# COST Action E27
## Protected Forest Areas in Europe – Analysis and Harmonisation (PROFOR)

# Country Report - Germany

**Working Group 1 – Task 1.1.**
**Description of the historical background that has led to the development of particular national Protected Forest Area frameworks**

Jan Carl Welzholz*[1] , Renate Bürger-Arndt[1], Winfried Bücking[2]

*Corresponding author: jan.welzholz@forst.uni-goettingen.de, +49 (0)551 39-3754
[1]Institute for Forest Policy, Forest History and Nature Conservation,
Georg August University, Göttingen, Germany
[2] Forestry Research Institute of Baden-Württemberg, Germany

**Abstract.** Germany, a country with a long tradition in forest management and forest protection, is a federal state consisting of 16 *Länder* (states). The country's federal structure has a major influence on the designation and management of Protected Forest Areas, as the *Länder* and not the Federal Government are responsible for nearly all Protected Forest Areas in Germany. With 11,076 thousand ha forest Germany has a forest cover of 31 %. According to official statistics, 5 % of the German forest area is located in strictly protected forest areas, which is equivalent to 1.6 % of the country's total land area. Due to overlapping of the different protection categories, however, it is difficult to produce reliable national statistics on the forest area in Protected Forest Areas. The Protected Forest Areas in Germany are based on laws and legal provisions from the fields of nature conservation, forest, water and road law. The protected area categories based on the nature conservation law can include forest and non-forest land, whereas the categories according to the forest, water and road law mainly contain exclusively forest and were partly designed particularly for the protection of forests. Not only Protected Forest Areas mainly designated for the maintenance of biodiversity but also Protected Forest Area types that fulfil primarily protective functions are considered in the report.



*Keywords:* Federal Republic of Germany, Protected Forest Area, forest, nature conservation, nature protection categories

## Abbreviations

| | |
|---|---|
| BfN | Bundesamt für Naturschutz<br>Federal Agency for Nature Conservation |
| BMELF | Bundesministerium für Ernährung, Landwirtschaft und Forsten<br>Federal Ministry of Food, Agriculture and Forestry |
| BMI | Bundesministerium des Innern<br>Federal Ministry of the Interior |
| BMU | Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit<br>Federal Ministry for the Environment, Nature Conservation and Nuclear Safety |
| BMVEL | Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft<br>Federal Ministry of Consumer Protection, Food and Agriculture |
| BNatSchG | Bundesnaturschutzgesetz (Gesetz über Naturschutz und Landschaftspflege)<br>Federal Nature Protection Act |
| BWaldG | Bundeswaldgesetz (Gesetz zur Erhaltung und zur Förderung der Forstwirtschaft)<br>Federal Forest Act |

| | |
|---|---|
| EEC | European Economic Community |
| FAO | Food and Agriculture Organization |
| GG | Grundgesetz für die Bundesrepublik Deutschland<br>Basic Law for the Federal Republic of Germany |
| GIS | Geographic Information System |
| IUCN | International Union for the Conservation of Nature – World Conservation Union |
| MCPFE | Ministerial Conference on the Protection of Forests in Europe |
| ML | Niedersächsisches Ministerium für Ernährung, Landwirtschaft und Forsten<br>Lower Saxony Ministry of Food, Agriculture and Forest |
| RNatSchG | Reichsnaturschutzgesetz<br>Reich Nature Protection Act |
| SRU | Der Rat von Sachverständigen für Umweltfragen<br>The German Council of Environmental Advisors |
| UNCED | United Nations Conference on Environment and Development |
| UN-ECE | United Nations Economic Commission for Europe |
| UNEP | United Nations Environment Programme |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |
| WCMC | World Conservation Monitoring Centre |
| WCPA | World Commission on Protected Areas |
| WHG | Wasserhaushaltsgesetz (Gesetz zur Ordnung des Wasserhaushalts)<br>Water Management Act |

## 1. Introduction

Germany is a densely populated country in Central Europe. It has a land area of 3,579 thousand ha, 8.3 million inhabitants and a population density of 231 inhabitants per square kilometre (Federal Statistical Office 2004). Its landscape is characterised by a mosaic of agricultural land (53.5 % of the German land area), forests (31.0 %), water bodies (2.3 %) settlements and roads (12.3 %) (BMVEL 2004, Federal Statistical Office 2004). The forest area totals 11,076 thousand ha (BMVEL 2004). The major tree species are spruce (*Picea abies*) (28.2 % of the lumber producing area) area), pine (*Pinus sylvestris*) (23.3 %), beech (*Fagus sylvatica*) (14.8 %) and oak (*Quercus robur/petraea*) (9.6 %). The most important exotic tree species planted in Germany are larch (*Larix decidua/kaempferi*) (2.8 %) and Douglas fir (*Pseudotsuga menziesii*) (1.7 %) (BMVEL 2004). Under natural conditions, the majority of the territory (66.5 %) would be covered by beech and mixed beech forests, and nearly all the remainder by other forest or wood communities (Bohn 2001). Germany is a federal state consisting of 16 *Länder*[3] (states), and this has a major influence on the designation and the management of Protected Forest Areas.

Since the Age of Romanticism, the idea of the 'German forest' has influenced the identity of the German people (von Bahder & Sickel 1922, Gross 1992). Thus, today's German public is interested in the preservation of the forests not only for ecological and socio-economic but also for emotional reasons. The German legal system provides several possibilities for putting forest areas under protection. Through the various protection categories, two thirds of the German forest area are formally protected (BMVEL 2001c).

**The term 'forest' in Germany**

The German language distinguishes between the terms *Wald* and *Forst* both translated into English as 'forest'. *Wald* implies all kinds of tree-dominated areas, whereas the word *Forst* sometimes just refers to state-owned forest or managed forest. The term *Forst* is also used to denote a far-from-natural forest that originates from plantation, is characterised by intense silvicultural activities and is composed of tree species not belonging to the site's potential natural vegetation (Meisel-Jahn 1955, Dierschke 1989, Zerbe & Sukopp 1995). According to the Federal and the *Land* forest laws, forest is regarded as "any area covered by forest plants" (s. 2 BWaldG). Forest plants are scientifically understood to be trees that are capable of shaping forest ecosystems. Such ecosystems are characterised by a nearly closed canopy and by an individual inner forest climate (Röhrig & Bartsch 1992). According to Thomasius and Schmidt (1996), in the temperate climatic region a minimum height of 5 m and a crown cover percentage of at least 30 % are necessary for the development of such an inner forest climate. Small tree-dominated areas with a size less than 0.1 ha and brushwoods are not regarded as forest (Klose & Orf 1998). Depending on the tree species and the site conditions, the German forest trees reach heights from 5 m to 50 m at maturity (Bartels 1993).

## 2. The history of Protected Forest Areas in Germany

### 2.1. The Middle Ages

#### 2.1.1 Holy groves and closed forests

In ancient times forests and other wooded land covered nearly all of Germany, with the exceptions of the coastline, on wet mires and on high mountains (Mantel 1990). Forest and wilderness were synonymous, because people could not settle and farm the land until they had cleared an area of forested land. People in Central Europe were hunters and gatherers up until the Neolithic Age (5500 B.C – 1800 B.C), when they started farming (Ellenberg 1996). From then on, people influenced the primary Central European forest ecosystems, and ultimately shaped today's cultural landscape. In the days of the old German tribes all free members of a settlement community had the right to exploit and clear forests and the whole of German forested land was common property (Hasel 1985). There was just one exception. The right of free members did not extend to those forests that served religious functions. These so-called 'holy groves' (*heilige Haine*) (Mantel 1990), which were consecrated to gods, can be regarded as the first Protected Forest Areas on German territory.

As the power of the Franconian kings grew from the 7th century, they took possession of great areas of wild forests (Hasel 1985). Intending to protect certain rights for themselves, e.g. the sole hunting right, they prohibited several activities, such as making clearings, within these forests. In this way, the Franconian kings made these forests 'closed forests' [in Middle Latin: *forestes*, in German: *Bannwälder* (Grimm *et al.* 1878)]. Many of these closed forests from those days continued to exist as property of the later sovereigns up to the 18th century (Hasel 1985).

#### 2.1.2 Adjudications and forest regulations

However, there were also restrictions of utilisation concerning the common forests in order to guarantee that the interests of all people, who were entitled to use the common forests, were represented. In the age of the old German tribes and of the medieval Germans, the rural law was established by assemblies (*Thinge*), which consisted of the members of the settlements. This law was common law, which was revised and extended by the later rural courts throughout the following centuries. Initially, it was handed down only orally, but since the 11th century many of these adjudications (*Weistümer*) were written down (Mantel 1990). In the late Middle Ages especially, the local sovereigns also issued several forest regulations (*Waldordnungen*), which extended over certain forested areas (Hasel 1985).

### 2.2. The Modern Age

#### 2.2.1 *Forst* regulations and early forest legislation

During the early times of the Modern Ages (since 1500 A.D.) the many small state sovereigns in Germany strengthened their power. At the same time, great deforestations took place (Schmidt 2002). Often motivated by their hunting interests, the sovereigns used their power to protect the forests by laying down *Forst* regulations (*Forstordnungen*) for their entire territories. These forest regulations were the predecessors of the later state forest laws, which were passed during the 19th century (Hasel 1985).

#### 2.2.2 The beginnings of nature protection in Germany

The ideas of Romanticism changed the view on nature at the turn of the 18th to the 19th century (Brockhaus 1998). One ideal of Romanticism was the naturalness of nature (Zielonkowski 1989). Here and there, this ideal was manifested in the conservation of Natural Monuments. Most of these monuments were of geological importance, such as the *Drachenfels* (Dragon's Rock) at the Rhine, Prussia, (protected since 1836) (Schoenichen 1937a) or the 'Teufelsmauer' ('Devil's Wall') north of the Harz mountains, Anhalt (protected since 1852) (Röper 2002). Examples of the first officially Protected Forest Areas of these times in Germany are the beech forests 'Theresienhain' near Bamberg, Bavaria, (protected since 1803) (Kölbel 2002) and 'Heilige Hallen' ('Holy Halls') in Mecklenburg (1850) (Succow 2002). Protection was implemented by official orders or purchases carried out by local, regional or national governments.

In the second half of the 19th century the enthusiasm for the rapidly progressing industrialisation superseded the romantic ideas, but the arising nature protection movement eventually caught up. Members of this protection movement committed themselves to the cause privately, or in the associations for the preservation or the improvement of

certain parts of the local landscape endangered by building projects or plot realignments (Stiftung Naturschutzgeschichte 2002). The most important representative of this movement was the musician Ernst Rudorff (1840-1916), who coined the German term for nature protection, *Naturschutz*, in 1888 (Zielonkowski 1989).

## 2.3. The 20th century

### 2.3.1 The institutionalisation of nature protection

Institutional nature protection only became the responsibility of the state at the beginning of the 20th century. Hugo Conwentz' memorandum "The Endangerment of the Natural Monuments and Suggestions for their Conservation" (Conwentz 1904) was a pioneering step on the way to the foundation of the first office for nature conservation in Germany. In 1906 the State Office for Natural Monument Management (*Staatliche Stelle für Naturdenkmalpflege*) was founded with its seat in Danzig, Prussia. Supported by provincial, regional, county and local commitees its task was to find, examine and conserve Natural Monuments. Hugo Conwentz (1855-1922) was appointed as the head of the institution, which moved to Berlin in 1910 (Wolf 1920). Initially, the Prussian Ministry for Sciences and Education was responsible for the institution. In 1936, it became a department of the *Reich* Forest Office (*Reichsforstamt*), i.e. the ministry of forestry in the Third *Reich* (Hasel 1985), and was called *Reich* Office for Nature Conservation (*Reichsstelle für Naturschutz*) (Stiftung Naturschutzgeschichte 2002). After the Second World War, the office was refounded in Bonn, West-Germany. But this Central Office for Nature Conservation and Landscape Management had less influence than its predecessor, because from then on, the *Länder* were responsible for selecting and designating protected areas. Today, after several reorganisations and renamings, it is called Federal Agency for Nature Conservation (*Bundesamt für Naturschutz*) (BfN 2005a).

In 1986 the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety was founded (BMU 2001). This ministry is the highest nature protection authority in Germany. The Federal Agency for Nature Conservation, a higher federal authority, is under the responsibility of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. It performs various advisory, supporting, approving, scientific and informing tasks in the field of nature conservation and landscape management (BfN 2005a).

### 2.3.2 The development of nature protection legislation

First laws regulating the conservation of Natural Monuments were passed in Bavaria in 1908 and Baden in 1912 (Wolf 1920). The biggest territorial German state Prussia amended its Field and Forest Policy Law (*Feld- und Forstpolizeigesetz*) of 1880 only in 1920 and, herewith, it created its first legal basis for designating Nature Protection Areas by ordinance (*Verordnung*) (Klose & Vollbach 1936). Previously, it was possible to protect areas just through civil law contracts for management upon payment, purchase or expropriation (Wolf 1920). In 1935 the first German nature protection law that was in force for the whole of Germany, the *Reich* Nature Protection Act (RNatSchG 1935), was promulgated. This act named three spatial protection categories, Natural Monument (*Naturdenkmal*), Nature Protection Area (*Naturschutzgebiet*) and *Reich* Nature Protection Area (*Reichsnaturschutzgebiet*).

In the German Democratic Republic the Act for Conservation and Management of Native Nature (*Gesetz zur Erhaltung und Pflege der heimatlichen Natur*) replaced the *Reich* Nature Protection Act in 1954 (Succow 2002). It was in force until 1970, when it was substituted by the State Cultivation Act (*Landeskulturgesetz*) and its Nature Protection Ordinance (*Naturschutzverordnung*) (Schmidt 1992). The latter was completely revised in 1989. The *Bundestag* of the Federal Republic of Germany, the German Federal Parliament, adopted the Federal Nature Protection Act, a framework law, in 1976. Until then, the *Reich* Nature Protection Act had been in force in those *Länder* which had not enacted their own *Land* nature protection laws before (Kloepfer 1994). Rhineland-Palatinate and Bavaria were the first *Länder* which created their own *Land* nature protection laws in 1973. Baden-Württemberg and North Rhine-Westphalia followed by 1976.

### 2.3.3 Strict forest reserves

The first strict forest reserve was established in Württemberg in 1911 (Bücking 1995). Early efforts to create a German framework of strict forest reserves arose in the 1930s. They are connected with the names Hesmer and Hueck. In 1934 Hesmer demanded the establishment of a network of 'natural forest cells'

(*Naturwaldzellen*), in which any use should be prohibited (Hesmer 1934). After the Second World War, the forest researchers of the German Democratic Republic were the first to translate this idea into action again (Bücking 2000). In the 1950s the Institute for Landscape Science and Nature Protection (*Institut für Landschaftsforschung und Naturschutz*), Halle, started to set up a network of Protected Forest Areas and 'stocked total reserves' (*bestockte Totalreservate*) (Bücking 1995, Knapp & Jeschke 1991). In Western Germany, around the European Nature Protection Year 1970, the idea gained much support. Since then, many of the strict forest reserves, which have different names in the different *Länder*, were created by the forest administrations within the state-owned forests (Bücking 2000).

## 3. Current state

### 3.1. Main types of Protected Forest Areas, responsible organisations and procedures

#### 3.1.1 Main types of Protected Forest Areas

In principle, the entire German forest is protected by the legal requirements of the Federal Forest Act of 1975 and the *Land* forest laws (Möller 2004). For example, conversion of forest land to other land-uses requires the permission of the forest authorities [s. 9 BWaldG (BMELF 1999)]. This general protection can be understood as a kind of minimum protection. But there are several legal provisions that enable different authorities to designate Protected Forest Areas providing stronger protection. Apart from the strict forest reserves that consist exclusively of forest land, there are many different types of protected areas in Germany, which might or might not include forests. The following types include more or less extended forest areas. The appendices give detailed information about the terminology of the protection categories (Appendix 1) and the distribution of the protected areas in Germany (Appendix 2).

##### *3.1.1.1 Forests mainly protected for biodiversity*

***Protected forests according to the Federal and the Land nature protection laws***

***Nature Protection Areas (Naturschutzgebiete)***

There are 6,588 Nature Protection Areas with a total area of 924,779 ha in Germany, which makes up 2.6 % of the German territory (BfN 2002a). The sizes of the areas differ considerably, ranging from less than one to more than 10,000 ha. Only 22 % of them exceed 100 ha. Very strict conservation is provided by designating a habitat as a Nature Protection Area. Up to the nineties, the basic aim of the designations was to maintain the current ecological state of certain valuable habitats. Since 2002 however, the development and the restoration of habitats are also considered as legal objectives (s. 23 BNatSchG). Within Nature Protection Areas, land-use is limited to certain activities, which conform to the aims of protection; sometimes utilisation is completely excluded. However, forest management that follows the proper forestry principles (*ordnungsgemäße Forstwirtschaft*) is generally allowed (Möller 2004). The decision as to whether an area of habitat becomes a Nature Protection Area or not, and which restrictions are applied, always depends on local conditions. The Nature Protection Areas are ordained by the County District Commissions or the Regional Governments. Some *Länder*, e.g. Lower Saxony and North Rhine-Westphalia, call Nature Protection Areas that consist exclusively of forest land 'forest nature protection areas' (*Waldnaturschutzgebiete*) or 'forest reserves' (*Waldreservate*), legally not different from the other Nature Protection Areas.

***National Parks (Nationalparke)***

As in other countries, a National Park is always a large-scale reserve of mostly natural landscape. "The majority of the National Parks' area fulfils the requirements of a Nature Protection Area" (s. 24 BNatSchG). National Parks should be left to free succession, although parts of them are open to the public for recreation. Many visitors are attracted by their beauty and uniqueness. In such circumstances, the protective and the recreational function may conflict. The land areas of ten of the fourteen National Parks in Germany include exclusively or mostly forested land. Established by law or ministerial ordinance (*Ministerialverordnung*), these are the National Parks 'Bayerischer Wald' ('Bavarian Forest', Bavaria), 'Eifel' (North Rhine-Westphalia), 'Hainich' (Thuringia), 'Harz' (Lower Saxony and Saxony-Anhalt), 'Kellerwald' (Hesse), 'Sächsische Schweiz' ('Saxon Switzerland', Saxony), 'Vorpommersche Boddenlandschaft' ('Vorpommern Lagoon Area'), 'Jasmund' and 'Müritz' (all Mecklenburg-Western Pomerania). The National Parks 'Niedersächsisches Wattenmeer' ('Lower Saxony Wadden Sea'),

'Hamburgisches Wattenmeer' ('Hamburg Wadden Sea') and 'Schleswig-Holsteinisches Wattenmeer' ('Schleswig-Holstein Wadden Sea') consist exclusively of tidal flats of the North Sea, the National Park 'Berchtesgaden' in the Bavarian Alps comprises mainly alpine plant communities and lakes, and the National Park 'Unteres Odertal' ('Lower Oder Valley', Brandenburg) is an almost non-wooded floodplain. The National Park 'Bayerischer Wald' was the first one established in Germany in 1969 (Haug 1993). Except from the two new National Parks 'Eifel' and 'Kellerwald' established in 2004 all German National Parks are recognised by the IUCN as National Parks according to category II of the IUCN international system of Protected Area Management Categories (IUCN-WCPA 1994) (UNEP-WCMC 2005). In 2002 the total National Parks' land area amounted to 171,168 ha, which is 0.5 % of the total German land area (BfN 2002a). Additionally, 776,691 ha were situated in the North Sea and the Baltic Sea. The sizes of the terrestrial National Parks ranged from 7,600 ha to 32,200 ha.

***Biosphere Reserves (Biosphärenreservate)***

Based on UNESCO's Programme Man and the Biosphere (MAB), which was established in 1971, the German legislation created the Biosphere Reserve category with an emphasis on cultural landscape aspects (s. 25 BNatSchG). However, the designation of a Biosphere Reserve according to these laws does not necessarily require that it is officially recognised by the UNESCO (Louis *et al.* 2000). The purpose of the Biosphere Reserves is not only to conserve the areas that are close to nature, but also the typical characteristics of certain cultural landscapes that have developed over centuries. Biosphere Reserves should provide opportunities to reconcile the conservation of biodiversity and biological resources with their sustainable use (UNESCO 1995). According to the UNESCO's terminology, Biosphere Reserves are organised into three zones: 'core area', 'buffer zone' and 'transition area'. In Germany these zones are called 'core area', 'designed management zone' and 'development zone'. One could find the German provisions governing Biosphere Reserves in the Nature Protection Ordinance of the former German Democratic Republic and since 1998, in the all-German Federal Nature Protection Act (Louis *et al.* 2000) and in some *Land* nature protection laws. At the moment 14 Biosphere Reserves covering 2.0 % of the German land area are recognised by the UNESCO (BfN 2002a). As a rule, the Biosphere Reserves include other protection categories such as Nature Protection Areas, National Parks or Landscape Protection Areas.

***Landscape Protection Areas (Landschaftsschutzgebiete)***

The protection category Landscape Protection Area makes up a large proportion of the German territory (26.7 %) (BfN 2002a). The reason for the legally binding designation is the importance of the area for the natural balance, for the beauty of the landscape and for recreation. Even if in Landscape Protection Areas the status of protection is less strict than in the Nature Protection Areas, all interventions that might change the specific character of the protected landscape are principally prohibited (s. 26 BNatSchG).

***Nature Parks (Naturparke)***

The Nature Park movement goes back to the efforts to establish the 'Naturschutzpark Lüneburger Heide' ('Nature Protection Park Lüneburg Heath') south of Hamburg at the beginning of the 20$^{th}$ century (VDN 2001). Nature Parks serve recreational purposes to an even greater extent than the Landscape Protection Areas. One purpose of Nature Parks is to attract visitors through the combination of a charming landscape scenery and a good tourism and recreation infrastructure. Although Nature Parks consist mainly of Landscape Protection Areas and Nature Protection Areas, tourism was the top priority in the Nature Parks of the old *Länder* until recently (Möller 2004). However, the newly amended Federal Nature Protection Act puts more emphasis than before on the importance of Nature Parks for the conservation of biological diversity and requires the sustainable development of Nature Parks (s. 27 BNatSchG). Nearly all German Nature Parks are in landscapes with a high forest cover.

***Natural Monuments (Naturdenkmale)***

Nature Protection Areas and Natural Monuments have similar intentions. But in the context of the German nature protection laws, Natural Monuments are just small-scale protected areas, which are designated with the aim of maintaining individual natural features (s. 28 BNatSchG). Their function as habitats for wildlife and plants is of secondary importance. In the early days of nature protection in Germany, the term 'Natural Monument' had a broader definition that encompassed areas with the characteristics of today's Nature Protection Areas. It was used for all kinds of objects in the landscape that

seemed worthy of preservation (Wolf 1920). The geographer and natural scientist Alexander von Humboldt (1769-1859) introduced the term 'natural monument' (Naturdenkmal) into the German language in 1819, but it is suspected that the French statesman and writer François René Chateaubriand (1768-1848) used the term 'natural monument' (*monument de la nature*) for the first time in 1805 (Stiftung Naturschutzgeschichte 2002).

***Legally Protected Biotopes (Gesetzlich geschützte Biotope)***

In the synecological context, the terminology 'biotope' means the habitat of a biocenosis, i.e. its inorganic environment (climate, water, nutrients, spatial structures etc.). In the nature protection practice, 'biotope' also includes the vegetation, originally part of the biocenosis, and applies only to certain valuable biotope types. Through the first amendment of the Federal Nature Protection Act, the category Specially Protected Biotope was established in 1986. Since 2002 it is called Legally Protected Biotope (s. 30 BNatSchG). The law named various habitat types that from then on were protected *ipso iure*. The following forest biotopes were included: 'forests of dry-warm habitats', 'swamp and fen forests', 'wet-soil forests' and 'alluvial forests'. During the following years, this new regulation of the federal framework legislation was translated into the *Land* laws. Some *Länder* also preserved the habitat types 'ravine forests', 'block-scree forests', 'shade-slope forests' and 'mire forests'. With an exception of the 'mire forests', which are in any case covered by the type 'mires', these habitat types were also taken up into the federal act in March 2002 (4th amendment of the Federal Nature Protection Act) thereby achieving nationwide protection. Before the amendment, approximately 480 thousand ha (4.5 %) of the German forest area were Legally Protected Biotopes (BMVEL 2001c). Riecken (2002) gives more detailed definitions of the biotopes protected by law.

***Strict forest reserves (Naturwaldreservate)***

Strict forest reserves are mainly located in the state-owned forests, mostly protected just by self-obligation of the forest administration. Depending on the *Land*, the legal bases are the *Land* forest laws, the ministerial ordinances (*Ministerialverordnungen*) or the ministerial orders (*Ministerialerlasse*) (Bücking 2000). Strict forest reserves contribute to forest ecology research and are part of the environmental monitoring of forest ecosystems. Crucial aims are the conservation of habitats and of genetic resources (Bücking 2000). Strict forest reserves are left to free development. No silvicultural intervention takes place and any human impact that can be avoided is excluded. Currently, 781 strict forest reserves exist in Germany. They have a total area of 28,205 ha and a mean size of 36.1 ha. They cover 0.26 % of the entire forest land of Germany (Bücking 2003). So far, Berlin and Bremen are the only *Länder* that have not designated any strict forest reserves.

***Protected forests according to special Land provisions***

Some *Länder* have additionally established nature protection categories to meet the particular conservation aims within forests. For example, forests that have been managed as pasture forests, coppices or coppices with standards in the past should be preserved. This kind of conservation considers the fact that, in comparison with natural forests, management can enrich the forests' biodiversity (v. Oheimb *et al.* 1999). In Appendix 1 the following Protected Forest Area categories according to special *Land* provisions are described in detail: Designed Management Forest (*Schonwald*), Protected Forest Biotope (*Biotopschutzwald*), Natural Managed Forest (*Naturwirtschaftswald*), Light Managed Forest (*Lichter Wirtschaftswald*) and Historico-cultural Managed Forest (*Kulturhistorischer Wirtschaftswald*).

***3.1.1.2 Protective forests***

Unlike the protected forests mainly protected for biodiversity, protective forests are mainly designated with the aim to protect nature or people against detrimental environmental influences and only secondarily with the aim of protecting the forest ecosystems as such. Nevertheless, protective forests can be regarded as Protected Forest Areas because through designation they achieve similar legal protection as the protected forests mainly protected for biodiversity.

***Protective forests according to the Federal and Land forest laws***

Forests and woodland have a great importance for the local climate and the beauty of the landscape. They protect cultural monuments, settlements and people from airborne pollution, light, noise, avalanches and other environmental dangers or irritations. Not the least and in contrast to non-forest soils, forest soils are only little endangered by erosion (BMELF 2000, Möller 2004). Based on these important functions and

according to the Federal and some *Land* forest laws, forest areas can be declared 'protective forests' by administrative act (*Verwaltungsakt*) (Möller 2004) or by ordinance. The forest owners are obliged to manage them in a way that maintains their particular protective functions. The protective forests are assigned mostly to the following common classes: forests with protective functions for/against the local climate, noise, emissions, avalanches, the water, the soil or the coastline. Together with the strict forest reserves the protective forests are the only protection category in Germany which consists exclusively of forest land.

***Protective forests according to the Federal and Land water laws (Water Protection Areas)***

Considering the outstanding importance of the public water supply, forest or non-forest areas, especially close to the reservoirs and wells, can formally be declared Water Protection Areas. The objective of designation is to guarantee a high quality and a sufficient supply of groundwater and drinking water. Forests are especially important in this regard because they have a high water storage and filtration capability. 1,371 thousand hectares of forest, or 12.7 % of the total forest area of Germany, are located in Water Protection Areas (BMELF 1994a). Selection and designation of Water Protection Areas by ordinance falls under the responsibility of the water authorities (Möller 2004). In addition to the provisions of the water laws according to which Water Protection Areas' can be designated, several forest laws enable the forest authorities to protect forests that should mainly serve the protective function for the water by declaring them 'water protection forests'.

***Protective woods and forests according to the Federal and Land road laws***

Those parts of forest and woodland that are declared protective by the road building authorities in the County District Commissions have similar functions and legal status to the forests with protective functions for the local climate and against noise according to the forest laws (Möller 2004). On one hand, it is very difficult to get a permission to clear these woods and forests, but on the other, they are under stress from the exhaust fumes themselves.

#### *3.1.1.3 The European ecological network Natura 2000*

The ecological network Natura 2000 will be composed of sites that include the Special Areas of Conservation pursuant to Council Directive 92/43/EEC (SACs) and the Special Protection Areas pursuant to Council Directive 79/409/EEC (SPAs) (EC 1992). No SACs exist yet as the ecological network is still under construction. They are preliminarily called 'proposed Sites of Community Importance' (pSCIs).

A large proportion of the Natura 2000 sites suggested by the Federal Republic of Germany is covered by forests (BMVEL 2001c). By January 2005, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety had proposed 4,588 Sites of Community Importance and 511 Special Protection Areas for the future network. The proposals contain a total land area of 3,309 thousand ha, i.e. 9.3 % of the total German land area, (SCIs) and 2,570 thousand ha, i.e. 7.2 % of the total German land area, (SPAs) respectively. In addition to these terrestrial areas the proposed sites include marine areas with a total size of 2,217 thousand ha (BfN 2005b).

According to the Federal Nature Protection Act (s. 33 BNatSchG) various possibilities exist to protect Natura 2000 sites at the national level. The protection can be guaranteed by the assignment as legally protected areas pursuant to the nature protection laws. But this method is not necessary if the conservation is secured by other self-obligations, contracts or any administrative regulations (s. 33 [4] BNatSchG). The latter possibilities are connected with much uncertainty and give reasons for discussion.

### 3.1.2 Offences against the protection regulations

Of the protected areas mentioned, Nature Protection Areas, National Parks and Water Protection Areas receive the strictest legal protection. Actions that damage nature within these sites can be punished under the Federal Criminal Code. However, most offences against the protection regulations are just regarded as regulatory rather than criminal offences (Möller 2004).

### 3.1.3 Statistics on Protected Forest Areas in Germany

Several institutions such as the *Land* Forest Ministries, the Federal Ministry of Consumer Protection, Food and Agriculture (BMELF 1994a, BMVEL 2001c), common project groups of the Federal Government and the *Länder* (Volk 2002, Volk & Schirmer 2003) as well as individual scientists (Bücking 2000, Schlott 2004) have committed themselves to collecting data and producing statistics on numbers and areas of Protected Forest Areas. One important hindrance of a meaningful synopsis are the many overlaps of protected areas belonging to

different categories (BMELF 1994a). With the aid of GIS software, it is possible to analyse these overlaps and most *Länder* have started to analyse their protected areas by using this instrument. This work, however, is not nationally co-ordinated. Apart from this, the *Länder* gain information about the proportion of forest in protection categories that comprise forested and non-forested land from the mapping of forest functions (Volk & Schirmer 2003).

German federalism has a significant influence, and the divergent definitions used by the 16 *Länder* make it difficult to produce statistics for the whole of Germany. The meaning of 'strict protection' is disputed and to which categories it refers. Furthermore, there exist sites that are protected by private but not by public measures. The extent to which these privately protected sites can be regarded as Protected Forest Areas at all is controversial. Another inconsistency in terminology across the *Länder* is the term 'Protected Forest Area', which sometimes implies the non-forest biotopes can be situated in forests, and sometimes not.

To obtain figures allowing comparisons across the different situations in the *Länder*, the 'Project group Landscape Management of the Federal Government and the *Länder*' proposed the distinction between the two categories 'core areas of nature protection in the forest' and 'forest areas with an extended nature protection function'. By 2001 twelve of the sixteen *Länder* had been examined, and the 'core areas of nature protection in the forest' in the considered *Länder* included between 6 % and 16 % of the forest area (Volk 2002).

Among all Protected Forest Area types in Germany, the strict forest reserves are the best studied because apart from nature protection, the scientific interest on forest ecosystems is a major motive for their designation. Thus, relevant data on numbers, sizes, total area and other parameters are permanently available. The *Land* statistics on the strict forest reserves are combined by the Federal Agency for Nature Conservation (BfN 2001, 2002a), which also collects and analyses numerous other data on protected areas and nature conservation in general. In parallel, the 'Project group Strict Forest Reserves in the common working group Forest Survey of the Federal Government and the *Länder*' produces separate statistics on strict forest reserves.

In 1937, Walther Schoenichen, head of the State Office for Natural Monument Management from 1922 to 1938 (Stiftung Naturschutzgeschichte 2002), named 207 existing 'forest nature protection areas' (*Waldnaturschutzgebiete*) in Germany (Schoenichen 1937b). Nowadays, however, no such list that gives an overview of all Nature Protection Areas containing mainly forested land exists.

The following table summarises some results of inquiries that were conducted by the Federal Ministry of Consumer Protection, Food and Agriculture among the *Länder* between 1996 and 1999 and aimed at quantifying the protected forest area in Germany.

*Table 1:*
*Protected forest area in Germany (BMVEL 2001c, Federal Statistical Office 2004)*

| Status of protection | Protected forest area (ha) | Protected forest area (% of the total German forest area) | Protected forest area (% of the total German land area) |
|---|---|---|---|
| 1. Total protection | 83,176 | 0.77 | 0.2 |
| 2. Forest area in strict protection categories | 558,538 | 5 | 1.6 |
| 3. Legally protected biotopes | 480,000 | approx. 4.5 | 1.3 |
| 4. Forest areas in all legal protection categories (incl. landscape protection areas and nature parks) | 7,018,880 | 65 | 19.7 |
| 5. Forest areas with minimum protection (according to the forest laws) | 10,740,670 | 100 | 30.1 |

ad 1. no intervention, left completely to free succession: strict forest reserves, core areas of National Parks and Biosphere Reserves; inquiry by the BMVEL among the *Länder* from 1006
ad 2. Nature Protection Areas, National Parks, strict forest reserves (without Biosphere Reserves for the reason that their core areas overlap with Nature Protection Areas);
inquiry by the BMVEL among the *Länder* with the qualifying date 01/01/1998
ad 3. according to the Federal Nature Protection Act and the nature protection and forest laws of the *Länder* (Stand: 20/08/1999)
ad 4. in all formally designated protected areas according to the nature protection laws, the forest laws the water laws or other legal provisions, without overlaps; inquiry by the BMVEL among the Länder with qualifying date 01/01/1998, without Berlin and Bremen
ad 5. minimum protection includes, for example, the prohibition of the conversion of forest land to other land uses and the obligation to proper and sustainable forest management

*Table 2:*
*Protected and protective forest area in Germany according to the MCPFE Classification for Protected and Protective Forest and Other Wooded Land in Europe (MCPFE 2003, Federal Statistical Office 2004)*

| MCPFE Class | | Area (ha) | Area (% of the total German forest area) | Area (% of the total German land area) |
|---|---|---|---|---|
| 1: Main Management Objective 'Biodiversity' | 1.1: 'No Active Intervention' | 90,831 | 0,8 | 0,2 |
| | 1.2: 'Minimum Intervention' | 2,047,591 | 18,5 | 5,4 |
| | 1.3: 'Conservation Through Active Management' | 4,686,038 | 42,3 | 12,4 |
| 2: Main Management Objective 'Protection of Landscapes and Specific Natural Elements' | | 2,424,266 | 21,9 | 6,4 |
| 3: Main Management Objective 'Protective Functions' | | 556,584 | 5,0 | 1,5 |

With regard to the 4th Ministerial Conference on the Protection of Forests in Europe in April 2003 and based on the MCPFE Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe, the governments of the European countries produced comparable national statistics about the areas of protected and protective forests in their countries (MCPFE 2003). In accordance with the data collated by the Federal Ministry of Consumer Protection, Food and Agriculture, 9,805 thousand ha are assigned to one of the three MCPFE Classes for Protected and Protective Forest and Other Wooded Land in Europe. This is nearly the whole German forest area (88.5 %). The MCPFE classes 1 and 2, the management of which aims at biodiversity and the protection of landscapes and specific natural elements, cover together 9,249 thousand ha (83.5 % of the German forest area).

### 3.1.4 Responsible organisations and their procedures

#### *3.1.4.1 State authorities*

Germany is a federal state which consists of 16 *Länder* (states). These *Länder* are responsible for selecting and designating all kinds of Protected Forest Areas. It is possible to distinguish two basic types of *Länder*, the territorial *Länder* and the city-states. The territorial *Länder* are Baden-Württemberg, Bavaria, Brandenburg, Hesse, Mecklenburg-Western Pomerania, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, Saxony, Saxony-Anhalt, Saarland, Schleswig-Holstein and Thuringia. The city-states are Berlin, Bremen and Hamburg. The *Länder* Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia, which acceded to the Federal Republic of Germany in 1990 on German Reunification, are often referred to as 'new *Länder*'. The German *Länder* with their land area, forest area and population are listed in the following table. Figure 2, which follows the table, illustrates the administrative structure of Germany.

Most territorial *Länder* have a three-tiered structure of authorities with the highest *Land* authorities (*Land* ministries) at the top, the Regional Governments (*Bezirksregierungen*) between, and the lower administrative authorities beneath, some of which are also attached to the higher level of the local administration as state interfaces (BMI 1999). The higher level of the local administration is formed by the County District Commissions (*Kreisverwaltungen*) and the municipalities of the towns and cities that do not belong to a county district (*Landkreis*). Depending on the total land area and population, the *Länder* contain between zero and seven regional administrative districts (*Regierungsbezirke*) (Federal Statistical Office 2004). Both the nature protection administration and the forest administration follow this basic structure. At the lower level, the forest administration is fully or partly separate from the County District Commissions, whereas the nature protection administration is not. At this level, the forest administration divides normally into the lower forest authorities in the County District Commissions and into separate forest offices (*Forstämter*).

The nature protection authorities are responsible for selecting and designating protected areas according to the nature protection laws. As a rule, a protected area is fixed by ordinance of the Regional Government or the County District Commission. Only National Parks, Biosphere Reserves and Nature Parks are often founded by ministerial order or even

*Table 3:*
*The German Länder, their land area, forest area and population (BMELF 1992a, BMVEL 2001c, 2004, Federal Statistical Office 2004)*

| State | Land area (1000 ha) | Forest area (1000 ha) (FFI II[1]) | Forest cover percentage (FFI II[1]) | Population (mill. inhabitants) | Population density (inhabitants per sq km) |
|---|---|---|---|---|---|
| **The territorial old *Länder*** | | | | | |
| Baden-Württemberg | 3,575 | 1,362 | 38.1 % | 10.7 | 298 |
| Bavaria | 7,055 | 2,558 | 36.3 % | 12.4 | 176 |
| Hesse | 2,112 | 880 | 41.7 % | 6.1 | 288 |
| Lower Saxony | 4,762 | 8.0 | 168 | | |
| Lower Saxony + Hamburg + Bremen | 4,878 | 1,163 | 23.8 % | | |
| North Rhine-Westphalia | 3,408 | 888 | 26.0 % | 18.1 | 530 |
| Rhineland-Palatinate | 1,985 | 836 | 42.1 % | 4.1 | 204 |
| Saarland | 257 | 98 | 38.3 % | 1.1 | 415 |
| Schleswig-Holstein | 1,576 | 162 | 10.3 % | 2.8 | 179 |
| **The territorial new *Länder*** | | | | | |
| Brandenburg | 2,948 | 2.6 | 88 | | |
| Brandenburg + Berlin | 3,037 | 1,072 | 35.3 % | | |
| Mecklenburg-Western Pomerania | 2,317 | 535 | 23.1 % | 1.7 | 75 |
| Saxony | 1,841 | 512 | 27.8 % | 4.3 | 236 |
| Saxony-Anhalt | 2,045 | 492 | 24.1 % | 2.5 | 125 |
| Thuringia | 1,617 | 518 | 32.0 % | 2.4 | 148 |
| **The city-states** | | | | | |
| Berlin | 89 | 16[2] | 18 %[4] | 3.4 | 3,804 |
| Bremen | 40 | -[3] | 0 %[4] | 0.7 | 1,638 |
| Hamburg | 76 | 3.4[3] | 4 %[4] | 1.7 | 2,289 |
| Federal Republic of Germany | 35,703 | 11,076 | 31.0 % | 82.5 | 231 |

[1] FFI II: Federal Forest Inventory 2001-2002 (BMVEL 2004)
[2] data not from the FFI II but from earlier inventories and calculations (BMVEL 2001c)
[3] data not from the FFI II but from the FFI I (BMELF 1992a)
[4] data from BMVEL 2001c

by law (Louis 2000). The nature protection authorities work out management plans for some Protected Forest Areas.
In the territorial *Länder*, the work of the nature protection authorities is supported by the *Land* agencies for nature and environmental protection. The knowledge they provide helps the nature protection authorities to make reasonable administrative decisions. Moreover, these agencies are responsible for the selection of Natura 2000 sites.
Mostly the *Land* forest administration, namely the forest research institute or the forest planning office, is responsible for selecting, designating and examining the strict forest reserves. Following the tradition of the German Democratic Republic, the nature protection administration performs these tasks in some new *Länder*.

#### *3.1.4.2 Non-governmental organisations*

The non-governmental organisations concerned with Protected Forest Areas are primarily the nature conservation associations and the forest owners associations. Nature conservation associations sometimes manage legally protected areas either with or without payment. They also conserve areas that are not yet legally protected by purchasing the land. Furthermore, according to the Federal Nature Protection Act, certain accredited nature conservation associations have the right to participate in the procedure of designation (s. 60 BNatSchG). The forest owners associations represent the interests of their members, the forest owners, and herewith also of those whose rights on the utilisation of forests are planned to be restricted by putting their forest land under protection.

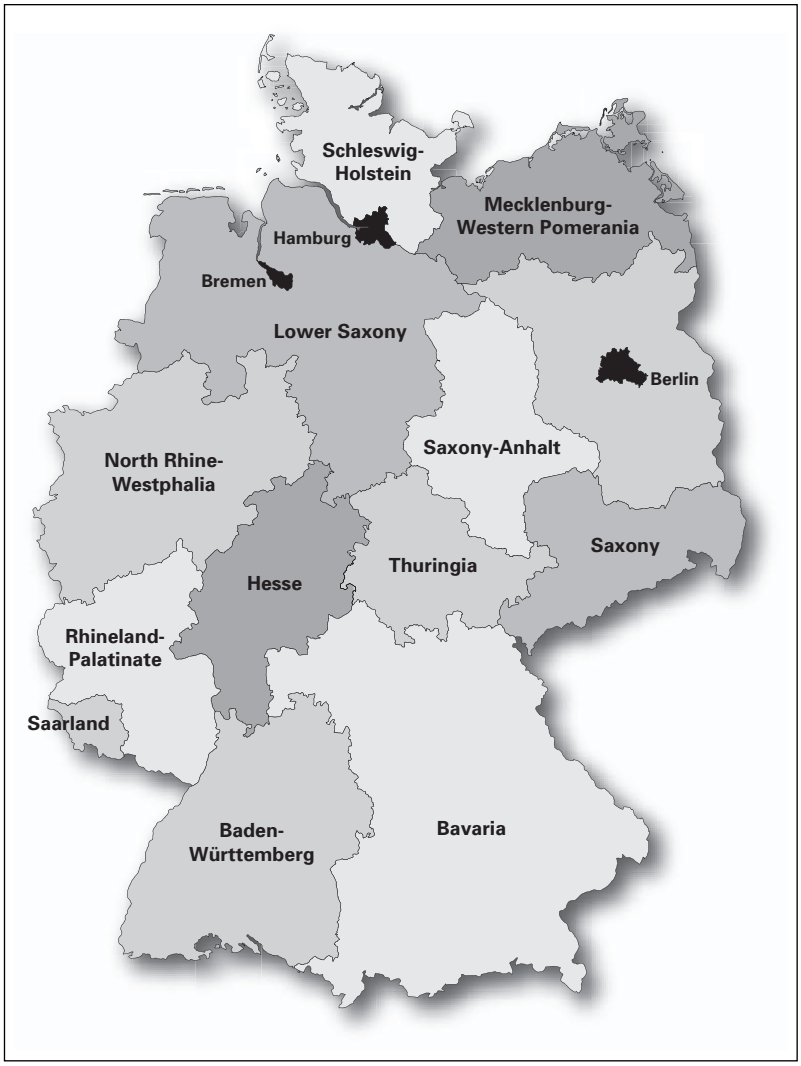



*Figure 1:*
*The* Länder *of the Federal Republic of Germany*

## 3.2. Selection criteria and representativity

### 3.2.1 Criteria for the selection of Protected Forest Areas

There are no standardised criteria for the selection of Protected Forest Areas in Germany. Basically, the criteria are taken from the laws and the other legal norms, which enable the designation of protected areas and in which they are defined. These definitions include the framework requirements and the major criteria for the designations. Apart from this dependence on the law, the responsible authorities have the opportunity to decide autonomously about each designation and take the local conditions, e.g. the threat status of an area, into account. Red lists of animal and plant species as well as of plant communities and habitat types are important instruments in the selection of Protected Forest Areas. They were produced at the regional but also by the Federal Agency for Nature Conservation at the national level (Riecken *et al.* 1994, BfN 1996, 1998, Rennwald 2000).

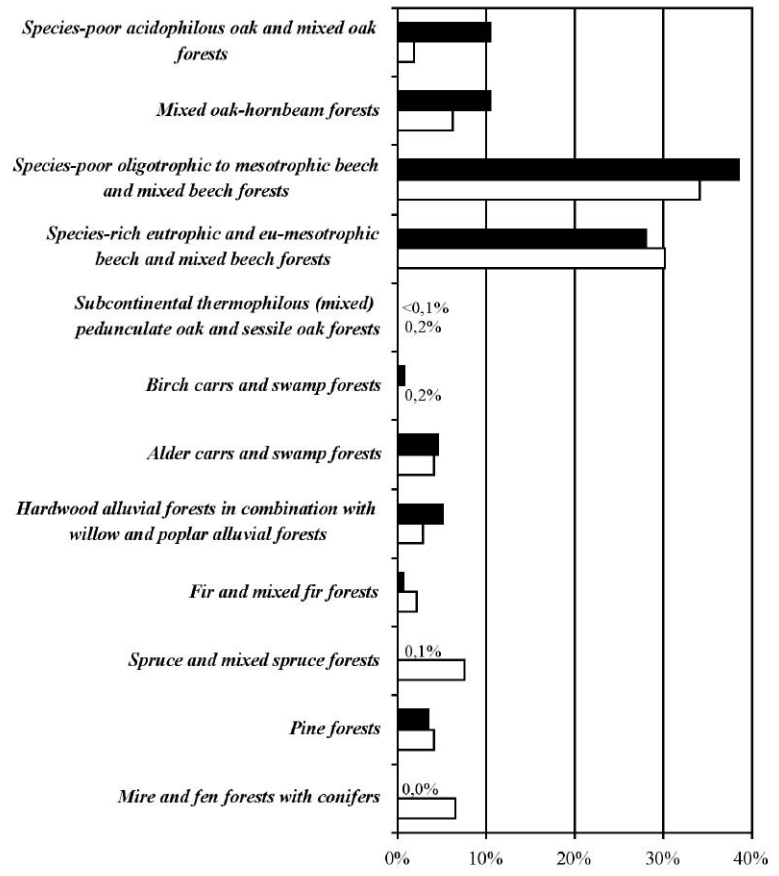
According to the Federal Nature Protection Act a Nature Protection Area is characterised by its rarity, specificity, beauty and importance for scientific, nature-historical and cultural reasons. Additionally, the Nature Protection Area's importance as a habitat of natural wildlife and plants is taken into account.

Especially because strict forest reserves are closely related to research activities, there is an intensive discussion about the criteria for the selection of strict forest reserves. Within this discussion the 'Project group Strict Forest Reserves' worked out recommendations for the selection and the management of strict forest reserves (Projektgruppe Naturwaldreservate 1993). According to Bücking (1995), a forested area has a high chance of becoming a strict forest reserve if it represents one of the regional natural forest vegetation types (i.e. on grounds of representativity) and if it has a close-to-nature structure combined with close-to-nature site conditions. With respect to negative edge effects, size also plays a decisive role in selection.

The criteria for the selection of Natura 2000 sites are described in the appendices of the Habitat Directive (92/43/EEC) and the Birds Directive (79/409/EEC). The Federal Agency for Nature Conservation released a handbook with guidelines for the selection of these areas (Ssymank *et al.* 1998). The "natural habitat types of Community interest whose conservation requires the designation of Special Areas of Conservation" (annex I of Council Directive 92/43/EEC) existing in Germany are described in detail throughout the book.

### 3.2.2 Forest vegetation types represented in Protected Forest Areas

At the moment, only data on the areas of the forest vegetation types in strict forest reserves are available. At least 55 % of the total area of strict forest reserves in Germany are dominated by beech and mixed beech forests (*Fagus sylvatica*), 14 % by other deciduous broad-leaved forests and 18 % by coniferous forests (Fritsche 2001, BfN 2002a). In comparison with their potential natural percentages of the German land area, the German coniferous forest types are over-represented within the strict forest reserves. Moreover, not all of these coniferous forest types represented in the strict forest reserves are potentially natural. Oak forests on acid soils, mixed oak-hornbeam forests and species-poor beech forests do by far not reach their potential natural percentages (see Figure 2).




black bars: proportion of the forest type's area in Germany in relation to the total German land area (34.43 mill. ha) under natural conditions (potential natural vegetation)

white bars: proportion of the actual strict forest reserves' area dominated by the forest type in relation to the total German strict forest reserves' area (28,205 ha)

The predominant forest type of a strict forest reserve represents the entire area of the reserve, even if the reserve contains more than one forest type.

**Characteristic tree species of the forest types:**

- Species-poor acidophilous oak and mixed oak forests:
  *Quercus robur, Q. petraea, Betula pendula, Pinus sylvestris, Fagus sylvatica*
- Mixed oak-hornbeam forests:
  *Quercus robur, Q. petraea, Carpinus betulus*
- Species-poor oligotrophic to mesotrophic beech and mixed beech forests:
  *Fagus sylvatica, Quercus robur, Q. petraea*
- Species-rich eutrophic and eu-mesotrophic beech and mixed beech forests:
  *Fagus sylvatica, Acer pseudoplatanus, Quercus robur, Fraxinus excelsior*
- Subcontinental thermophilous (mixed) pedunculate oak and sessile oak forests:
  *Quercus robur, Q. petraea, Pinus sylvestris*
- Birch carrs and swamp forests:
  *Betula pubescens, Pinus sylvestris*
- Alder carrs and swamp forests:
  *Alnus glutinosa, Betula pubescens, Fraxinus excelsior*
- Hardwood alluvial forests in combination with willow and poplar alluvial forests:
  *Quercus robur, Ulmus spec., Fraxinus excelsior, Tilia cordata, Salix spec., Populus spec.*
- Fir and mixed fir forests:
  *Abies alba, Picea abies, Fagus sylvatica*
- Spruce and mixed spruce forests:
  *Picea abies, Fagus sylvatica*
- Pine forests:
  *Pinus sylvestris, Quercus robur*
- Mire and fen forests with conifers:
  *Picea abies, Pinus sylvestris*

*Figure 2:*
*The potential area of the natural forest types in Germany (black bars) in comparison with the actual area of the natural forest types located in strict forest reserves (white bars) (Bohn 2001, Bohn & Neuhäusl 2000/2003, Bücking 2003, Fritsche 2001)*

### 3.3. Inventories and monitoring

Forest inventories have been conducted for about two hundred years in Germany. Depending on the purpose of examination, certain parameters, mostly concerning forest growth and site conditions, have been assessed. The reference area has usually been the stand, which is the smallest forest management unit. It is defined as a community of trees possessing sufficient uniformity as regards species composition, age and structure, to be distinguishable from adjacent communities (ML 1987). The results of such inventories (*Waldbegänge*), for which the *Land* forest authorities are responsible, have been written down in the forest management plans so far. As a rule, the inventories are repeated every ten years. As almost the entire public forestry sector is obliged by law to produce the forest management plans, basic ecological data on nearly all publicly owned forests are available. However, figures that are representative of the forest structures and the forest conditions in the *Länder* and in Germany can only be obtained by large-scale inventories. Additionally, several small-scale inventories have been developed with the aim of using them for the detailed examination of particular areas. The most important terrestrial inventories of regional or national significance are described in the following.

#### 3.3.1 Large-scale inventories at the national level

***Federal forest inventories* (Bundeswaldinventuren)**
The Federal Forest Inventory I was conducted for the old *Länder* between 1986 and 1990. Data on forest areas, which were graded by types of ownership, tree species and silvicultural systems, as well as on standing volume were gathered. The density of the sample plot grid depending on region was 4 x 4 km, 2.83 km x 2.83 km or 2 km x 2 km (BMELF 1992a, 1992b). After German Reunification, the existing data on the forests of the new *Länder* Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia were analysed according to the principles of the Federal Forest Inventory I (BMELF 1994b). The Federal Forest Inventory I was based on the classic parameters of forest management planning. The Federal Forest Inventory II, which was conducted between 2001 and 2004, examines also ecological parameters to provide, for example, information about the potential natural forest vegetation, the area of Legally Protected Biotopes, the amount of deadwood and the degree of naturalness of German forests (BMVEL 2001a, 2004, 2005). The same sample plot grid as in 1986 to 1988 is used. The first all-German forest inventory since 1937 was under the charge of the Federal Ministry of Consumer Protection, Food and Agriculture, the Federal Research Centre for Forestry and the *Landesforstverwaltungen*[4]. The results of the Federal Forest Inventory II were published at the end of 2004 and the beginning of 2005. The complete data are provided in a database that can be found under the address http://www.bundeswaldinventur.de. One of the main results of the Federal Forest Inventory II is that the German forest area is increasing (BMVEL 2004).

***Nationwide forest damage survey* (Waldzustandserhebung)**

Coordinated by the Federal Government, since 1984 the *Länder* have contributed to the annual forest damage survey. It is part of the environmental monitoring of forest ecosystems and gives information on the health of forests. The condition of the forests is derived from the degree to which the tree crowns are defoliated and discoloured (crown condition assessment). The sample plot density is 16 x 16 km (BMVEL 2002). This so-called Level I Monitoring is extended by the more intensive Level II Monitoring, which is carried out in a network of permanent observation plots for intensive, continuous monitoring. Permanent observation plots can, but must not be chosen from the Level I grid. The monitoring on permanent observation plots comprises different standardised surveys, *inter alia*, in respect of the tree growth, the chemical soil condition, the development of the ground vegetation and pollutant emission.

***Nationwide forest soil inventory* (Bodenzustandserhebung)**
In addition to the annual nationwide forest damage survey, a national forest soil inventory was conducted in Germany between 1987 and 1993, also as a part of the environmental monitoring of forest ecosystems. The forest soil inventory was designed, above all, to investigate the current condition of forest soils, to reveal possible changes in the soil chemical properties in connection with atmospheric depositions, and to derive necessary measures for the conservation and improvement of the soil status of forest ecosystems. The distribution of sampling plots was 8 x 8 km. In addition to chemical soil data, supplementary analyses of needles/leaves were examined (BMELF 1997a, 1997b).

### 3.3.2 Small-scale inventories at the regional level

***Forest site survey* (Standortskartierung)**
The forest site survey is a combined method to assess the abiotic environmental factors that determine the type and the quality of vegetation at a particular place. The site is described by parameters such as the climate, relief and physical and chemical characteristics of the soil (Arbeitskreis Standortskartierung 1996). The methods in the *Länder* are different, but they are based on guidelines worked out by the 'Project group Forest Site Survey of the common working group Forest Survey of the Federal Government and the *Länder*' (Arbeitskreis Standortskartierung 1996). Therefore a lot of data on forest site conditions are comparable throughout Germany. One can derive the potential natural vegetation and the degree of naturalness of the actual vegetation from the information obtained in the forest site survey.

***Forest biotope mapping* (Waldbiotopkartierung) *and mapping of forest functions* (Waldfunktionenkartierung)**
With the intention of assessing the position and size of the most valuable biotopes within forests, especially those that are legally protected, most *Landesforstverwaltungen* have produced forest biotope maps, which will be permanently updated in the future (Arbeitskreis Forstliche Landespflege 1996). Additionally, the *Länder* create overviews of how the several nature conservational, protective and recreational functions are distributed to the forests (Volk & Schirmer 2003).

**Systematic Strata Sampling (*Betriebsinventur*)**
The *Betriebsinventur* is a method of forest assessment which is used in three of the German *Länder*, Baden-Württemberg, Bavaria and Lower Saxony (Arbeitskreis Zustandserfassung und Planung 1990, Niedersächsisches Forstplanungsamt 1994). The sampling unit is the entire forest property. Permanently marked circular concentric sample plots are distributed systematically. Each sample plot represents between 4 and 6 ha. The plots are remeasured every ten years. The *Betriebsinventur* was designed for collecting information on tree species distribution, age classes and standing volume of forest enterprises with a forest management area of more than 1,000 ha. One important disadvantage of the *Betriebsinventur* is that only strata-based and no stand-based information that is needed for management purposes is provided (von Gadow & Schmidt 1998). Despite of this, it is very suitable for monitoring protected areas, such as National Parks, or natural forests with an area of more than 1,000 ha (von Gadow 2003).

***Forest inventories within strict forest reserves***
The inventories in strict forest reserves are very intense and vary depending on the *Land*. Meyer *et al.* (2001) worked out recommendations for data collection and data analysis, aimed at standardisation of monitoring methods in strict forest reserves throughout Germany. The usual interval between the resurveys is ten years (Meyer *et al.* 2001). Not only the forest structure but also other forest ecosystem aspects related to fauna and flora are monitored in strict forest reserves (Thomas *et al.* 1995, Winter *et al.* 1999)

## 3.4. Landscape, spatial and other considerations

### 3.4.1 Conflicts between protection and other forest functions

With 231 inhabitants per square kilometre, Germany is a quite densely populated country (Federal Statistical Office 2004). Moreover, only one third of the territory is covered by forests (11,076 thousand ha) (BMVEL 2004). Consequently, many people make claims on using the forests. Under these conditions, it is difficult to put extensive parts of the German forests under strict protection. Apart from the protective function, the forests must fulfil two further major functions that have to be maintained for the benefit of the public: these are productive as well as recreational. The aim of multi-purpose forest management is even laid down in the Federal Forest Act (s. 1 BWaldG). The actual situation and the future development of Protected Forest Areas is considered in and influenced by different technical plans, such as the general landscape development plan (*Landschaftsrahmenplan*), the general plan of forestry (*Forstlicher Rahmenplan*) and the regional planning programme (*Regionales Raumordnungsprogramm*).

Conflicts between protection and production particularly arise in privately owned forests, which include 43.6 % of the entire forest area (BMVEL 2004). According to the Water Management Act (federal), the state is obliged to compensate forest owners for economic losses that result from restrictions of proper forestry activities within Water Protection Areas (s. 19 [4] WHG). Intending to compensate the owners of other protected areas, the governments of some *Länder*, such as Hesse, North Rhine-Westphalia and Lower Saxony, have introduced the 'contract nature protection'

(*Vertragsnaturschutz*). The idea is that the forest owner is paid by the state for activities or non-activities that conform to the protection aims. However, there are also attempts to introduce mandatory, non-compensatable 'good expert practice' (*gute fachliche Praxis*) as a minimum standard for the integration of nature conservation aspects into forest management (Hofmann *et al.* 2000, SRU 2000, Winkel & Volz 2003).

### 3.4.2 Biotope and Protected Forest Area networks

The Federal Nature Protection Act was revised in March 2002. One new aim that was adopted in law is the construction of a nationwide 'biotope network' (*Biotopverbund*) (s. 3 BNatSchG). By designating new protected areas, including Protected Forest Areas, that shall serve as biological stepping stones, it is planned to connect the protected areas already existing ecologically. The long-term goal is to build up a network consisting of strictly protected areas and covering 10 % of the German land area.
A special Protected Forest Area network has been set up in the Lower Saxony state forests since 1994 (ML 1994). Apart from the 'natural forest', i.e. strict forest reserve, it includes the new protection categories 'natural managed forest', 'light managed forest' and 'historico-cultural managed forest'. These categories provide no legal protection but protection by self-obligation of the *Land* forest administration. Despite of this, some of them are legally protected because they are located in legally protected areas such as Nature Protection Areas.

## 3.5. Future developments

As has been shown, the availability of data on area, size and structure of Protected Forest Areas at the national level is unsatisfactory. The reason for this is not really a lack of data, but rather that the *Länder* follow different ideas concerning the selection, designation and assessment of Protected Forest Areas. The standardisation of the data is, therefore, difficult. A more intense co-operation between the *Länder* in the fields of nature conservation and forestry could improve the situation. For this reason, in the National Forest Programme the Federal Government and the *Länder* agreed on building up a central register of protected areas with the aim to gain a better national overview of the existing protected areas in Germany, their forest area and the overlaps between them (BMVEL 2003).

For the time being, several *Landesforstverwaltungen* have stopped designating strict forest reserves because of economical reasons. In the next years they will focus on the examination of the existing reserves and not any longer on the designation of new ones. However, the construction of the nationwide biotope network including 10 % of the German land area and, above all, the establishment of the Natura 2000 network requires the designation of further Protected Forest Areas in the years to come.

# 4. References

ARBEITSKREIS FORSTLICHE LANDESPFLEGE (ed.) 1996: Waldlebensräume in Deutschland. Ein Leitfaden zur Erfassung und Beurteilung von Waldbiotopen. Mit einer Übersicht der natürlichen Waldgesellschaften Deutschlands. ecomed. Landsberg, 124 pp.

ARBEITSKREIS STANDORTSKARTIERUNG IN DER ARBEITSGEMEINSCHAFT FORSTEINRICHTUNG 1996: Forstliche Standortsaufnahme. Begriffe, Definitionen, Einteilungen, Kennzeichnungen, Erläuterungen. IHW-Verlag. Eching. 352 pp.

ARBEITSKREIS ZUSTANDSERFASSUNG UND PLANUNG IN DER ARBEITSGEMEINSCHAFT FORSTEINRICHTUNG 1990: Stand und Entwicklung der Betriebsinventur auf Stichprobenbasis in der Bundesrepublik Deutschland. Die Verfahren der Bundesländer im Vergleich. Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg. Freiburg.

VON BAHDER, K. & SICKEL, H. 1922: Deutsches Wörterbuch von Jacob und Wilhelm Grimm. Dreizehnter Band. W – Wegzwitschern. Verlag von S. Hirzel. Leipzig.

BARTELS, H. 1993: Gehölzkunde. Einführung in die Dendrologie. Eugen Ulmer/UTB. Stuttgart, 336 pp.

BFN (BUNDESAMT FÜR NATURSCHUTZ) (ed.) 1996: Rote Liste gefährdeter Pflanzen Deutschlands. Bonn-Bad Godesberg. Schriftenreihe für Vegetationskunde 28, 744 pp.

BFN (BUNDESAMT FÜR NATURSCHUTZ) (ed.) 1998: Rote Liste gefährdeter Tiere Deutschlands. Bonn-Bad Godesberg. Schriftenreihe für Landschaftspflege und Naturschutz 55, 434 pp.

BFN (BUNDESAMT FÜR NATURSCHUTZ) 2002a: Daten zur Natur. Landwirtschaftsverlag. Münster, 284pp.

BFN (BUNDESAMT FÜR NATURSCHUTZ) 2005a: Das BfN. http://www.bfn.de

BFN (BUNDESAMT FÜR NATURSCHUTZ) 2005b: Arbeitsschwerpunkte: Natura 2000. http://www.bfn.de

BMELF (DER BUNDESMINISTER FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1992a: Bundeswaldinventur 1986-1990. Band I. Inventurbericht und Übersichtstabellen für das Bundesgebiet nach dem Gebietsstand bis zum 03.10.1990 einschließlich Berlin (West). Bonn, 118 pp.

BMELF (DER BUNDESMINISTER FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1992b: Bundeswaldinventur 1986-1990. Band II. Grundtabellen für das Bundesgebiet nach dem Gebietsstand vor dem 03.10.1990 einschließlich Berlin (West). Bonn, 364 pp.

BMELF (DER BUNDESMINISTER FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1994a: Nationaler Waldbericht der Bundesrepublik Deutschland. Bonn, 94 pp. + appendix.

BMELF (BUNDESMINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1994b. Der Wald in den neuen Bundesländern. Eine Auswertung vorhandener Daten nach dem Muster der Bundeswaldinventur. Bonn, 37 pp.

BMELF (BUNDESMINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1997a: Deutscher Waldbodenbericht. Ergebnisse der bundesweiten Bodenzustandserhebung im Wald von 1987-1993 (BZE). Band 1. Bonn, 141 pp.

BMELF (BUNDESMINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1997b: Deutscher Waldbodenbericht. Ergebnisse der bundesweiten Bodenzustandserhebung im Wald von 1987-1993 (BZE). Band 2. Bonn.

BMELF (DER BUNDESMINISTER FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1997c: Waldbericht der Bundesregierung. Bonn, 54 pp.

BMELF (DER BUNDESMINISTER FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1999: Gesetz zur Erhaltung des Waldes und zur Förderung der Forstwirtschaft – Bundeswaldgesetz (BWaldG) vom 2. Mai 1975, zuletzt geändert durch Gesetz vom 26. August 1998

BMELF (FEDERAL MINISTRY OF FOOD, AGRICULTURE AND FORESTRY) 2000: National Forest Programme Germany. Bonn, 31 pp.

BMI (FEDERAL MINISTRY OF THE INTERIOR) (1999): The public service in Germany. Bonn, 142 pp.

BMU (BUNDESMINISTERIUM FÜR UMWELT, NATURSCHUTZ UND REAKTORSICHERHEIT) 2001: 15 Jahre Bundesumweltministerium – Rückschau und Ausblick, 13 pp. http://www.bmu.de

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2001a: Aufnahmeanweisung für die Bundeswaldinventur II. Bonn, 108 pp.

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2001b: Die biologische Vielfalt des Waldes. Ihre Erhaltung und nachhaltige Nutzung. Bonn, 29 pp.

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2001c: Gesamtwaldbericht der Bundesregierung. Bonn, 102 pp.

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2002: Bericht über den Zustand des Waldes 2001. Ergebnisse des forstlichen Umweltmonitorings. Bonn, 86 pp.

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2003: Nationales Waldprogramm Deutschland. 2. Phase. Vom Nationalen Forstprogramm zum Nationalen Waldprogramm. Bonn. http://www.nwp-online.de

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2004: Die zweite Bundeswaldinventur – BWI$^2$. Das Wichtigste in Kürze. Zu den Bundeswaldinventur-Erhebungen 2001 bis 2002 und 1986 bis 1988. Berlin, 87 pp.

BMVEL (BUNDESMINISTERIUM FÜR VERBRAUCHERSCHUTZ, ERNÄHRUNG UND LANDWIRTSCHAFT) 2005: Bundeswaldinventur_ - Alle Ergebnisse und Berichte. BWI-Ergebnisdatenbank. http://www.bundeswaldinventur.de

BNATSCHG (GESETZ ÜBER NATURSCHUTZ UND LANDSCHAFTSPFLEGE – BUNDESNATURSCHUTZGESETZ) vom 25. März 2002. Bundesgesetzblatt I, 1193-1218.

BOHN, U. 2001: Statistik für die Karte der natürlichen Vegetation Deutschlands. Stand 17.7.2001. BfN. Bonn. MS Excel table.

BOHN, U. & NEUHÄUSL, R., unter Mitarbeit von / with contributions by Gollub, G., Hettwer, C., Neuhäuslová, Z., Raus, Th., Schlüter, H. & Weber, H. 2000/2003: Karte der natürlichen Vegetation Europas / Map of the Natural Vegetation of Europe. Maßstab / Scale 1 : 2 500 000. Landwirtschaftsverlag. Münster.

BROCKHAUS – Die Enzyklopädie in 24 Bänden. Zwanzigste, überarbeitete und aktualisierte Auflage. Achtzehnter Band. RAH – SAF 1998. F. A. Brockhaus. Leipzig, Mannheim, 752 pp.

BÜCKING, W. 1995: Naturwaldreservate in Deutschland. Jahreshefte der Gesellschaft für Naturkunde in Württemberg 151: 41-72.

BÜCKING, W. 2000: Naturwaldreseservate, Bannwälder, Schonwälder. In: Konold, W. *et al.*: Handbuch Naturschutz und Landschaftspflege. Kapitel III-2.2. ecomed. Landsberg, 16 pp.

BÜCKING, W. 2003: Naturwaldreservate. "Urwald" in Deutschland. Bonn. aid infodienst Verbraucherschutz, Ernährung, Landwirtschaft 1473/2003, 66 pp.

BÜCKING, W., AL E., FALCONE P., LATHAM, J. & SOHLBERG, S. 2000: Working Group 1: "Strict Forest Reserves in Europe and Forests Left to Free Development in Other Categories of Protection". In: European Commission: COST Action E4 – Forest reserves research network. Directorate-General for Research. Brussels, 39-133.

CONWENTZ, H. 1904: Die Gefährdung der Naturdenkmäler und Vorschläge zu ihrer Erhaltung. Gebrüder Bornträger. Berlin, 207 pp.

DIERSCHKE, H. 1989: Natürlichkeitsgrade von Wäldern und Forsten. NNA-Berichte 2 (3): 149.

RÖHRIG, E. & BARTSCH, N. 1992: Waldbau auf ökologischer Grundlage. Erster Band. Der Wald als Vegetationsform und seine Bedeutung für den Menschen. Paul Parey. Hamburg und Berlin, 350 pp.

EC (THE COUNCIL OF THE EUROPEAN COMMUNITIES) 1992: Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal L 206, 22/07/1992: 7-50.

ELLENBERG, H. 1996: Vegetation Mitteleuropas mit den Alpen. 5th edition. Eugen Ulmer. Stuttgart, 1096 pp., 4th edition also available in English: Vegetation Ecology of Central Europe. Translated by G. K. Strutt (1988). Cambridge University Press. Cambridge, 731 pp.

FEDERAL STATISTICAL OFFICE 2004: Statistical Yearbook 2004 for the Federal Republic of Germany. Wiesbaden, 775 pp.

FRITSCHE, B. 2001: Gesamtflächen der einzelnen Waldformationen in den Naturwaldreservaten. BfN. Bonn. MS Excel table.

PRESS AND INFORMATION OFFICE OF THE FEDERAL GOVERNMENT 1998: Basic Law for the Federal Republic of Germany. Promulgated by the Parliamentary Council on 23 May 1949 as Amended up to 16 July 1998. Bonn, 139 pp.

VON GADOW, K. (2003): Personal communication.

VON GADOW, K. & SCHMIDT, M. 1998: Periodische Inventuren und Eingriffsinventuren. Forst und Holz 53 (22): 667-671.

GRIMM, J., WEIGAND, K. & HILDEBRAND, R. 1878: Deutsches Wörterbuch von Jacob und Wilhelm Grimm. Vierten Bandes erste Abtheilung. Erste Hälfte. Forschel – Gefolgsmann. Verlag von S. Hirzel. Leipzig.

GROSS, J. 1992: Über die Deutschen. Manesse Verlag. Zürich, 133 pp.

HASEL, K. 1985: Forstgeschichte. Ein Grundriß für Studium und Praxis. Verlag Paul Parey. Hamburg und Berlin, 258 pp.

HAUG, M. 1993: Entstehungsgeschichte des Nationalparks Bayerischer Wald und Entwicklung seit 1969. Schriftenreihe des Bayerischen Staatsministeriums für Ernährung, Landwirtschaft und Forsten 11: 35-86.

HESMER, H. 1934: Naturwaldzellen. Der Deutsche Forstwirt 16 (14): 141-143.

HOFMANN, F., KILL, J., MEDER, R., PLACHTER, H., VOLZ, K.-R. *et al.* 2000: Waldnutzung in Deutschland. Bestandsaufnahme, Handlungsbedarf und Maßnahmen zur Umsetzung des Leitbildes einer nachhaltigen Entwicklung. Materialien zur Umweltforschung herausgegeben vom Rat von Sachverständigen für Umweltfragen 35. Metzler-Poeschel. Stuttgart, 316 pp.

IUCN–WCPA (WORLD COMMISSION ON PROTECTED AREAS) & WCMC (WORLD CONSERVATION MONITORING CENTRE) 1994: Guidelines for Protected Area Management Categories. http://www.wcpa.iucn.org/pubs/publications.html

KLOEPFER, M. 1994: Zur Geschichte des deutschen Umweltrechts. Schriften zum Umweltrecht Band 50. Duncker & Humblot. Berlin.

KLOSE, F. & ORF, S. 1998: Forstrecht. Kommentar zum Waldrecht des Bundes und der Länder. Aschendorff Rechtsverlag Münster/Verlag Dr. Otto Schmidt Köln, 746 pp.

KLOSE, H. & VOLLBACH, A. 1936: Die Naturschutzgesetzgebung des Reiches. Erster Teil. Das Reichsnaturschutzgesetz vom 26. Juni 1935. Verlag von J. Neumann. Neudamm, 116 pp.

KNAPP, H. & JESCHKE, L. 1991: Naturwaldreservate und Naturwaldforschung in den ostdeutschen Bundesländern. In: Bundesforschungsanstalt für Naturschutz und Landschaftsökologie (ed.): Naturwaldreservate. Bonn-Bad-Godesberg. Schriftenreihe Vegetationskunde 21: 21-54.

KÖLBEL, M. 2002: Geschichte der Schutzgebiete in den Staatswäldern Bayerns. In: Bleymüller, H. *et al.* (eds.): 250 Jahre Bayerische Staatsforstverwaltung – Rückblicke, Einblicke, Ausblicke. Mitteilungen aus der Bayerischen Staatsforstverwaltung 51, Band 1: 143-155.

LOUIS, W. *et al.* 2000: Bundesnaturschutzgesetz – Kommentar. 1. Teil. Schapen Edition. Braunschweig, 748 pp.

MANTEL, K. 1990: Wald und Forst in der Geschichte. Ein Lehr- und Handbuch. Verlag M. & H. Schaper. Alfeld-Hannover, 518 pp.

MCPFE (MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE) 2000: General Declarations an Resolutions. Adopted at the Ministerial Conferences on the Protection of Forests in Europe. Strasbourg 1990 – Helsinki 1993 – Lisbon 1998. Liaison Unit Vienna, 88 pp.

MCPFE (MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE) 2003: State of Europe's Forests 2003. The MCPFE Report on Sustainable Forest Management in Europe. Jointly prepared by the MCPFE Liaison Unit Vienna and UNECE/FAO. Vienna, 126 pp.

MEISEL-JAHN, S. 1955: Die Kieferngesellschaften des nordwestdeutschen Flachlandes. Angewandte Pflanzensoziologie (Stolzenau/Weser) 11.

MEYER, P., ACKERMANN, J., BALCAR, P., BODDENBERG, J., DETSCH, R., FÖRSTER, B., FUCHS, H., HOFFMANN, B., KEITEL, W., KÖLBEL, M., KÖTHKE, C., KOSS, H., UNKRIG, E., WEBER, J. & WILLIG, J. 2001: Untersuchung der Waldstruktur und ihrer Dynamik in Naturwaldreservaten. Methodische Empfehlungen erarbeitet im Auftrag des Arbeitskreises Naturwälder in der Bund-Länder-Arbeitsgemeinschaft Forsteinrichtung. IHW-Verlag. Eching, 107 pp.

ML (NIEDERSÄCHSISCHES MINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1987: Anweisung zur Betriebsregelung (Forsteinrichtung) in den Niedersächsischen Landesforsten. Hannover, 55 pp.

ML (NIEDERSÄCHSISCHES MINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1994: Langfristige, ökologische Waldbauplanung für die Niedersächsischen Landesforsten. Runderlaß des ML vom 5.5.1994. Hannover.

ML (NIEDERSÄCHSISCHES MINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN) 1999: Waldprogramm Niedersachsen. Wolfenbüttel. Schriftenreihe Waldentwicklung in Niedersachsen 3, 98 pp.

MÖLLER, W. 2004: Umweltrecht, Wald, Planung, Naturschutz, Jagd u.a. Bundesrecht und niedersächsisches Landesrecht weitgehend kommentiert. Eigenverlag. Hannover, Göttingen.

NIEDERSÄCHSISCHES FORSTPLANUNGSAMT 1994: Anweisung zur Kontrollstichprobe. Betriebsinventur mit dauerhaften Stichproben. Teil 1, 97 pp.

V. OHEIMB, G., ELLENBERG, H. JR., HEUVELDOP, J. & KRIEBITZSCH, W.-U. 1999: Einfluß der Nutzung unterschiedlicher Waldökosysteme auf die Artenvielfalt und –zusammensetzung der Gefäßpflanzen in der Baum-, Strauch- und Krautschicht unter besonderer Berücksichtigung von Aspekten des Naturschutzes und des Verbißdruckes durch Wild. In: Scholz F., Degen B. (eds.): Wichtige Einflußfaktoren auf die Biodiversität in Wäldern. Abschlußbericht eines BML-Verbundprojekts, ausgeführt von den Universitäten Hamburg und Göttingen, koordiniert von der Bundesforschungsanstalt für Forst- und Holzwirtschaft (BFH). Hamburg (Max Wiedebusch). Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft Hamburg 195: 279-391.

PROJEKTGRUPPE NATURWALDRESERVATE DES ARBEITSKREISES STANDORTSKARTIERUNG IN DER ARBEITSGEMEINSCHAFT FORSTEINRICHTUNG 1993: Empfehlungen für die Einrichtung und Betreuung von Naturwaldreservaten in Deutschland. Forstarchiv 64 (3), 122-129.

RENNWALD, E. (ed.) 2000: Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands. Bonn-Bad Godesberg. Schriftenreihe für Vegetationskunde 35, 800 pp.

RIECKEN, U., RIES, U. & SSYMANK, A. 1994: Rote Listen der gefährdeten Biotoptypen der Bundesrepublik Deutschland. Bonn-Bad-Godesberg. Schriftenreihe für Landschaftspflege und Naturschutz 41, 184 pp.

RIECKEN, U. 2002: Novellierung des Bundesnaturschutzgesetzes: Gesetzlich geschützte Biotope nach § 30. Natur und Landschaft 77: 397-405.

RNATSCHG (REICHSNATURSCHUTZGESETZ) 1935, Reichsgesetzblatt I, 821-826.

RÖPER, C. 2002: Vom Steinbruch zum Europäischen Schutzgebiet. In: 150 Jahre Schutz der Teufelsmauer. Halle. Berichte des Landesamtes für Umweltschutz Sachsen-Anhalt SH 1: 12-15.

RÜFFER, O. & MÜLLER, K. 2002: Naturschutz und Privatwald. In: Privatwald in Brandenburg. Entwicklung, Rahmenbedingungen und aktuelle Situation. Eberswalder Forstliche Schriftenreihe 16: 64-71.

SCHLOTT, W. 2004: Schutzgebiete, Waldwirkungen & Forstwirtschaft vor dem Hintergrund veränderter klimatischer Bedingungen. Rechtliche Regelungen – Expertenvoten - Statistische Daten – Simulationskonzept. Dissertation an der Fakultät Wissenschaftszentrum Weihenstephan für Ernährung, Landnutzung und Umwelt der Technischen Universität München. 412 pp.

SCHMIDT, P. A. 1992: Einige Aspekte zum Problemkreis Forstwirtschaft und Naturschutz in der ehemaligen DDR. In: Henle, K. & Kaule, G. (eds.): Arten- und Biotopschutzforschung für Deutschland. Forschungszentrum Jülich GmbH. Berichte aus der Ökologischen Forschung 4/1992: 277-292.

SCHMIDT, P. A., GNÜCHTEL, A., WAGNER, W. & WENDEL, D. 1997: Vorschläge zur Weiterentwicklung des Systems waldbestockter Naturschutzgebiete im Freistaat Sachsen. Landesamt für Umwelt und Geologie (ed.): Materialien zu Naturschutz und Landschaftspflege 1997, 51 pp.

SCHMIDT, U. 2002: Der Wald in Deutschland im 18. und 19. Jahrhundert. Das Problem der Ressourcenknappheit dargestellt am Beispiel der Waldressourcenknappheit in Deutschland im 18. und 19. Jahrhundert. Conte Verlag. Saarbrücken, 433 pp.

SCHOENICHEN, W. 1937a: Urdeutschland. Deutschlands Naturschutzgebiete in Wort und Bild. Erster Band. Verlag J. Neumann. Neudamm, 319 pp. + 96 plates.

SCHOENICHEN, W. 1937b: Urdeutschland. Deutschlands Naturschutzgebiete in Wort und Bild. Zweiter Band. Verlag J. Neumann. Neudamm, 342 pp. + 96 plates.

SRU (Der Rat der Sachverständigen für Umweltfragen) 2000: Umweltgutachten 2000. Verlag Metzler-Poeschel. Stuttgart, 685 pp.

STIFTUNG ARCHIV, FORUM UND MUSEUM ZUR GESCHICHTE DES NATURSCHUTZES IN DEUTSCHLAND (STIFTUNG NATURSCHUTZGESCHICHTE) & RHEINISCHER VEREIN FÜR DENKMALPFLEGE UND LANDSCHAFTSSCHUTZ (eds.) 2002: Naturschutz in der Geschichte. Daten, Personen, Konflikte, Institutionen. Eine interaktive CD-Rom. Königswinter.

SSYMANK, A. *et al.* 1998: Das europäische Schutzgebietssystem NATURA 2000. BfN-Handbuch zur Umsetzung der Fauna-Flora-Habitat-Richtlinie (92/43/EWG) und der Vogelschutzrichtlinie (79/409/EWG). Bonn-Bad-Godesberg. Schriftenreihe für Landschaftspflege und Naturschutz 53, 560 pp.

SUCCOW, M. *et al.* 2002: Die Krise als Chance – Naturschutz in neuer Dimension. Michael Succow Stiftung zum Schutz der Natur (ed.). Findling Buch- und Zeitschriftenverlag. Neuenhagen.

THOMAS, A., MROTZEK, R. & SCHMIDT, W. 1995: Biomonitoring in naturnahen Buchenwäldern. Aufgaben, Methoden und Organisation eines koordinierten Biomonitoringsystems in naturnahen Waldökosystemen der Bundesrepublik Deutschland. Forschungs- und Entwicklungsvorhaben des Bundes. Abschlußbericht. Bonn-Bad-Godesberg. Angewandte Landschaftsökologie 6, 151 pp.

THOMASIUS, H. & SCHMIDT, P. A. 1996: Wald, Forstwirtschaft und Umwelt. Buchwald, K. & Engelhardt, W. (eds.): Umweltschutz – Grundlagen und Praxis Bd. 10. Economica Verlag. Bonn, 435 pp.

UNEP-WCMC (WORLD CONSERVATION MONITORING CENTRE) AND IUCN-WCPA (WORLD COMMISSION ON PROTECTED AREAS) 2005: World Database on Protected Areas. http://quin.unep-wcmc.org/wdbpa/index.htm

UNESCO (ed.) 1995: The Sevilla Strategy for Biosphere Reserves. Drawn up by the International Conference on Biosphere Reserves at the invitation of the Spanish authorities in Seville (Spain) from 20 to 25 March 1995. http://www.unesco.org/mab

VDN (VERBAND DEUTSCHER NATURPARKE E. V.) 2001: Die deutschen Naturparke – Aufgaben und Ziele / The German Nature Parks – Tasks and Objectives. 2. Fortschreibung 2001. Bispingen.

VOLK, H. 2002: Naturschutz und Erholung – Grundlagen für eine neue Leistungsbilanz der Wälder. Schriftenreihe Freiburger Forstliche Forschung 18: 56-67.

VOLK, H. & SCHIRMER, C. (ed.) 2003: Leitfaden zur Kartierung der Schutz- und Erholungsfunktion des Waldes (Waldfunktionenkartierung). Projektgruppe Landespflege in der Arbeitsgemeinschaft Forsteinrichtung. J. D. Sauerländer's Verlag. Frankfurt am Main, 107 pp.

WINKEL, G. & VOLZ, K.-R. 2003: Naturschutz und Forstwirtschaft: Kriterienkatalog zur "Guten fachlichen Praxis". Ergebnisse aus dem F+E-Vorhaben 800 84 001 des Bundesamtes für Naturschutz. Bonn-Bad Godesberg. Angewandte Landschaftsökologie 52, 194 pp.

WINTER, K., BOGENSCHÜTZ, H., DORDA, D., DOROW, W. H. O., FLECHTNER, G., GRAEFE, U., KÖHLER, F., MENKE, N., SCHAUERMANN, J., SCHUBERT, H., SCHULZ, U. & TAUCHERT, J. 1999: Programm zur Untersuchung der Fauna in Naturwäldern. IHW-Verlag. Eching, 61 pp.

WOLF, B. 1920: Das Recht der Naturdenkmalpflege in Preussen. Gebrüder Bornträger. Berlin. Beiträge zur Naturdenkmalpflege 7, 305 pp.

ZERBE, S. & SUKOPP, H. 1995: Gehören Forste zur Vegetation? Definition und Abgrenzung eines vegetationskundlichen und kulturhistorischen Begriffes. Tuexenia 15: 11-24.

ZIELONKOWSKI, W. 1989: Geschichte des Naturschutzes. In: Akademie für Naturschutz und Landschaftspflege (ed.): Ringvorlesung Naturschutz. Laufener Seminarbeiträge 2/89: 5-12.

authors: Jan Carl Welzholz
Institute for Forest Policy,
Forest History and Nature Conservation
Georg August University Göttingen
Büsgenweg 3
D-37077 Göttingen, Germany
E-Mail: jan.welzholz@forst.uni-goettingen.de

Renate Bürger-Arndt
Institute for Forest Policy,
Forest History and Nature Conservation
Georg August University Göttingen
Büsgenweg 3
D-37077 Göttingen, Germany

Winfried Bücking
Forestry Research
Institute of Baden-Württemberg
Wonnhaldestraße 4
D-79100 Baden-Württemberg, Germany

# Appendix 1

## List of the Protected Forest Area types in Germany

| Categories (English) | Categories (German) | Legal Bases | Definitions/Annotations |
|---|---|---|---|
| Nature Protection Area | Naturschutzgebiet | Federal Nature Protection Act and the *Land* nature protection laws | Areas that are protected<br>1. in order to maintain, develop or restore the biotopes or the biocenoses of special wildlife and plant species,<br>2. for scientific, nature historical or cultural reasons or<br>3. because of their rarity, specificity or eminent beauty.<br>All activities that could result in the destruction, damage or alteration of Nature Protection Areas or their components or that could cause their sustainable disturbance are prohibited. |
| National Park | Nationalpark | | Large-scale natural or near to nature areas. The majority of the National Parks' area is left yet or will be left to free succession in the future. In those parts in which the natural balance is deeply disturbed it should be restored by designed management. National Parks are divided into core areas and buffer zones. If it is compatible with the conservation objectives, National Parks should also serve scientific, educational and inspirational purposes. |
| Biosphere Reserve | Biosphärenreservat | | Large-scale areas that<br>- serve as 'living laboratories' for testing out and demonstrating integrated management of land, water and biodiversity on a regional scale,<br>- contribute to the conservation of landscapes, ecosystems, species and genetic variation,<br>- foster economic and human development which is socio-culturally and ecologically sustainable and<br>- provide support for research, monitoring, environmental education, recreation, ecotourism and information exchange related to local, national and global issues of conservation and development.<br>Biosphere Reserves are organised into three zones: 'core areas', 'designed management zones' and outer 'development zones'. |
| Landscape Protection Area | Landschafts-schutzgebiet | | Large-scale areas in which nature and landscape are protected<br>1. in order to maintain, develop or restore the natural balance or the regeneration capability and the sustainable use of the natural goods,<br>2. because of the diversity, the specificity and the beauty or the particular historico-cultural importance of the landscape or<br>3. because of their particular implications for recreation.<br>All activities that change the specific character of protected landscapes and that are inimical to the purposes of protection are prohibited. |
| Nature Park | Naturpark | | Large-scale areas<br>- that are well suited for recreation,<br>- in which the development of sustainable tourism is encouraged and<br>- that serve the restoration, development or restoration of a varied landscape and its biological diversity. |

| Categories (English) | Categories (German) | Legal Bases | Definitions/Annotations |
|---|---|---|---|
| Natural Monument | Naturdenkmal | Federal Nature Protection Act and the *Land* nature protection laws | Single creations of nature or areas up to 5 ha that are protected<br>1. for scientific, nature historical or cultural reasons or<br>2. because of their rarity, specificity or beauty.<br>The elimination of Natural Monuments and all activities that could result in their destruction, damage or alteration are prohibited. |
| Legally Protected Biotope | Gesetzlich geschützter Biotop | | Certain valuable and rare habitat types and plant communities that are protected *ipso iure*. The status of protection is similar to that one of Nature Protection Areas. All interventions that could result in the destruction or other serious or sustainable impairments of the biotopes are prohibited. |
| Protected Forest Biotope | Biotopschutzwald | Forest Law of Baden-Württemberg | Small-scale protection zones reserved for the preservation of rare close to nature forest types, special geological features within forests, ancient forest management types and richly-structured forest edges by directed management or non-interventions. |
| Strict Forest Reserve | Bannwald, Naturwald, Naturwaldparzelle, Naturwaldreservat, Naturwaldzelle, Schutzwald, Totalreservat, Urwald von morgen | Depending on the *Land*, the *Land* forest law, ministerial orders or ordinances | Unmanaged forests reserved for natural processes (natural development). Main objectives: Basic scientific research (fauna, flora, site, stand structure, ecosystem functioning); applied research (silviculture, landscape, management, biotope management); monitoring areas (ecosystem development, biological development, naturalness, reference sites for managed or polluted areas); nature protection (rare and endangered species, genetic resources) and personal nature experience („Virgin Forest of Tomorrow"). |
| Designed Management Forest | Schonwald | Forest Law of Baden-Württemberg | Forests in which the management is designed for the maintenance, the development or the restoration of forest communities with rare wildlife and plant species, special stand structures, special forest biotopes or ancient forest management types. |
| Natural Managed Forest | Natur-wirtschaftswald | Self-obligation of the Lower Saxony forest administration (ministerial order) | Forests that are exclusively managed with tree species of the potential natural forest community. |
| Light Managed Forest | Lichter Wirtschaftswald | | Managed forests that consist mainly of light demanders. They have developed and have been maintained by management. Even if they do not represent the potential natural forest vegetation they should also be managed in the present way in the future. The objective of this management is to secure the habitats' continuity within the growth zone, thereby conserving and enhancing biodiversity. |
| Historico-cultural Managed Forest | Kulturhistorischer Wirtschaftswald | | Small forest areas that are relics of historical silvicultural systems (e.g. coppice and coppice with standards). Within these areas the ancient management types should be revived. The objectives are the protection of biotopes and of species and the maintenance of characteristic features of the cultural landscape. |

| Categories (English) | Categories (German) | Legal Bases | Definitions/Annotations |
|---|---|---|---|
| Protective Forest | Schutzwald | Federal Forest Act and some *Land* forest laws | Forests that should<br>- protect men, wildlife, plants, soils, water, the atmosphere, cultural assets and other movables and immovables against airborne pollution, noise, light, thermal radiation and other impacts,<br>- improve the local climate,<br>- protect the soils against erosion and drying up,<br>- avert avalanches, rockfalls, landslides, floods, snowdrifts, damages caused by storm, forest fires and similar dangers,<br>- protect the banks, the shores and the coastlines against erosion or<br>- serve the conservation of forest genetic resources. |
| Water Protection Area | Wasserschutzgebiet | Water Management Act (federal) and the *Land* water laws | Land areas designated in order to protect the inland waters and the groundwater against any impacts. Water Protection Areas are organised into three zones, in which except from forestry and greenland management any land-use (zone I), building and the use of fertilising and plant protecting agents (zone II) or just the industrial building (zone III) is/are prohibited. The purpose of protection is the supply of clean water for the public. |
| Protective Wood and Forest | Schutzwaldung | Federal Major Road Act and the *Land* road laws | Woods and forests along the federal major roads that should protect the environment especially against noise, exhaust fumes and light. |

# Appendix 2

## Number of protected areas in Germany and its Länder by selected protection categories

*Table A2.1:*
*Number of protected areas by protection categories, part 1*

| | Nature Protection Area | National Park | Biosphere Reserve | Landscape Protection Area | Nature Park | Natural Monument |
|---|---|---|---|---|---|---|
| Baden-Württemberg | 945 | - | - | 1,508 | 6 | * |
| Bavaria | 537 | 2 | 3 | 713 | 16 | * |
| Berlin | 31 | - | - | 48 | 1 | * |
| Brandenburg | 306 | 1 | 3 | 113 | 11 | * |
| Bremen | 17 | - | - | 2 | - | * |
| Hamburg | 27 | 1 | 1 | 43 | - | * |
| Hesse | 744 | - | 1 | 101 | 10 | * |
| Mecklenburg-Western Pomerania | 248 | 3 | 3 | 53 | 5 | * |
| Lower Saxony | 721 | 2 | 2 | 1,464 | 12 | * |
| North Rhine-Westphalia | 1,644 | - | - | 1,960 | 14 | * |
| Rhineland-Palatinate | 487 | - | 1 | 99 | 6 | * |
| Saarland | 87 | - | - | 124 | 1 | * |
| Saxony | 207 | 1 | 1 | 168 | 2 | * |
| Saxony-Anhalt | 180 | 1 | 1 | 63 | 2 | * |
| Schleswig-Holstein | 177 | 1 | 2 | 281 | 5 | * |
| Thuringia | 230 | 1 | 2 | 61 | 1 | * |
| **Federal Republic of Germany** | 6,588 | 13 | 14[1] | 6,801 | 85 | * |
| *state* | *Dec. 1999* | *Nov. 2001* | *Dec. 2001* | *Dec. 1999* | *Dec. 2001* | |

all figures from BfN 2002a
[1] 3 biosphere reserves are located in more than one Land
* existing but number not available
Not only the Protected Forest Areas but all protected areas that belong to the listed protection categories are considered.

*Table A2.2:*
*Number of protected areas by protection categories, part 2*

| | Legally Protected Biotope | Protected Forest Biotope | Strict Forest Reserve | Designed Management Forest | Natural Managed Forest | Light Managed Forest |
|---|---|---|---|---|---|---|
| Baden-Württemberg | * | * | 87 | 3771 | - | - |
| Bavaria | * | - | 150 | - | - | - |
| Berlin | * | - | - | - | - | - |
| Brandenburg | * | - | 35 | - | - | - |
| Bremen | * | - | - | - | - | - |
| Hamburg | * | - | 4 | - | - | - |
| Hesse | * | - | 30 | - | - | - |
| Mecklenburg-Western Pomerania | * | - | 31 | - | - | - |
| Lower Saxony | * | - | 104 | - | * | * |
| North Rhine-Westphalia | * | - | 73 | - | - | - |
| Rhineland-Palatinate | * | - | 60 | - | - | - |
| Saarland | * | - | 11 | - | - | - |
| Saxony | * | - | 14 | - | - | - |
| Saxony-Anhalt | * | - | 15 | - | - | - |
| Schleswig-Holstein | * | - | 119 | - | - | - |
| Thuringia | * | - | 48 | - | - | - |
| **Federal Republic of Germany** | * | * | 781[1] | 377[2] | * | * |
| *state* | | | *Aug. 2001* | *Jan. 2001* | | |

* existing but number not available
[1] Bücking 2003
[2] Baden Württemberg forest administration
Not only the Protected Forest Areas but all protected areas that belong to the listed protection categories are considered.

*Table A2.3:*
*Number of protected areas by protection categories, part 3*

| | Historico-cultural Managed Forest | Protective Forest | Water Protection Area | Protective Forest/Wood |
|---|---|---|---|---|
| Baden-Württemberg | - | * | * | * |
| Bavaria | - | * | * | * |
| Berlin | - | * | * | * |
| Brandenburg | - | * | * | * |
| Bremen | - | * | * | * |
| Hamburg | - | * | * | * |
| Hesse | - | * | * | * |
| Mecklenburg-Western Pomerania | - | * | * | * |
| Lower Saxony | * | * | * | * |
| North Rhine-Westphalia | - | * | * | * |
| Rhineland-Palatinate | - | * | * | * |
| Saarland | - | * | * | * |
| Saxony | - | * | * | * |
| Saxony-Anhalt | - | * | * | * |
| Schleswig-Holstein | - | * | * | * |
| Thuringia | - | * | * | * |
| **Federal Republic of Germany** | * | * | * | * |

* existing but number not available
Not only the Protected Forest Areas but all protected areas that belong to the listed protection categories are considered.