanisation.

The first piece of legislation on nature protection within forests was enacted in 1973 and called the ‘Law for Nature Protection’. This law officially provided for the creation of Forest reserves (adjacent to Nature reserves).

Since the beginning of the century, the forest administration was preoccupied with afforestation, which was very much oriented towards production. Even during the seventies, management was still very traditional, and although more attention was paid to multiple function-forestry (with special emphasis on recreation), very little attention was given to the creation of Forest reserves. Moreover, the procedure for selection and recognition of these reserves was far too complicated.

Between 1975 and 1980 the forest and nature protection sector was ‘regionalised’, i.e. forest management, policy and legislation became the responsibility of authorities in each of the three regions, Flanders, Wallonia and Brussels.

In Flanders, separate administrations were established for forests and for nature protection. However, in Wallonia and Brussels both areas are still linked and are the responsibility of the forest administration. In Flanders a new forest law, called the ‘Flemish Forest Decree’ was enacted in 1990. This document is extremely important for forest management as a whole, and for the ecological function of forests, in particular.

In this Decree, special attention is paid to aspects of nature protection in forest management, and also caters for the creation of Forest reserves. Previously devised, impractical regulations on Forest reserves were abolished, and a new procedure was stipulated in an ‘Implementation Order on Forest Reserves’ in 1993. In 1995, the first series of Forest reserves were officially established.

This does not mean that prior to 1995 protected forests did not exist in Flanders. As early as the beginning of this century, protection initiatives for nature and typical forest landscapes were implemented. A good example of such initiatives was the creation of the ‘Canton Pittoresque’ in Zoniënwood (Forêt de Soignes). As in Fontainebleau, part of the forest was selected by the Academy of Art for aesthetic reasons. Unfortunately, a

decision was not made at that time to make it a strict reserve and specific felling and pruning activities were performed to create 'picturesque trees'. This type of management was abolished in the 1950s.

Another important initiative was the creation of *unofficial forest reserves*. Around 1970, they already existed in Neigembos and a special nature conservancy-management plan was implemented.

In 1986, an old beech-stand in Zoniënwood, 18 ha in area, was designated as an unofficial 'strict reserve'. These two unofficial reserves were included in the first series of official Forest reserves in 1995.

Some forests are also protected as official *nature reserves*. They used to fall under the 1973 national Law for Nature Conservation. Recently however, a new Decree on Nature Conservation was adopted by the Flemish parliament. In addition to providing for the administration of management in Nature reserves, this law also provides for the creation of new Nature reserves, which would form part of a larger 'Ecological Network for Flanders', totalling 50,000 ha.

The administration for nature protection is responsible for the management of all State Nature reserves, including those containing forest. Although official management plans are not yet completed, it is envisaged that parts of these reserves will become strict reserves. If agreements can be made with the administrations concerned, some of these are potential candidates for inclusion in a monitoring network. At present, six forests in Flanders are protected as Nature reserves, occupying a total area of about 500 ha.

In Wallonia, there are eight State Forest reserves with a total area of 244 ha. They have been established under the old 1973 Law for Nature Protection. These Forest reserves are all 'specifically managed', according to a special management plan. No fundamental research has been carried out in any of them.

There are two private Forest reserves, one of which is designated as a 'strict reserve' (Forêt de Rognac). Some dendrometric measurements have been carried out by the official administration for Nature and Forest (Mr. Stein). There is no Forest Decree in Wallonia, nor any other Forest reserves legislation, as of yet. The list of Wallonian Forest reserves is given below.

In the Brussels Region, there are two Forest reserves (Rood Klooster and Vuylbeek), in addition to several small Nature reserves in Zoniënwood, which is under their jurisdiction. All of them are managed reserves, selected for botanical or historical reasons, i.e. a neolithic site. Some detailed vegetation studies have been performed there by the University of Brussels (VUB).

### **1.3. Summary on legal status of protected forests in Belgium**

*Nature reserves*: areas protected under the 1973 Law on Nature Protection (Wallonia & Brussels) or by the 1997 Decree for Nature Conservation (Flanders). The main objectives are the maintenance and enhancement of the natural value and diversity of the area.

There are recognised private nature reserves, owned by environmental organisations, for which an official recognition dossier, complete with management plans have been approved by the administration for nature protection. Forested areas are poorly represented in this category, i.e. only a few hundred hectares.

**Table 2.** Forest reserves in Wallonia.

| Name                | Area     | Owner   | Forest-type (rough classification)  |
|---------------------|----------|---------|---|
| Bois d'Ellinchamps  | 29.8 ha  | State   | ?   |
| Bois de Marmont     | 44.5 ha  | State   | ?   |
| Ouren               | 1.1 ha   | State   | <i>Luzulo-Fagetum</i>   |
| Rurbusch            | 108.4 ha | State   | <i>Sphagno-Alnetum</i> > <i>Luzulo-Fagetum</i><br>> <i>Melico-Fagetum</i>         |
| Bois Lembrée        | 10.6 ha  | State   | <i>Quercion robori-petraeae</i>   |
| Grande Va           | 7.0 ha   | State   | <i>Carici-Carpinetum</i> > <i>Mesobromion</i>                                     |
| Bois de Faacht      | 13.5 ha  | State   | <i>Luzulo-Fagetum</i> ><br><i>Primulo-Carpinetum</i>                              |
| Ave-et-Auffe        | 29.4 ha  | State   | <i>Carici-Carpinetum</i> > <i>Mesobromion</i>                                     |
| Forêt de Rognac     | 10.1 ha  | RNOB    | <i>Luzulo-Fagetum</i> > <i>Stellario-Carpinetum</i> > <i>Carici remotae Frax.</i> |
| Forêt de Grimonster | 106.0 ha | Private | <i>Luzulo-Fagetum</i> > <i>Stellario-Carpinetum</i> > <i>Carici remotae Frax.</i> |
| Total               | 360.5 ha |         |   |

Official Nature reserves are State owned, for which management plans are made. They may be strict, or partially strict reserves. If the area is dominated by forest they are called 'State Nature reserves with forest character' – in Flanders they amount to about 500 ha – and 'Forest reserve' in Wallonia, which total about 250 ha.

*Forest reserves* in Flanders are protected under the Flemish Forest Decree (1990). The main objective of this protection status is scientific in nature, namely to provide knowledge about forest ecosystems and their dynamics. These can be 'integral reserves', which means 'strict reserve', or 'directed reserve', which means that specific management operations are carried out. Forest reserves in Wallonia and Brussels are protected by the 1973 Law on Nature Protection and are all managed by their respective administrations.

Belgium only has one *National Park*, i.e. Hohes Venn, which is predominantly a peat bog ecosystem.

## 2. NETWORK OF FOREST RESERVES IN FLANDERS: ACTUAL SITUATION

Since 1995, a total of 25 Forest reserves have been established. This chapter gives general information on their area, forest type and location.

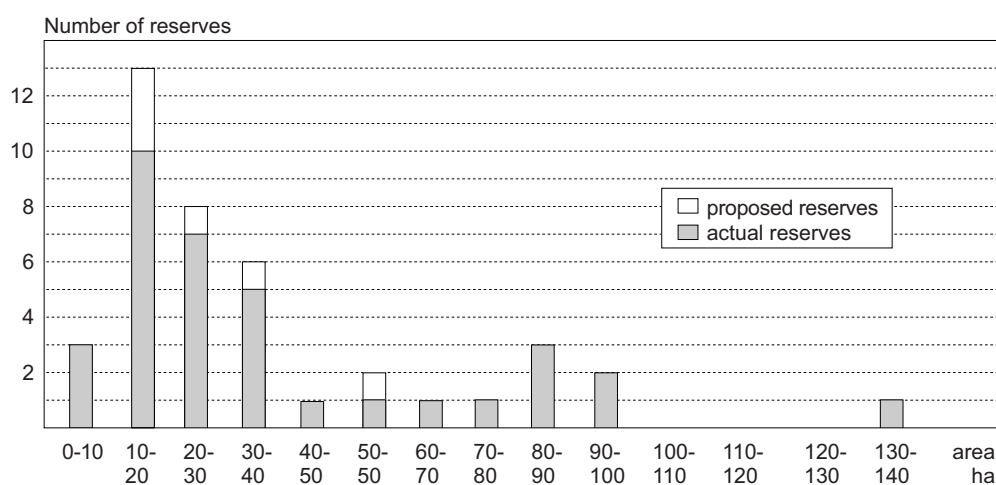
| Existing Reserves  |         | Reserves in procedure |        |
|--------------------|---------|-----------------------|--------|
| Number of reserves | 35      | Number                | 6      |
| Area               | 1374 ha | Area                  | 164 ha |
| Average area       | 39 ha   |                       |        |

**Table 3.** Forest reserves in Flanders: present situation (total 1,373.83 ha).

| Name                               | Area      | Location    | Owner     | Forest-type (rough classification)                        |
|------------------------------------|-----------|-------------|-----------|---|
| Beiaardbos                         | 17.06 ha  | Kluisbergen | State     | <i>Endymio-Carpinetum</i>                                 |
| Bos Terriest                       | 28.59 ha  | Pepingen    | State     | <i>Endymio-Carpinetum</i>                                 |
| Coolhembos                         | 78.64 ha  | Puurs       | State     | <i>Alnetum</i>  |
| Dilserbos- Platte Lendenberg       | 58.16 ha  | Dilsen      | State     | <i>Fago-uercetum petraeae</i>                             |
| Galgenberg                         | 29.82 ha  | Hasselt     | State     | <i>Quercion &gt; oligotrophous swamp-forest</i>           |
| Gasthuisbos                        | 11.02 ha  | Diest       | Community | <i>Quercion &gt; Stellario-Carpinetum</i>                 |
| Grootbroek                         | 136.41 ha | Kinrooi     | State     | <i>Quercion &gt; Oligotrophous swamp-forest</i>           |
| Hallerbos (4 areas)                | 63.78 ha  | Halle       | State     | <i>Quercion &gt; Endymio- Carpinetum &gt; Alno-Padion</i> |
| Heverlee: De grote omheining       | 32.2 ha   | Leuven      | State     | <i>Quercion</i>   |
| Heverlee: Putten + Klein moerassen | 15.0 ha   | Leuven      | State     | <i>Fagion Carpin &gt; Alno-Padion</i>                     |
| In de Brand                        | 11.44 ha  | Hechtel     | State     | <i>Quercion</i>   |
| Jagersborg                         | 86.54 ha  | Maaseik     | State     | <i>Quercion</i>   |
| Jongenbos                          | 82.04 ha  | Kortesseem  | State     | <i>Quercion &gt; Stellario-carpinetum</i>                 |
| Koemook                            | 39.47 ha  | Mol-Postel  | Private   | <i>Quercion</i>   |
| Kolmontbos                         | 18.58 ha  | Tongeren    | State     | <i>Stellario-Carpinetum &gt; Carici-Fagetum</i>           |
| Lanklaarderbos-Saenhoeve           | 83.69 ha  | Dilsen      | State     | <i>Fago-Quercetum petraeae</i>                            |
| Meerdaalwoud: Grote konijnepijp    | 25.2 ha   | Leuven      | State     | <i>Quercion</i>   |
| Meerdaalwoud: Veldkant Renissart   | 19.0 ha   | Leuven      | State     | <i>Milio-Fagetum</i>                                      |
| Meerdaalwoud: De drie eiken        | 7.3 ha    | Leuven      | State     | <i>Quercion</i>   |
| Meerdaalwoud: Everzwijnbad         | 27.5 ha   | Leuven      | State     | <i>Milio-Fagetum</i>                                      |
| Meerdaalwoud: Mommedeel            | 25.3 ha   | Leuven      | State     | <i>Quercion &gt; Carici laevigatae.-Alnetum</i>           |
| Meerdaalwoud: Pruikenmakers        | 38.7 ha   | Leuven      | State     | <i>Milio-Fagetum</i>                                      |
| Melisbroek-Vieversel               | 34.86 ha  | Zolder +    | State     | <i>Quercion &gt; oligotrophous swamp-forest</i>           |
| Neigembos                          | 45.01 ha  | Meerbeke    | State     | <i>Endymio-Fagetum Carpinetum</i>                         |
| Op den Aenhof                      | 35.71 ha  | Zolder      | State     | <i>oligotrophous swamp-forest</i>                         |
| Parikebos                          | 9.33 ha   | Brakel      | State     | <i>Endymio-Fagetum &gt; Alno-Padion</i>                   |
| Pijnven: het Ven                   | 15 ha     | Hechtel     | State     | <i>oligotrophous swamp-forest</i>                         |
| Pijnven: Droog gedeelte            | 22 ha     | Hechtel     | State     | <i>Quercion</i>   |
| Sevendonck                         | 67.60 ha  | Turnhout    | State     | <i>Quercion &gt; Alnetum</i>                              |
| Wijnendaele-bos                    | 91.60 ha  | Torhout     | State     | <i>Fago-Quercetum</i>                                     |
| Zoniën: Harras                     | 26.60 ha  | Hoeilaart   | State     | <i>Endymio-Carpinetum + Milio-Fagetum</i>                 |
| Zoniën: Kersselaerspleyn           | 90.60 ha  | Hoeilaart   | State     | <i>Milio-Fagetum</i>                                      |

**Table 4.** Forest reserves in Flanders: proposed reserves (in the process of being established).

| Name                  | Area       | Forest-type (rough classification)                               |
|-----------------------|------------|--|
| Helschot              | 56 ha      | <i>Quercion</i> > <i>Endymio-Carpinetum</i> > <i>Alno-Padion</i> |
| Muizenbos             | 33 ha      | calcareous alder-elm > alder-ash > <i>Quercion</i>               |
| RTT-domein Liedekerke | 23 ha      | <i>Quercion</i> > <i>Stellario-Carpinetum</i>                    |
| Arkenbos              | 15 ha      | <i>Quercion</i> + alder swamp-forest                             |
| De Kampanje           | 18.8 ha    | <i>Endymio-Carpinetum</i>  |
| Withoefse heide       | 18 ha      | <i>Quercion</i>  |
| Total                 | ca. 164 ha |  |

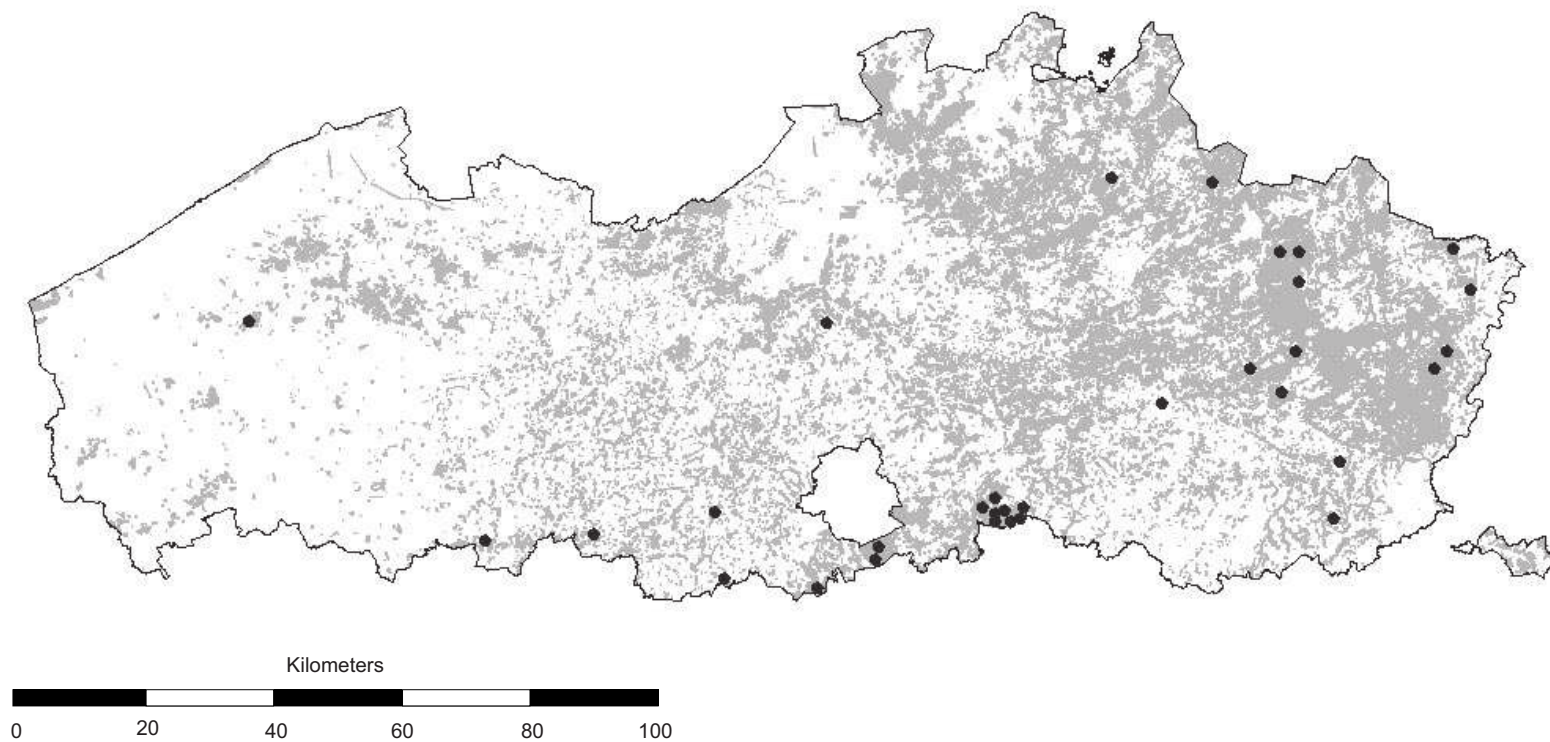
**Figure 2.** Forest reserves in Flanders by area-class divisions.

## 2.1. Integral and Directed reserves

In contrast with ‘Nature reserves’ the concept of ‘Forest reserves’ has no tradition in Flanders. Management initiatives are automatically linked with nature preservation activities. The original concept of forest reserves as is understood, especially in Central Europe, and represented by ‘strict reserves’ with specific scientific goals, is completely new to Flanders.

This explains why there is a distinction between ‘strict Forest reserves’ on the one hand, and ‘Forest reserves with special management’ was included in the ‘Implementation Order on Forest Reserves’. In addition, other regulations and selection criteria, typical for Nature reserves are included. Thus, the difference between Nature reserves and Forest reserves is very small and consequently, creates much confusion.

The basic criteria for ‘directed Forest reserves’ (with special management) and ‘integral Forest reserves’ (strict reserves) are listed in Table 2.



**Figure 3.** Distribution of forest reserves in the Flemish Region.

**Table 5.** Basic criteria for the two types of Forest reserves in Flanders.

|                                  | 'Directed reserve'  | 'Integral reserve'  |
|----------------------------------|---|---|
| Goals                            | Special management directed towards enhancing the ecological value  | Monitoring of spontaneous development   |
| Principal criteria for selection | Actual natural value e.g.: <ul style="list-style-type: none"> <li>• old coppice (with standards)</li> <li>• rare vegetation-type which requires special management</li> </ul> | Development of a representative network of forests: <ol style="list-style-type: none"> <li>1. all forest types in the principal landscape units</li> <li>2. minimum area (Minimum Structural Area)</li> </ol> |
| Scientific research              | Studies on of the effects of different management regimes   | Monitoring of spontaneous processes<br>-fundamental knowledge on forest ecology<br>-application in forest management  |
|                                  | Vergleichsfläche (Hessen), Nature reserves, National parks, etc.  | Strict Forest reserves in other European countries  |

For all Forest reserves a management plan must be made and a Management Commission subsequently outlines the required management prescription. At present, no definite decisions have been made on strict or managed reserves, although some options have already been proposed.

### 3. FOREST ECOLOGY RESEARCH

As the establishment of Forest reserves is a very recent development in Flanders, research has, up to recently, been very limited. Hence, this section has been broadened to include ecological research in forests as a whole. The following review endeavours to summarise some of the most important research completed to date on this topic, although the list is by no means complete. Although some of the research was done in unofficial Forest reserves, most of it was carried out outside Forest reserves. Nevertheless, it gives some guidance from past research experience as to what research can be implemented in Forest reserves currently.

In Belgium, forest research began as early as 1864, when a school for forestry was established in Bouillon. This school lasted for only 4 years and its programme was subsequently adopted by the agricultural institution of Gembloux and the University of Leuven.

In 1898, a course with a specialisation year in forestry was instigated at the institutes of Gembloux and Leuven. In 1919, a new agricultural institute was created in Ghent, which was later incorporated into the university of Ghent, and here too, a forestry department was created.

In the late 1960s, the University of Leuven was split into a Flemish and French-speaking institute in Louvain la Neuve. In total, this means that there are four different Universities providing an education in forestry. A considerable amount of important forestry research is carried out in these institutions.

In 1896, under the auspices of the forestry administration, the Research Station for Forest and Hydrobiological Research was established. This station was amalgamated with the Institute for Populiculture in Geraardsbergen in 1991, to form the Institute for Forestry and Game Management, the official scientific institute for forest research in Flanders.

The Institute for Nature Conservation is similar to the Flemish administration responsible for research in Nature Conservation. Although more emphasis is given to other ecosystems, some of their research is also carried out in forests.

In Wallonia, forestry research in Forestry is organised at the two universities and in the Forestry Department of the Institute for Agricultural Research in Gembloux. Further information on Wallonian forests is available on the Internet at <http://envagri.wallonie.be>. In addition, a list of contact addresses is given at the end of this section.

### **3.1. Historical research: review of the most important topics**

Up to the 1960s, forest research was very much oriented towards productivity and the potential of new, exotic species in Belgium. However, some research was done on forest ecology. Since the 1970s, increasingly more attention was paid to aspects of forest ecology, forest ecosystems, close-to-nature forestry and nature conservation in forests. Consequently, research on these aspects expanded enormously. The motivation and stimulus for focusing greater attention on such aspects came primarily from the research sector, especially at the universities.

#### **At the Station for Forest and Hydrobiological Research in Groenendaal:**

1950s and 1960s: compilation of Forest Ecological Maps.

- Galoux A. & Reginster P. (1954). *Cartographie écologique et forestière du Domaine provincial de Mirwart.*
- Rogister J.E. (1968). *Cartographie écologique et forestière de la Forêt Domaniale de Longues Virées*
- Rogister J. & Galoux A. (1982). *Forestry and ecological mapping in Belgium.* IN: Jahn G. (ed.) *Handbook of Vegetation Science, Part 12, 117-146; The Hague.*

1960s and 1970s: research on forest ecosystem ecology (gas-exchanges, energy fluxes, water balance,....)

- Galoux A. et al. (1968-1973). *Recherches sur l'écosystème forêt. La chênaie mélangée calcicole de Virelles-Blaimont. Proefstation van Waters en Bossen werken – reeks A, nr. 12-14*
- Galoux A. (1974). *Ecosystem, open thermodynamic system. The oak forest of Virelles-Blaimont.* *Göttinger Bodenkundliche Berichte, 30, 131-149.*  
*also: Rad. and Environm. Biophys. 15, 113-130.*



## 1970s and 1980s: phytosociological research and ecological classification of forest plants by ROGISTER

- ROGISTER J.E. (1981). *Contribution à la classification écologique des groupements forestiers dans la vallée de la Semois ardennaise. Proefstation van Waters en Bossen werken – reeks A, nr. 18.*
- ROGISTER J.E. (1981). *Het karakteriseren van bosplantengezelschappen met behulp van trofie- en hydrie-soortengroepen. Toepassing op gezelschappen op natte en vochtige groeiplaatsen. Proefstation van Waters en Bossen werken – reeks A, nr. 27.*
- ROGISTER J.E. (1985). *De belangrijkste bosplantengemeenschappen in Vlaanderen. roefstation van Waters en Bossen werken – reeks A, nr. 29.*
- ROGISTER J.E. (1988). *Invloed van de boomsoortenkeuze op de ontwikkeling en samenstelling van de kruidlaag. Proefstation van Waters en Bossen werken – reeks A, nr. 15.*

## Research on forest structure in a proposed forest reserve at Liedekerke

- De Cuyper B. (1993). *An unmanaged forest – research strategy and structure and dynamics. IN: Broekmeyer M., Vos W. & Koop H.(eds.)(1993). European forest reserves, pp. 215-216. Proceedings of the European Forest reserves Workshop; 6-8 May 1992, Wageningen. IBN-DLO – Wageningen – Netherlands.*

## At the Institute for Nature conservation

### Testing the Dutch SILVI-STAR-methodology in three Forest Nature reserves.

- Koop H., Leten M., Boddez P., Tielens T. & Hermy M. (1992). *Bosstructuur en soortensamenstelling van het Rodebos; monitoring van bosstaatsnatuurreservaten in Vlaanderen. IBN-DLO – rapport 92/27.*
- *Bosstructuur en soortensamenstelling van het Walenbos; monitoring van bosstaatsnatuurreservaten in Vlaanderen. IBN-DLO – rapport 92/28.*
- *Bosstructuur en soortensamenstelling van het Hannecartbos; monitoring van bosstaatsnatuurreservaten in Vlaanderen. IBN-DLO – rapport 92/29.*

## Research on relations between forest type and specific faunal groups (including: spiders, Carabids and birds.)

- Gaspar C. et al (1989). *Recherches sur l'écosystème forêt, Biocénose des Coléoptères.*
- *Comptes rendus du Symposium 'Invertébrés de Belgique'.*
- *Bulletin of the Royal Belgian Institute for Natural History.*
- *Reports of the Institute for Nature Conservation.*

## At the University of Ghent

### Analyses of the unofficial forest reserve in Zoniënwoud:

- Van den Berge K., Maddelein D. & Muys B. (1993). *Recent structural changes in the beech forest reserve of Groenendaal (Belgium) In: Broekmeyer M., Vos W. & Koop H.(eds.)(1993) European forest reserves; pp. 195-198. Proceedings of the European Forest reserves.*

Workshop; 6-8 May 1992, Wageningen. IBN-DLO – Wageningen – Netherlands.

- Van den Berge K., Roskams P., Verlinden A., Quataert P., Muys B., Maddelein D. & Zwaenepoel J. (1990). Structure and dynamics of a 215-years old broad-leaved forest stand recently installed as a total forest reserve. *Silva gandavensis* 55, 113-152.

### Research on nutrient fluxes and relationships between soil and forest stand

- MUYS B. (1990). N-excess in the forest: effects and possible measures. *Silva Gandavensis* 55, 35-42.
- MUYS, B. (1993). *Synecologische evaluatie van regenwormactiviteit en strooiselafbraak in de bossen van het Vlaamse Gewest als bijdrage tot een duurzaam bosbeheer. doctoral theses – University of Ghent, 335 p.*
- Maddelein D., Meyen S. & Lust N. (1991). *Driving forces and limiting factors in long-term dynamics of forest ecosystems on sandy soil. University of Ghent, 223 p.*
- Sioen G., Neiryneck J., Maddelein D. & Muys B. (1993). *Site-classification in relation with vegetation and humus characteristics in the forest of Halle (Belgium).*
- IUFRO S1.02.06 *Technical meeting on site classification and evaluation, Clermont-Ferrand, France, October 19-22, 1993.*

### Other important research

#### Phytosociology and forest plant ecology:

- NOIRFALISE A. (1984). *Forêts et stations forestières en Belgique. Les presses agronomiques de Gembloux.*
- HERMY M. (1985). *Ecologie en fytosociologie van oude en jonge bossen in Binnen-Vlaanderen. Doctoral thesis, Faculty of Sciences, University of Ghent.*

#### CO<sub>2</sub>-concentrations:

- *Effect of increased atmospheric CO<sub>2</sub>-concentration on primary productivity and carbon allocation in typical Belgian forest ecosystems. – Final report. Laboratory of Plant ecology: University of Gent.*

#### Historical ecology of forests:

- Tack G., Van Den Brecht P. & Hermy M. (1993). *Bossen van Vlaanderen: een historische ecologie. Davidsfonds – Leuven.*
- Hermy M., Van Den Brecht P. & Tack G. (1993). *Effects of site history on woodland history. IN: Broekmeyer M., Vos W. & Koop H.(eds.)(1993). European forest reserves, pp. 219-232 Proceedings of the European Forest reserves Workshop; 6-8 May 1992, Wageningen – IBN-DLO – Wageningen – Netherlands.*

#### Ecological characteristics of tree species:

GROUPE INTERUNIVERSITAIRE F.S.A.Gx. – U.C.L. – U.L.B. – U.Lg. (1991). *Le fichier écologique des essences, 1 en 2: définition de l'aptitude des stations forestières. Ministère de la région Wallonne. Nouvelle imprimerie Duculot, Gembloux.*

### 3.2. Ongoing research – research institutions

University of Leuven:

- research on the ecology of old-forest-plants (Doctoral research by ir. Olivier Honnay; M. Hermy)
- geographic information system for Nature Conservation (an ACCESS-Arcview programme)
- research on Protection forests

Institute for Nature Conservation:

- research on relations between forest type and specific animal groups
- ecohydrological study in relation to the vegetation in the forest nature reserve ‘Walenbos’
- realisation of ‘red lists’ and ‘Biological Evaluation Maps of Flanders’

University of Gent:

- research on liming in forests
- research on nutrient cycling, carbon-cycle, transformation of homogeneous forest stands etc.

Institute for Forestry and Game Management:

- research on European level II-plots (forest health vitality network): nutrient cycles
- relation between soil condition and tree species:
- forest ecology monitoring towers (measurement of ozone-conc., radiation, wind velocity, etc.)
- methodology for quantification of forest biodiversity
- research on the relationship between soil- and soil-dwelling invertebrates and soil condition
- PNV-map of Flanders
- co-ordination of research in Forest reserves.

### 3.3. Research in official forest reserves: ongoing research and future tasks of the Institute for Forestry and Game Management

Current research is limited to the following topics

- basic inventory of Forest reserves (carried out by the Universities of Ghent and Leuven)
- methodology for the study of Forest reserves (carried out by the University of Ghent)

Future tasks of the Institute for Forestry and Game Management are summarised as follows:

1. Assistance and advise in realising a forest reserve network
  - list of selection criteria
  - follow-up of new proposals
  - time-table for completion of the network
2. International contacts
3. Follow up of proposals for management
  - choice between ‘directed’ and ‘integral’ reserves
4. Development of a monitoring methodology
  - analysis of foreign monitoring systems
5. Co-ordination, organisation and logistical support for scientific research in Forest-reserves
  - organisation of monitoring
  - centralisation of all data and research results in a central databank (using GPS, GIS, etc.)

#### 4. LIST OF IMPORTANT CONTACT ADDRESSEES

##### In Flanders:

Institute for Forestry and Game Management  
section Geraardsbergen:  
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fax: +32-54 410 896  
kris.vandekerkhove@lin.vlaanderen.be

Institute for Forestry and Game Management  
section Groenendaal:  
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tel: +32-2 657 03 86  
fax: +32-2 657 96 82

Laboratory of Forestry – University of Ghent:  
Prof. Dr. ir. N. Lust  
Laboratorium voor Bosbouw  
Universiteit Gent  
Geraardsbergse Steenweg 267  
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tel: +32-9 252 21 13  
fax: +32-9 252 54 66

Laboratory of plant ecology – Univ. of Ghent  
Coupure Links 653, B-9000 Ghent  
tel: +32-9 264 61 16  
fax: +32-9 224 44 10

Laboratory for Forest, Nature and Landscape –  
Katholic University of Leuven:  
Prof. Dr. M. Hermy  
Dr. ir. B. Muys  
Vital de Costerstraat 102  
3000 Leuven  
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fax: +32-16 230 607

Administration for Forestry:  
Contact person on forest reserves:  
ir. D. Maddelein  
Graaf de Ferraris-gebouw  
Emile Jacquainlaan 156  
1000 Brussels  
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fax: +32-2 553 81 05

Institute for Nature Conservation  
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des Ressources naturelles et de l'Agriculture  
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1000 Brussels.  
Internet: WWW: [http:// envagri.wallonie.be](http://envagri.wallonie.be)

ir. Yvan Grollinger  
Inspecteur général de la Nature et des Forêts  
Avenue Prince de Liège 15  
5100 Namur

Mr. Jacques STEIN  
Ministère de la région Wallonne  
Direction Générale des Ressources naturelles  
et de l'environnement  
Direction de la conservation de la Nature  
et des Espaces verte  
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**Brussels Region:**

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Dir. Nature et Forêt  
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