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

Country Report - Austria

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

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Abstract. The COST Action E27 was started in the year 2001 with the aim of delivering a comprehensive overview of European Protected Forest Areas. The objective of Working Group 1 of COST E27 is to give a description of the historical background that has led to the development of particular national protected forest area frameworks. The Austrian paper concentrates on the following subjects: categories of protected forest areas in Austria (e.g. nature reserve, protected landscape, natural monument, national park), the characteristics of different categories of managed forests (e.g. protection forests), and hemeroby of forest ecosystems (i.e. the degree of anthropogenic influence on forests, or the unnaturalness of forests). The legislative processes on the conservation and protection of nature began centuries ago with decrees against over-exploitation of forests, paving the way for the protection of individual natural monuments in the 19th century and, later on, for conservation laws on the protection of landscapes and complete ecosystems. Austria does not have only one Federal Nature Protection Law. In contrast, at the regional level there are 9 different nature protection laws in force, resulting in a huge number of separate (but similar) categories of protection areas. For the first time, a study of the Austrian Federal Environment Agency enables a classification of protected forest areas of all Austrian provinces according to the criteria of the Ministerial Conference on the Protection of Forests in Europe (MCPFE).

Keywords: Nature conservation, protected forest areas, natural forest reserves, hemeroby of forest ecosystems, categories of protected areas, Austria

1. Introduction

Almost half of the Austrian territory (47 %) is covered by forests. The country is characterised by a mostly mountainous landscape, which has been used intensively for centuries. These conditions have led to a fine-scaled mosaic, varied cultural landscape. About two thirds of the national territory are covered by the Alps, which contributes to the special characteristics of the forests and their history, but brings with it also the need for special protection measures.

Forests shape the landscape and therefore, many protected areas in Austria include forests and conservation laws often deal with issues connected to forests. This paper describes the characteristics and

the protection of forests in Austria, as well as a short overview of forest history and the background to both nature protection and forestry legislation in Austria.

Forests are important parts of the landscape, but the reasons they are protected are often only indirectly linked to the forest *per se*. For example the aim is often the conservation of the landscape, i.e. scenery in its current form. Hence, the present land uses may not be legally restricted, but there may be a ban on clear cutting, the use of certain species or limits on the construction of roads in the forest. An advantage of the complex system of nature conservation in Austria is the great variety of possible conservation categories and protection goals. The disadvantage is that terms and categories may be used in ways that do not correspond well to how they are used elsewhere.

1.1 Definition of forests

Forests

Forests in the sense of the Austrian Forest Act - as amended in 2002 - are areas covered with forest tree species listed in the annex of the law, with a minimum area of 1,000 m^2 and an average width of 10 m. Forests in the sense of this law also include areas in which the tree cover is temporarily reduced or removed, for example following harvesting.

Protection forests

About two-thirds of the surface of Austria are covered by the Alps, a fact which brings about specific characteristics of forests and forest history, but requires also special protection measures.

According to the definition of the Austrian Forest Act, § 21 (Jäger 2003) protection forests are split into

(1) forests which protect the sites on which they are located, for example all forests on soils which, without a forest cover, would be eroded by wind, water and weathering, and where reafforestation would be possible only under difficult circumstances.
(2) forests which protect man, human settlements and buildings, or cultivated ground against natural risks or damaging environmental impacts and which need special treatment to secure their protective or beneficiary functions.

Protection forests declared by decree (Bannwald)

The term "Bannwald" is used in Austria – different to Germany – when a recipient benefits directly from a protective function and the forest is declared a protection forest by official decree. Depending on the characteristic features in the respective protection forest, the official decree can, on the one hand limit particular forms of utilization (e.g. prohibition of forest pasture, logging only on frozen soil etc.) or, on the other, prescribe certain measures (e.g. the introduction of regeneration through felling of individual trees). Costs have to be borne by the beneficiary. The declaration as "Bannwald" therefore reduces the financial burden on the forest owners, where costly measures would only be of advantage to another party. Also, many forests in Austria have a protective effect but do not fulfil an essential criterion of protection forests, namely the formal act of being put under a ban which establishes the beneficiary's obligation to finance silvicultural measures. The reason for this may be the complex legal procedure of declaring forests as "Bannwald" (Frank et al. 1998).

1.2. General Information about Austrian forests

The following data are taken from the Austrian Forest Inventory 2000-2002, (Bundesamt und Forschungszentrum für Wald 2004).

Table 1: General statistics for Austria's forests

Austria's national territory	**8,385,000 ha**
Forest area at present	3,960,000 ha
Wooded area in percentage of the total area	47.2 %
Population density	96/km2
Forested area per inhabitant	0.49 ha

Since the start of the Austrian Forest Inventory in the year 1961 the forested area has steadily increased in Austria.

Nearly 20 % of the Austrian forests are protection forests. Many of these give no commercial yield (Table 2) because of steep slopes in the Alps and high costs of forest harvesting.

Table 2: Silvicultural management methods (percentage of total forest area)

Silvicultural management methods	**%**
Production forests	75.2
Protection forests with commercial yield	7.6
Protection forests without commercial yield	11.9
Forested area without commercial yield	3.0
Coppice stands	2.3
TOTAL	100.0

In Austria, only 18 % of the forests are publicly owned and 53.8 % of the forest properties are smaller than 200 ha. The average size of all forest properties is about 17 ha. This fact has a strong influence on the selection of protected forest areas (Parviainen & Frank 2003).

Table 3:
Types of ownership (percentage of total forest area)

Types of ownership	%
Private forests (<200 ha)	53.8
Private forests (>200 ha)	31.3
ÖBf-AG (State-owned forests)	14.9

Austria's forests are naturally conifer-dominated. This has been increased to some extent through human activity for economic reasons (compare Table 4 and 5), but the extent of conifer dominance has been declining over the last decade.

Table 4:
Main tree species (percentage of production forest area)

Main tree species	%
Picea abies	53.7
Pinus sylvestris	4.9
Larix decidua	4.6
Abies alba	2.3
Other coniferous species	1.4
CONIFEROUS SPECIES	**66.9**
Fagus sylvatica	9.6
Quercus sp.	2.0
Other broadleaf species	12.3
BROADLEAF SPECIES	**23.9**

The rest of 9.4 % are gaps or shrub areas.

Table 5:
Main natural forest communities presumed (percentage of the total forest area)

Main Natural Forest Communities (presumed communities if there was no human influence)	%
Norway spruce dominated communities	15
Norway spruce- silver fir communities	14
Norway spruce- silver fir- beech communities	29
Beech dominated communities	12
Oak dominated communities	11
Others	19

Broadleaved forests and mixed forests with a high percentage of broadleaved trees have increased, whereas pure coniferous stands have decreased. Silver fir is endangered mainly by lack of natural regeneration, caused by game browsing, and management practices that favour Norway spruce.

Table 6:
Species mixture in Austrian Forests (percentage of the production forest area)

Species mixture in production forests	%
Pure stands:	
Proportion of coniferous trees > 0.8	62.2
Proportion of broadleaved trees > 0.8	12.5
Mixed stands:	
Proportion of coniferous trees 0.6 - 0.8	14.7
Proportion of broadleaved trees 0.5 - 0.8	10.6

The diversity of **forest biotopes** in Austria is relatively high: about 90 forest biotope types can be found. Some of the forest biotopes, especially riparian woodland biotopes, are threatened with extinction; 20 biotope types have been categorized as "endangered" and 28 as "vulnerable". The forest biotopes of higher altitudes tend to be less threatened (Essl et al. 2002).

The threat classification corresponds to the results of the study entitled "Hemerobie österreichischer Waldökosysteme" (Hemeroby of Austrian Forest Ecosystems; Grabherr et al. 1998; see chap 1.3). Many of the forest biotope types that are not threatened or under lower degrees of threat represent biotope types commonly found over large areas. Nearly all biotope types listed in the highest threat categories are rare forest biotope types. A similar situation prevails in the neighbouring Central European countries (Essl et. al. 2002).

The Austrian *Forest Development Plan* reflects societies' expectations of the forests (Frank et al. 1998). In total, 19 % are protective forests, of which 7 % give a commercial yield, 12 % not. This includes the forests whose function is to protect human settlements and infrastructure against natural hazards like avalanches, floods, rock fall or landslides, and those protecting the site itself against soil erosion. Because of very steep terrain and harsh site conditions, 182,000 ha (5 %) of the protective forests are without any commercial yield and are inaccessible to people; they can be considered similar to natural forests (Bundesamt und Forschungszentrum für Wald 2004, p. 10). This means that 12 % of the forests are equivalent to the same protection regime as totally protected forests, they are *de facto* left for free development.

Norway Spruce is the dominant woody species in these protection forests with *Pinus mugo, Larix decidua, Pinus cembra* also important. However, only 63 % of the protection forest areas are in a stable

condition. Regeneration is very often insufficient because of game browsing and grazing (Bundesamt und Forschungszentrum für Wald 2004, p.21-22) because there is no specific game management in these areas. Also these forests do not include representatives of all the large variety of forest types in Austria. So, while we could simply declare these unexploitable protection forests as protected forests, they are not part of the Natural Forest Reserves Programme (Frank 1997).

1.3. Hemeroby of Austrian forests

As in other European countries with a large proportion of forests, the level of naturalness in the forests is important both in commercial forestry and in nature protection. In Austria, in 1995, a project was launched to assess the naturalness of, or its converse the degree of human impact on, the Austrian forest as a whole, and for forests of particular regions (Koch & Grabherr 1998). The effects of silvicultural treatments, impacts of cattle grazing, browsing by game, tourism and other kinds of man-made impacts on forests were analysed. A specific set of criteria and indicators were developed such as current and potential tree composition, ground vegetation composition (including indicators of human-induced disturbance), intensity of harvesting practices, amount of deadwood and others. Data collection was linked with the systematic sample grid of the national forest inventory. Using a method of logical combination the single characters are aggregated to a synoptic value reflecting the degree of hemeroby of the site (Grabherr et al. 1998).

Results indicate that 3 % of Austria's forests have not been subject to significant human impact, and 22 % can be classified as semi-natural. Natural forests are located in the Central Alps as well as in the northern and southern peripheral zones of the Alps with mainly limestone dominated sites. Forests classified as "moderately altered" cover a proportion of 41 %. These forests are all commercially exploited, yet the potential natural vegetation is at least partly present. 27 % are classified as being "altered" and 7 % as "artificial". These stands have been intensively exploited and their tree species composition does not reflect the original natural conditions.

The study also shows which regions have been affected most by human impact and where natural or semi-natural forests no longer remain, particularly in the peripheral zone and outside of the Alps. Here the potential natural forest communities would predominately be mixed beech and oak forests, but in the areas potentially dominated by Silver Fir (*Abies alba,* Mill.). In these areas the establishment of representative natural forest reserves has been insufficient until now. Specific selection approaches will be needed to establish natural forest reserves in bio geographic regions covered originally by forest communities dominated by Silver Fir.

Deadwood in forests has been assessed by the Austrian National Forest Inventory for the last two inventory periods. The overall number of standing dead trees is 57.1 per ha (5.4 % of all stems) but the standing volume of deadwood is only 6.1 m^3 per ha (1.9 % of the living volume). The average amount of coarse woody debris (≤ 20 cm diameter) is 1.0 m^3 per ha (Bundesamt und Forschungszentrum für Wald 2004).

A dense network of forest roads is a prerequisite for close to nature forest management. The average length of forest roads in production forests is 35.4 m per ha (Winkler 1997).

1.4. Legislation background

Forestry and forest management are within the competence of the Federal Government. Legal requirements are covered by the Forest Act (BGBl. 440/1975 idF 59/2002). The nine Federal Provinces have legal authority regarding legislation and implementation of provisions in the field of nature and landscape protection. Hence, Austria does not have one Federal law on the protection or conservation of nature but nine provincial jurisdictions. Legally the Federal Government is not responsible for the protection of nature, with the exceptions of international agreements, relevant European Commission programmes, and supporting the provinces in the establishment and management of national parks.

2. History of Protected Forests in Austria

The state of biodiversity of Central European forests, in particular those of the Alpine region, cannot be fully understood without taking into consideration the long-term forest succession on the one hand and the history of settlement and human impact in the region on the other hand.

Austrian forests were much more intensively exploited by people in the past than they are today. Wood was not only an important construction material, but also the main source of energy. Entire valleys were extensively clear-cut to cover the energy demand of the iron and steel industry, the salt works and the firewood demand of the flourishing towns. As a result of permanent pasturing and removal of forest litter over hundreds of years, the original forests were transformed into open, park-like landscapes in many areas. Many forest ecosystems have not recovered from that intensive agricultural exploitation.

Virgin forests without significant anthropogenic impacts have survived only in areas which are either inaccessible or not well-suited for agricultural use because of their difficult terrain and soil conditions. Hence reserves were formerly established mainly at montane and subalpine levels, and particularly in the Limestone Alps. Untouched forests preserved in the Alpine region are limited to a few hundred hectares in unexploitable areas (Diaci & Frank 2001). Except in the Alps and the inaccessible mountains of the Carpathians and the Balkan range no true virgin forests have remained in Central Europe.

2.1. Earliest occurrences of forest areas with some form of protection

For centuries the natural resources in central Europe have been increasingly used by an ever-growing number of people. Early laws on hunting, fishing and timber extraction were necessary to provide the sustainable use of natural resources, for example the prohibition of forest utilization to protect specific birds such as the sparrow-hawk (Carinthia 1514) or game animals such as the ibex (Salzburg 1499). The protection of certain tree species dates back to 1492 (Tyrol) and 1511 (Vienna Forest) and the regulations include the prohibition of forest grazing and clearings for agricultural usage. By the beginning of the 16th century protection forest were established to avoid avalanches falling on the villages below them (Tyrol 1517, Carinthia 1518).

The increase in alpine mining and salt production lead to disastrous deforestation and consequently huge and frequent natural disasters (landslides, floods) and a shortage of timber and fuel wood. In 1524, the archbishop of Salzburg, a province heavily affected by this, signed a law to ensure the sustainable use of forests to supply the mining industry. These early laws which were introduced to ensure constant quantities of timber and not the ecological quality of the natural forest can nevertheless be seen as the first forms of protection of landscapes.

2.2. Cultural and religious aspects

Myths and rites focusing on old trees have their roots in the close interrelationships between people and forests before christianity. Some of the early regulations to protect woodland and trees can therefore be traced back to old myths. In particular, oak and lime-trees received special attention and protection until the Middle Ages. Tall stems symbolized old age, long life, strength and permanent growth. Oak and other trees bearing fruits were associated with fertility, coniferous trees were also symbols for everlasting life. In Austria even today trees play an important role in traditional customs (e.g. Maypole, Christmas)

2.3. Protection of forests against over-exploitation – close to nature-management - Social and aesthetic motives for the protection of forests

In the second half of the 19th century the substantial migration of rural people towards industrial sites contributed to the rapid expansion of industrial centres. People became separated from their former traditional way of living and lost the close relationship to nature. This alienation led to a remarkable social change resulting also in a rethinking of human attitudes towards nature.

The “return to nature” as proclaimed in art became apparent also in the spirit of the whole period and in the conduct of life. While on the one hand there was an increasing impact on nature caused by human industrial activities, at the same time extensive outdoor stays were considered necessary and beneficial for mind and body. Therefore it was thought that forests should be opened for recreational purposes to everybody. In the 1880s a social stratum living in urban areas not directly deriving economic advantage from forest utilisation nonetheless picked up the idea of nature protection. This movement was connected very closely to the development of Alpine tourist clubs. Along with the appreciation of cultural, historical and scientific importance of natural phenomena, the idea of nature conservation was taken up by different social groups in Central Euro-

pean countries simultaneously. Both the individual and the state were seen to have a role, and in consequence, legislation and administrative mechanisms were developed to express this deeply-felt general need. Forests should be protected in their own right.

In the 1880s the aesthetic aspects of forestry were introduced as an independent topic into literature. Forests were considered not only as an economic property, cultivated to produce a certain yield, but also as a source of pure enjoyment. Through the demands of society, silvicultural measures, expressed in the term "aesthetics of forestry", should protect the natural beauty of landscapes.

A suite of measures, necessary for forest management to comply with social claims was proposed at the International Agricultural Congress in Vienna in 1907. Thereby the term 'conservation of natural monuments' in its originally narrow meaning was extended to cover examples of landscape protection according to aesthetic principles in recreational forests and forests near big cities, holiday resorts and spa towns. The representatives of forest teaching as well as forest practice regarded landscape conservation as an important task alongside the intention to gain the highest profit margin from the forest.

The following criteria were considered to achieve the aesthetic goal:

The choice of

- how to cultivate the soil,
- how to utilize it
- the preferred tree species
- how to regenerate the forest
- how to improve the stand;
- the design of the forest road network,
- the spatial order of the forest stands and
- a series of measures to improve the aesthetic aspects of the forest taking into consideration the aesthetic value of meadows, hedges, water and fences.

The management of forests regarding the cultivation of beauty took two different courses: on the one hand the avoidance of the abuse of nature (close-to-nature silviculture), and on the other hand the implementation of the principles of art (maintenance of old trees, upkeep of nature monuments, cultivation of shrubs).

Natural monuments included natural formations of watercourses, trees and rocks. The desire was fulfilled by individual legislation for particular provinces of Austria. Foresters could promote the above efforts by finding, choosing, naming and supervising such objects on a voluntary basis.

Natural stands which contained species threatened by extinction were to be excluded from exploitation and especially protected. Virgin forests, swamps and habitats of rare plants were worthy of such special protection. However the "Reichsforstgesetz" (Imperial Forest Law) of 1852 contained no rules on the management of forests according to ethical or aesthetic principles. It was up to the individual to make a choice. Hence it was due to the initiative of some especially devoted forest-owners that habitats of rare plants received special protection. By the 1900s six privately-owned nature forest reservation areas, where utilisation was stopped, existed in the former Austro-Hungarian Monarchy.

In 1911, in Germany as well as in Austria, an appeal to found nature reservations was made by a society of eminent persons, especially founded for this purpose. The main task was the preservation of typical landscapes including their fauna and flora, based on the example of the USA. In 1911, the project for the creation of a high-altitude natural park in the Austrian Alps had made significant progress, but World War I prevented the implementation of the plan. The idea was taken up again in 1918 when an area of about 4,000 ha was donated by a private forest owner to the German-Austrian Alpine Association for the purpose of establishing a National Park which came into being at the end of the 20th century in the Austrian Alps (National Park Hohe Tauern).

2.4. Evolution of protected areas

In the 19th century the attitude towards nature started to change. Tourists began to visit the Alps and easy access was provided by newly built railroads. People began to be fascinated by natural landscapes and vegetation. The first plant protected by law in Austria was the Edelweiss (*Leontopodium alpinum* Cass.) in the province of Salzburg 1886. In the following years several laws were introduced to protect birds, alpine plants and natural monuments (e.g. ancient trees, caves and valleys). During this period of legislation, predominantly single species were protected but not their habitats. The knowledge about the ecological processes, which would have been necessary for the understanding of the ecosystematical relationship between species and habitats, was limited at this time.

In 1926, Lower Austria was the first province that enacted a conservation law. These first conservation laws protected the complete landscape; the scenery, rare plants and animals, and for the first time nature reserves were defined through a decree of the provincial government. These areas had to be rich in natural monuments or important for research.

In 1939, the German conservation law held legal force, until the provinces independently introduced new conservation laws again, after 1945. Together with the new regulations some province specific categories of protected areas were developed (e.g. protected parts of landscape and nature parks). Recently, within the various categories, strategies changed from strictly endangered species protection to a system with diverse conservation possibilities. Hence, whole habitats can now be protected by decree. In addition, the recent nature conservation laws include a general obligation to obtain permission for the use of selected ecosystems such as wetlands, nutrient-poor meadows and the alpine glaciers. Projects listed in the conservation laws such as construction of buildings, fences, gravel pits, artificial ponds e.t.c. have to get permission for using areas of non- built–up land. Permission is only granted when the natural balance and the character of the landscape is not negatively affected.

International and EU-initiatives are becoming more important in Austria (NATURA 2000 and Ramsar sites). Currently there are 11 Ramsar sites in Austria designated through the convention on wetlands of international importance. The protected regions are quite big, up to 118,000 hectares, and include different categories of conservation.

2.5. Tradition of voluntary forest protection in Austria

The protection of remnants of virgin forests, which were located mainly in the Northern and Southern Limestone Alps was initiated in the last century by forest-owners that were responsible for them. Maintenance of nature for future generations was a key priority at this time. From the very beginning, private forest-owners have played a major role in the establishment of natural forest reserves, which did not take place exclusively in State forests. The establishment and maintenance of natural forest reserves has been ongoing for several decades. The process was undertaken and promoted by a few outstanding scientists, forest owners, and forest practitioners, albeit not within the framework of a national programme. Since 1965, new activities have been undertaken in relation to scientific activities in reserves. Even at this early stage, efforts were made to build up a network of natural forest reserves, which would eventually represent all important forest communities in proportion to their significance. (Mayer et al. 1987, Zukrigl 1990).

Examples of outstanding initiatives included the designation of primarily small areas (termed natural forest stands), through private law-contracts concluded by the forester's association of the Tyrol with private or communal forest owners. The establishment of natural forest reserves located close to the city, by the Municipal Forest Department of Vienna, was also a far-sighted achievement. In 1986 a contractual agreement, also based on private law, was arranged between the University of Agricultural Sciences and the Austrian State Forests, to make the reserves located on State forest properties available for research.

3. Current state

3.1. Main types of PFA, responsible organisations and procedures

3.1.1. Legislative structure

There exists no national legislation for nature conservation and the 9 provinces execute 9 different nature conservation acts. They contain an additional 14 different protection regimes of which only three exist in all provinces, and also have different legal requirements.

Therefore, no common aim of conservation for the whole Austrian legislation can be stated. Despite the differences, the nine conservation laws have the same principles. How strictly an area is protected within a specific category is determined by provincial law and the specific ordinance. Restrictions relevant to forests are:

- **Area use regulations:** such as bans on forest utilisation
- **Regulations of forest management activities: for example use of** natural regeneration, limitations on tree species composition, specification of individual tree selection or strip-femel use only etc., prohibition of clear-cutting.
- **Bans or restrictions on the use of means of production:** for example on the use of chemicals (fertilizers or pesticide)

- Bans or restrictions on building and construction: for example the construction of fences, roads and everything that would affect the natural water supply.
- Bans or restrictions on hunting: Hunting may only be permitted at certain times and for defined species, or only with permission of the provincial government

Legal framework to protect an area

In each Austrian province there are at least 5 different categories to protect an area by decree of the provincial government. Normally local NGO's, private persons or the civil service apply at the provincial authority for the protection of a new area. After the importance of the area has been verified by an expert of the local government, the adjustment of the legal requirements (including the exceptions to any restrictions as laid down in the relevant conservation law), and the category of protection of the area concerned are defined by ordinance. In this way, the strictness of the protection of an area is defined. The motivation to protect an area can vary; from classical species and landscape protection to the protection of whole ecosystems and land use planning reasons. Owners of the protected areas receive financial compensation from the provincial authority, but only if a loss of money can be proved at the time of the establishment of the protected area. Today around 1,100 protected areas are designed by means of ordinance.

Recently, a new form of conservation has gained in importance. Nature conservation agreements under private law have increasingly contributed to nature conservation in Austria. After Austria signed the Resolutions of the Ministerial Conference for the Protection of Forests in Europe, in particular Resolution H2, General Guidelines for the Conservation of the Biodiversity of European Forests, in 1993, in Helsinki, a national programme for the Establishment of Natural Forest Reserves was initiated. Under this programme, new reserves are generally not established by decree, but on the basis of private-law contracts between the Republic of Austria and forest-tenants.

The "Mountain Forest Protocol" to the "Alpine Convention" involves the legally binding commitment to establish natural forest reserves. In Article 10 the parties commit themselves to establish natural forest reserves in sufficient size and amount and to treat them in an appropriate way to ensure their natural dynamics. The "Mountain Forest Protocol" explicitly provides the legal basis for the necessary co-operation in planning and establishing cross-border reserves.

In 1995, the Austrian Federal Forest Research Centre, scientists and stakeholders instituted the Austrian Nature Reserve Programme to develop a representative network of natural forest reserves for all Austrian forest communities. Scientific work in the network shall, *inter alia,* provide the basis for the development of a more ecological orientated form of silviculture. The administration and financing is done by the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The set-up of a new reserve follows a standardised method after the valuation of the area according to 8 criteria (composition of vegetation, structure of stand, size, topographical situation, rareness, buffer zones, impact of streets, forest roads and game). Private contracts with every single owner are signed for a period of 20 years. The owner agrees to stop all utilisation of the forest with the exception of hunting. By December 2002, 180 natural forest reserves with an area of 8,272 ha had been established.

BIOSA (Biosphere Austria, Society for Dynamic Management of Biotops), a private society of land and forest owners, dedicates voluntarily parts of their land for scientific projects. At the moment, approximately 1,700 ha of rare types of vegetation (wetlands, Alpine pastures and forests) are available for scientific work. BIOSA is financed by private sponsoring, public subsidies and the membership fees.

Through the EU co-financed program (Austrian Program on Rural Development; Österreichisches Programm zur ländlichen Entwicklung) implemented with the Agenda 2000, financial compensation can be paid for afforestation, hedges, retention of dead wood etc.

Although in the last few years the trend has been towards voluntary initiatives in nature protection the majority of protected forest areas still depend on protection by decree.

The following remarks refer to Protected Areas in general, not just those containing forests. A project dealing with quantity and quality of forests in protected areas was finished recently (see below).

3.1.2. Protection categories in accordance with the nature conservation laws of the Federal Provinces

Nature reserve
Areas which ensure the maintenance and conservation of natural and sustainable ecosystems or ecosystem complexes with a high abundance of species and great structural diversity, which offer habitats and treatment areas for rare animal and plant species, or which for another reason are of high scientific importance, are eligible for nature reserves. According to the above criteria, e.g. primary forests or relict forests are worthy of conservation (Druml 1992). Apart from specific conservation areas in national parks, nature preserves are the strictest form of area protection in all federal provinces (Tiefenbach 1993).

Nature reserves (which can be established in every Austrian province) are natural or near natural areas. These have a special ecological importance. All activities or activities which have negative impacts on nature can be forbidden through the provincial conservation laws. The possible regulations are stipulated in the provincial conservation law and have to be adapted by ordinance for every single area. Normally, nature reserves are subject to a high number of restrictions, but often exceptions are made for hunting, fishing, and some forms of agriculture and forestry. 390 areas covering about 3,350 km^2 are designated as nature reserve in Austria (2002).

Protected Landscape
A protected landscape is a semi-natural area with a special landscape character and a high recreational value. The aim of the conservation lies in protecting the landscape for local people and tourism. There are 252 Protected Landscapes distributed in each Austrian province covering 16 % of Austrian territory (13,290 km^2).

Landscape conservation areas offer much less protection than nature preserves do. Measures causing long-term impacts on the landscape are subject to approval. In landscape conservation areas, the effective protection of species or symbioses is not necessarily provided because further agricultural or silvicultural utilization is permitted and some management measures may even be encouraged.

Landscape conservation areas are predominantly oriented to the maintenance of traditional lands cultivated by man and, therefore, are not suitable for natural forest reserves.

Natural Monument
Natural monuments are natural creations like canyons, big old trees, caves and gorges which can be protected by ordinance. There is not a complete catalogue of natural monuments in every Austrian province, but the total number amounts to several thousand.

National park
The regulations applicable to national parks are laid down in separate provincial laws. National parks are conservation areas with characteristic landscapes, animal or plant species which are of outstanding significance for Austria (Tiefenbach 1993). They serve science and recreation and are thus in most cases open to the public. Provincial laws distinguish between inner and outer zones of national parks. In the inner zones, any form of utilization is prohibited, whereas in outer zones agricultural and silvicultural uses are usually possible without problems.

In Austria, there are 7 National Parks but only 6 are accepted as category II National Parks according to IUCN (World Conservation Union) criteria. Parts of a great variety of ecosystems are protected as National Parks (e.g. Danube flood plains, parts of a steppe lake, salt ponds, pastures, mountainous forests, alpine regions and glaciers). The size of the national parks varies between 13 and 1,800 km^2.

Other categories
Similarly, five other categories of conservation can be established in some of the Austrian provinces:
- **Protected Parts of a Landscape** (about 340 regions in several provinces with approximately 540 km^2),
- **Nature Parks** (31 parks in several provinces with 2,300 km^2)
- **Rest Areas** (7 areas in Tyrol with 1,300 km^2)
- 2 alpine **Plant Protection Areas** with 14 km^2 in Vorarlberg and
- two different types of **Special Protection Areas** (together 5 areas in Salzburg and Tyrol)

Protected Parts of a Landscape can have stronger restrictions than nature reserves. Nature Parks are mostly Nature Reserves or Protected Landscapes which additionally have an educational function.

Protection ex lege
More recent provincial laws on nature conservation are providing for opportunities for *ex lege* protection of ecologically sensitive habitats and can prohibit any intervention in such habitats. This applies mainly to the protection of lakes and rivers, banks, wetlands,

and alpine areas. However, legal protection of natural forest reserves through this category is hardly possible because it would include only individual swamp forests or riparian gallery forests.

3.1.3. Categories of protection through international or EU initiatives

Biosphere Reserves
In Austria 5 biosphere reserves are internationally recognized within the framework of UNESCO's Man and the Biosphere (MAB) Programme. Individual biosphere reserves remain under the sovereign jurisdiction of the countries in which they are located. One Austrian province has changed its legislation specifically to establish biosphere reserves (which are here called biosphere parks).

The last biosphere reserve established in Austria was the biosphere park Großes Walsertal in Vorarlberg. In this case 20 % of the whole area is core zone without any human activities. The core area needs to be legally established and provides long-term protection to landscape, habitats and species. In the biosphere reserve Großes Walsertal all these areas were already nature reserves or other protected areas before the biosphere park was established. At least 10 % of the whole area has to be a buffer zone. Here, with traditional forms of land-use, the landscape, crops and livestock should be conserved. In an outer transition area conservation agencies, scientists, cultural groups and stakeholders must agree to work together to develop a sustainable use of the area's resources.

At the moment there is a planning process running which aims to designate a further biosphere reserve, the Wiener Wald (Viennese Forest). The planning area is about 105,000 ha located to the west of the city of Vienna and dominated by deciduous trees (oak, hornbeam and beech). The landscape of forests and meadows is of great importance for Viennese population's recreation.

Biogenetic Reserves
56 areas in Austria are part of the European network or Biogenetic Reserves. They include an area of about 1,730 km^2 and are parts of existing legal categories of nature conservation (mostly nature reserves).

Ramsar Sites
Austria joined the Convention on Wetlands, signed in Ramsar, Iran, in 1983. It is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. By 2002 11 sites containing an area of about 1,180 km^2 are designated in Austria (e.g. Neusiedler See).

Natura 2000
The basis of the European Network "Natura 2000" are the Habitats Directive (92/43/EEC) and the Birds Directive (79/409/EEC). The main objective of the European Protected Areas network is the long term protection of habitats. The Member States of EU have to provide conservation plans and are obliged to report about a certain favourable conservation status. The designation of the areas is carried out by the 9 Austrian provinces according to the guidelines of the Directives. In Austria about 160 areas are nominated by 2002, they contain 16 % of the Austrian area. The process of designation is not finished yet.

3.1.4. Voluntary approaches on Forest Protection in Austria

The Natural Forest Reserves Programme
Nature protection by private law contracts are voluntary agreements between the responsible nature protection authorities and the owners of areas that are worthy of protection. The owners and entitled users commit to stop further management of the areas or to manage them in a way compatible with the goals of protection. For these active measures or omissions a compensation fee is calculated and agreed as part of the contract. In contrast to this partnership approach, nature protection by decree can sometimes allows the declaration of specific habitats as legally protected areas even without consent of the land-owner.

The Federal Forest Research Centre was charged with the technical and scientific implementation of the programme. By now, 180 forest reserves, covering a total of 8,272 ha, have been included in the network. This means a degree of implementation of about 60 % of the intended total number and size of the network.

The planning and establishment of a network of strict forest reserves was laid down in the form of a framework concept similar to an "Agreement of Principles" negotiated by all stakeholders such as forest owner's associations, administration representatives, the Federal Forest Research Centre, forest authorities, managers of the Federal State forests, and

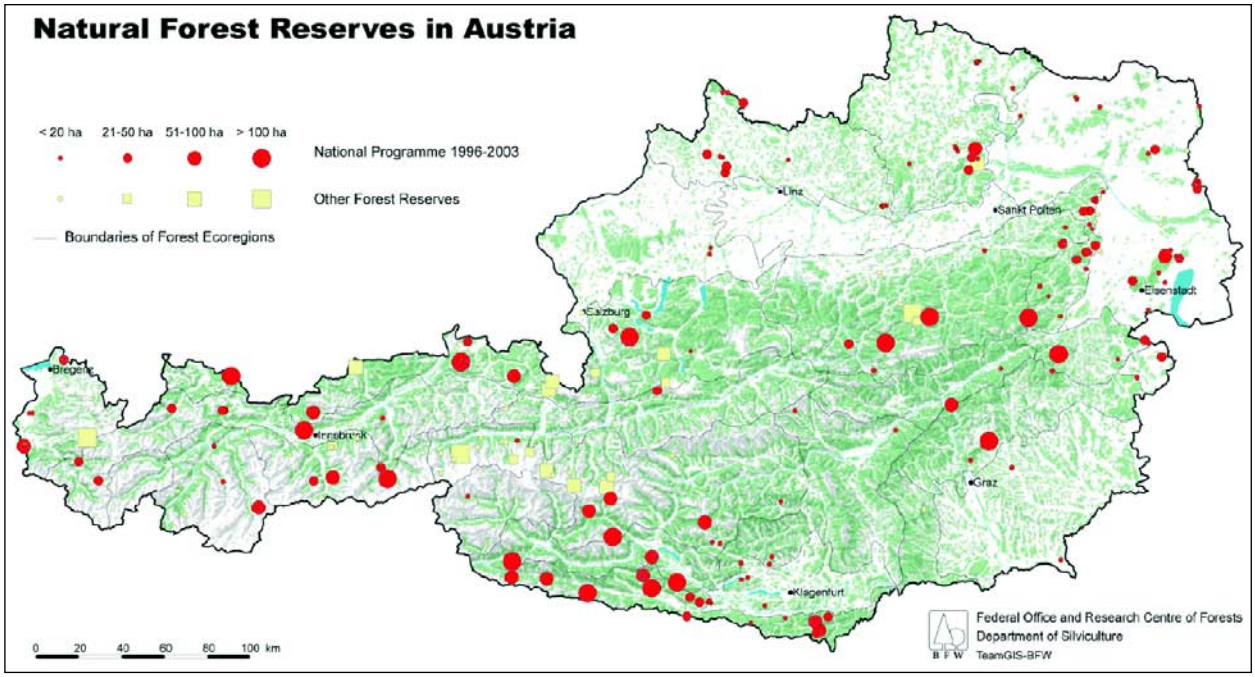


Figure 1: Natural Forest Reserves in Austria

representatives of large forest enterprises. Experiences from other countries have been taken into account and existing international programmes were integrated into the concept. This unanimously approved framework concept is the basis of all further individual contracts, but also for the selection process and the management of the reserves. Strictly following a bottom-up approach, all management measures as well as research programmes and the utilization of the reference areas for education and training purposes always take place in close co-operation with the individual forest owner.

The Austrian Natural Forest Reserve Programme of the Federal Government contributes considerably to the extensive protection of forest biodiversity. It seems to make sense to push the designation of further natural forest reserves, to increase their area on the one hand and to even out existing regional differences on the other.

Other voluntary initiatives on protected forest areas

By the seventies, the Forester's Association of the Tyrol had started an initiative to establish mainly small-scale forest reserves (Zukrigl 1990). Most of these reserves are equivalent to natural forest stands. They are too small to ensure sustainable and balanced development phases and mainly serve as specimen stands of natural forest communities; however, they play an important role in the integration of habitats.

Owing to the initiatives of private forest owners it was already possible to protect important remnants of virgin forests during the last century. Some of these very important habitats are still under the voluntary protection of same family. In most cases, the owners avoid attracting attention to these important habitats, seeing this as the best strategy to protect them.

BIOSA (Biosphere Austria) is a new initiative. It was founded as a non profit organisation by an Austrian landowner's association in 1955. The members of BIOSA voluntarily contract their land to BIOSA. These areas are a specific type of biotope, a specific project for the development of new ecological ideas, or joint research projects with other NGO's (e.g. multi faceted forest structure, Natura 2000 management plans etc.). BIOSA and the land owner sign a voluntary management agreement. This contract is a way of leasing over a period of 20 years. The biotope management concept is part of the contract. BIOSA projects are financed from governmental and other public sources, sponsors, international programmes (e.g. Natura 2000, "Life") and membership subscriptions.

In situ conservation of genetic resources

This programme was established in 1986 as part of a comprehensive programme of conservation of forest genetic resources (Müller 1993). The context at this time was not the conservation of forest biodiversity,

but primarily the problem of regeneration and supply of reproductive material caused by forest die-back which at the time was a serious threat.

Genetic variation is a prerequisite for the adaptability of forest ecosystems. Adaptability means the ability of a population to constantly adapt itself to the changes of environmental conditions by changing its gene-frequency. Due to the uncertainties of climate change, the adaptability of forest trees plays a major role in the future sustainable development of forests. To maintain the potential for adaptation, the unrestricted transmission of genetic variety to following generations must be ensured and the potential for evolution must not be prevented or affected (Gregorius 1997).

The combination of concerns in the eighties about forest die-back, regeneration and supply of reproductive material led the Federal Forest Research Centre to begin a comprehensive programme called "Contributions to the Maintenance of Forest Genetic Diversity". The primary goal of this conservation concept is to combine maintenance of genetic resources with the sustainable use of forests. Because of the specific characteristics of forest trees *in situ* conservation strategies are preferred to maintain genetic diversity. The objective of gene conservation forests is the robust maintenance of genetic diversity and the adaptive potential of tree populations. To achieve this, active measures are to be preferred against the classical non-intervention concept. Therefore the introduction and fostering of natural regeneration, selective protection of endangered tree types, pre-commercial thinning and other tree-type specific silvicultural measures are not only allowed but rather desired or even required (Frank & Müller 2003).

Participation in the Gene Conservation Forests programme is entirely voluntary and follows a bottom-up approach. The programme is based on the information and motivation of the forest owners through an informal agreement between the two partners. No formal contracts are signed. Therefore, this type of protected forest area cannot be accepted by international classification schemes.

3.1.5. Responsible organisations and their procedures

As mentioned above, the nine Federal Provinces have legal authority regarding legislation and implementation of ordinances in the field of nature and landscape protection. Therefore, for the implementation of all nature protection issues in Austria generally the nine provincial authorities are responsible.

On the national level all issues regarding international agreements and obligations concerning both forestry and nature conservation are under the responsibility of the Ministry of Agriculture, Forestry, Environment and Water Management. Nevertheless, specific federal institutions (e.g. Federal Office and Research Centre for Forests and the Federal Environment Agency Ltd. are in charge of research and development of expertise for nature and environmental protection.

General ecological research in biodiversity and other aspects of nature science in protected areas is done by universities and other private research and service companies.

Non governmental organisations (e.g. WWF, Bird Life, Greenpeace, etc.) and land owner associations (e.g. BIOSA Austria) are active in the field of forest biodiversity protection and lobbying.

3.1.6. Forests in Protected Areas – a comprehensive study on facts and numbers

A workshop promoted by the Austrian Federal Environment Agency in 2000 brought together experts of relevant institutions in Austria and some of European institutions dealing with topics of PFAs (Umweltbundesamt 2001). This meeting aimed to discuss the current status of international processes and their requirements, to assess the technical possibilities and international compatibility of existing data bases and to discuss legal requirements for nature conservation in practice. Results from this workshop show

- the need for PFAs to be combined with the protection of biodiversity of managed forests on the total forest area;
- the need for comparable classification schemes for PFAs at the international level;
- and the need to assess the quantity and quality of PFAs in Austria, not least to comply with international obligations of reporting.

This workshop initiated an Austrian project carried out by the Federal Environment Agency on behalf of the Ministry for Agriculture, Forestry, Environment and Water Management deals with the quality and quantity of forests in protected areas according to the classification scheme of MCPFE (Schwarzl & Aubrecht 2003). However, despite the international commitments and national interest, there is a lack of data Protected Areas in general and on the protection of their biodiversity in particular (CBD, MCPFE, PEBLDS).

The project is divided into two parts:

- The 'technical' part contains the blending of the Forest layer of the Austrian Map 1:50,000 with digital data of Protected Areas using GIS. The result is the quantity of forest area within Protected Areas of all categories (Nature Reserves, National Parks, Protected Landscapes etc.) protected by Nature Conservation Acts.
- Within the second part all the ordinances (about 1,100) of Protected Areas in Austria are examined for legal requirements concerning biodiversity of forest ecosystems. Therefore, the categorisation scheme developed by the MCPFE is applied to attribute each Protected Forest Area to the following four categories:

Table 7:
MCPFE classes and equivalents to the categories of the European Environment Agency (EEA) and IUCN without class 3 (Main Management Objective ‚Protective Functions').

MCPFE Classes/Categories				EEA	IUCN
1	Main Management Objective, Biodiversity'	1.1	No Active Intervention	A	I
		1.2	Minimum Intervention	A	II
		1.3	Conservation Through Active Management	A	IV
2	Main Management Objective *‚Protection of Landscapes and Specific Natural Elements'*			B	III, V, VI

Results:

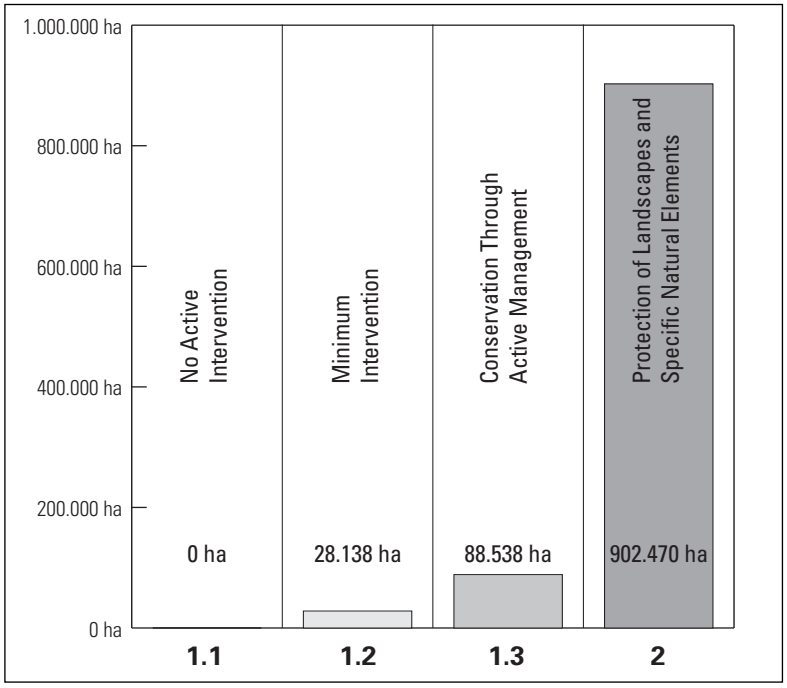
The results show that in Austria **more than one million hectares** of forest in protected areas (including natural forest reserves) could be allocated to one of the two classes of the MCPFE classification system (see Table 7 and Figure 2). This is equivalent to a quarter of the total Austrian forest area.

Nearly 89 % of this area accounts for class 2 (Protection of Landscapes and Specific Natural Elements), 11 % accounts for class 1 the main management objective of which is biodiversity. In relation to the total forested area 0.7 % accounts for class 1.2 (including the forest areas of the Austrian Nature Forest Reserve Program) and 2.3 % for class 1.3. Altogether, 3.0 % of the Austrian forests are subject to conservation legislative requirements which restrict forest management activities. In the remaining 23.2 % no restrictions according to the management objective protection of biodiversity exist but with respect to landscape protection, the main restrictions concern forest road construction.

Table 8:
Protected Forest Areas in Austria according to MCPFE Classification System

Class (MCPFE)	Forest area (ha)	Share (%) in	
		MCPFE-Forest area	Total Forest area
1.1	0,0	0,0 %	0,0 %
1.2	28.137,7	2,8 %	0,7 %
1.3	88.538,2	8,7 %	2,3 %
2	902.469,7	88,6 %	23,2 %
Total	**1.019.145,6**	**100,0 %**	**26,2 %**

Figure 2:
Protected Forest Areas in Austria according to MCPFE Classification System



Findings related to Results for Austria

- No protected area in Austria complies with the criteria of category 1.1. Due to the small-scale structures of the Austrian landscape there are no large (forest) areas that can be left entirely to their own resources. Regarding the Alpine landscapes of Austria, refraining from any intervention (No Active Intervention), e.g. deer population control, would result in unnaturally high populations of deer and

probably, in the long term, to major changes in the natural (forest) vegetation.

- Most of the category 1.2 forest areas can be found in national parks, especially those established in the last decade. This shows that the "classic" nature conservation policy of former decades was not focused explicitly on the protection of forest ecosystems.
- Forest areas of nature reserves (one of the most important protection categories in Austria) are mainly found in category 1.3. They are usually characterised by precise regulations regarding forest management (type of management, reduction of clear-cut areas, etc.), but forest utilisation is not prohibited. These areas, together with those of category 1.2, make up about 3 % of the total forest area. The main part of forests protected by nature conservation regulations belongs to category 2 (about 23 %).
- In practice, due to geographical conditions, large areas of the Austrian forests (nearly 12 %) are not productive (protective forest without yield).
- The results obtained from this study contribute to the ongoing debate as to how to best meet the objectives laid down by the Ministerial Conference on the Protection of Forests in Europe (MCPFE), and the objectives of nature conservation in general, related to forest protection. These results may apply to the delineation of new protected (forest) areas (e.g. spatial aspects) as well as aspects concerning the definition of management measures and their adequate promotion.
- The results of this project also show that the Austrian Natural Forest Reserve Programme of the federal government contributes considerably to the extensive protection of forest biodiversity. It seems to make sense to push the designation of further natural forest reserves, to increase their area on the one hand and to even out existing regional differences on the other.

Due to the fixed framework (permanent designated areas, not changing ordinances of the areas), it is not planned to repeat the survey. An up-dating after finishing the designation of the Natura 2000 sites could be possible.

3.2 Selection criteria and representativity

There is no binding nationwide practicable set of selection criteria available. Existing PFAs either have their background in historical initiatives or they have been established unsystematically on sites with specific conditions well suitable for specific protection categories. As a result, for large scale protected forest areas there is no coherent network which represents the full range of existing forest habitats. More recent initiatives of establishment of national parks have however aimed to meet the IUCN Guidance for Selection.

More formal networks are the Natura 2000 network and the Austrian Forest Reserves Programme. The latter follows strictly the idea of building up a representative network of all existing forest communities in Austria.

3.2.1. Selection of natural forests reserves

Representativity of natural forest reserves

Special emphasis has been laid on the representative distribution of reserves, covering all forest communities occurring in Austria. The following very simple concept has been chosen, to allow a certain flexibility in identifying suitable areas: for each of the 22 bio geographic areas (Kilian et al. 1994) the forest communities occurring inside are known. Each forest community has to be represented at least once in a reserve inside the defined bio geographic region.

Criteria for the selection of natural forest reserves

To produce a standardized and reconstructible judgement regarding the eligibility of forest areas as natural forest reserves, a binding list of criteria was established according to which forest areas should be examined and eligible forest areas identified.

The criteria include:

- *Naturalness of the vegetation*
  Tree species composition of the existing vegetation is to correspond with that of the potential natural vegetation.
- *Structure, age, texture of stand*
  Continued availability of all developmental phases of the stand within one reserve.
- *Minimum size*
  The minimum size of a natural forest reserve (with the exception of natural forest stands) is determined by the minimum structural area (Koop 1982, 1989), i.e. the area which is required to ensure sustainable representation of every forest community. The minimum structural area varies with forest communities and, according to current results from research, is between 10 and 50 ha.
- *Topographic unit*
  Consistency of orogoraphic units must be accounted for.

- *Rareness and endangered stands*
  All rare forest communities should be registered; for rare and/or endangered forest communities, the criterion of minimum area may count less.
- *Buffer zones*
  Buffer zones can minimize outside influences on the reserves, which is why a sufficient number of such zones should be maintained or established. In such reserve zones, close-to-nature forest management is permitted. Buffer zones should have a width of 1 to 3 times the height of a tree.
- *Disturbance through roads, trails, streets*
  Disturbances may not produce negative influences on the inner climate of forest communities or on the development of forests.
- *Influence due to game*
  Game densities must be low enough to allow regeneration, which should include the tree and shrub species of the potential natural forest community.

Reasons for non-selection and exclusion

Reasons for non-selection refer to cases when areas are examined for their suitability as natural forest reserves, whereas reasons for exclusion refer to existing reserves. They include the following conditions:

- protected forests are not eligible as natural forest reserves
- minimum size is not available
- present forest community differs fundamentally from potential natural forest community
- too high degree of fragmentation
- management of buffer zones is not possible
- excessive game numbers
- impact through present utilization for grazing
- site modifications, outside influences
- destruction of forest
- significant air-pollution impacts
- changes relating to forests functions
- changes regarding public interest

Schedule for establishing reserves

The establishment of natural forest reserves follows a standardized procedure and includes the following steps:

1. Registration of forest areas by forest-tenants and forest staff.
2. Preliminary examination of the proposed areas by representatives of the Federal Forest Research Centre and experts of the Provincial Forest Authorities.
3. Selection of suitable reserves and marking of the areas.
4. Basic survey by specifically trained survey teams on a grid of permanent sample plots for the assessment of compensations and for future observations. The most important features of such surveys are: vegetation surveys according to (BRAUN-BLANQUET 1964), determination and mapping of the potential natural forest communities, stand parameters, Bitterlich sampling, site exploration, stand quality.
5. Elaboration of an expert opinion and determination of the annual amount of compensation using a uniform formula for calculation.
6. Elaboration of a 20-year contract between the Republic of Austria and the forest-tenant.

Existing reserves are subject to regular control.

3.2.2. Selection of gene conservation forests

When selecting forest stands for in situ conservation it is important to take into consideration all natural forest associations of the biogeographic regions. The best possible distribution over all growth regions and altitudinal zones is sought. Populations at the edge of their area and relict populations should be overrepresented because there is a great danger of loss of rare gene combinations.

Selected stands have to be autochthonous or well adapted to site conditions, no impediments against natural regeneration are allowed. Their silvicultural treatment follows the principles of close-to-nature silviculture: permanent stocking, all age stand structure, long regeneration periods, permanent regeneration by simultaneous reproduction of overlapping generations, support of self-differentiation processes in all growing phases (Müller 1993, Frank & Müller 2003).

3.3 Inventories and monitoring

Currently no nationwide systematic approach on monitoring of protected forest areas exists. Site specific monitoring programmes are however present. The Austrian Forest Reserves Programme includes a periodical survey of both ecological and yield parameters. A monitoring programme for Natura 2000 sites is in preparation.

3.3.1. Austrian Forest Inventory

The Austrian Forest Inventory (Österreichische Waldinventur) was established in 1960 with the main objective of assessing the growing stock and forest

area in order to supply the Austrian timber industry. During early assessment periods the main focus was laid on economic requirements. During the more recent assessment periods more and more ecological questions have been taken into account. The assessment period of 1992-96 used the following significant parameters (compiled by Winkler 1997):

Table 9:
Short description of the Austrian Forest Inventory:

Name of the inventory	Austrian Forest Inventory
Description of what is recorded	Forest Area, Management methods Ownership proportions (public-private) Growing Stock (Volume) Increment Stand parameters: Age, State of development, Damages(Harvesting, fraying, Bark peeling) Stand Stability Formation phase Influence on game Forest grazing Site Parameters: Altitude Slope gradient Slope Exposure Soil categories Humus description Ground vegetation type Water regime Mass movements Ecological Data Woody species Deadwood Regeneration Natural Woodland Community Forest Roads (up to 1996)
Treatments on PFAs	No
Assessment techniques	Sample grid pattern with 5500 systematically distributed tracts all over Austria. Each tract contains 4 clustered sampling plots of 300 m^2, each invisibly fixed by an iron tube. Standing trees are assessed by a Bitterlich plot with the same centre as the sampling plots.
Responsible Organisation	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW), Seckendorff-Gudent-Weg 8, 1131 Vienna, Austria
First Survey	1961 – 70 (permanently fixed sample plots since 1981) GPS Data of the sample plots since 2000
Frequency	10 Years (1961- 1980) 5 Years (1981- 1996) not exactly known (2000+)
Web Link	http://bfw.ac.at

In addition to the assessment of these parameters, since 2000 emphasis has been placed on the assessment of ecological data. The method of assessing coarse woody debris was improved (data collected from 2000 to 2002 included ecological aspects).

Problems

Forest inventories cannot easily provide information about ecological aspects since for statistical reasons they can describe rare events only infrequently. Yet often these rare events are extremely important for nature conservation.

Austrian Forest Inventory and Protected Forest Areas

1,365 (25 %) of the 5,500 inventory tracts (Figure 3) are located in protected areas (Figure 4). Thus, it will be possible to compare the estimated data with the results of the non protected forests. It is important to realise, that the national inventory, as a large scale inventory, currently uses no specific set of parameters in protected forest areas.

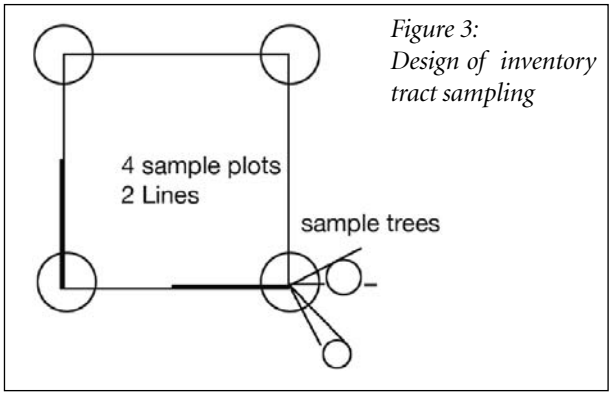


Figure 3:
Design of inventory tract sampling

Species diversity and vertical structure

Currently 149 well defined tree and shrub species are assessed. Their abundance is registered according to the method of Braun-Blanquet (Dierschke 1994). The abundance of every species is attributed to the layer where it is found. Four layers are distinguished and their canopy percentages are recorded.

Horizontal structure

To assess the horizontal structure of a forest - which describes the frequency of the changing living conditions within a forest (e.g. different intensity of light exposure) - a line assessment (Schieler & Hauk 2000) was established in 2000. Starting from a randomly chosen corner of the "tract", structural diversity is

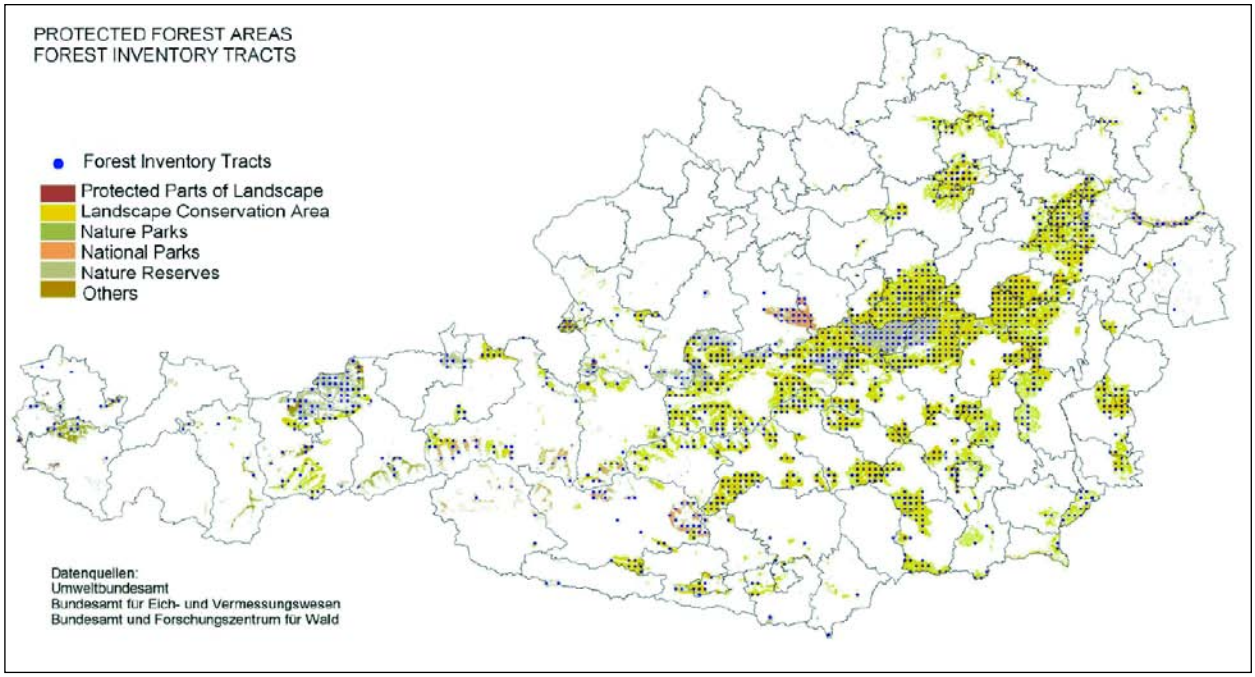


Figure 4: Inventory sampling tracts in protected forest areas in Austria

described along a 100 m line. The line leads either from the south to the north or from the east to the west (Figure 1).

Length of inner forest edges
The length of inner forest edges shows the frequency of the changing light conditions in the forests.

Deadwood
Forest Inventory distinguishes between standing dead and Coarse Woody Debris (CWD) spread on the ground. Pieces over 20 cm are counted according to length classes and the rate of decomposition, from CWD (lying and stumps) up to 20 cm diameter the ground cover percentage is estimated.

Length of outer forest edges
The Length of outer forest edges can provide information about the shape of the forest areas.

Study of 'Protected Forests in Austria'
As described in chap. 3.1.6 a comprehensive study was carried out by the Federal Environment Agency Ltd. to find out quantity and quality of protected forest areas in Austria (Schwarzl & Aubrecht 2003). Table 11 gives you a short overview of the significant parameters of this survey.

Due to the fixed framework (permanent designated areas, not changing ordinances of the areas), it is not planned to repeat the survey. An up-dating after finishing the designation of the Natura 2000 sites could be possible.

Table 11:
Description of the inventory "Protected Forest Areas in Austria"

Name of inventory	**Forests in Protected Areas**
Description of what is recorded	area and protection status of forests in Protected Areas
Treatments on PFAs	yes
Reference area	country-wide
Assessment techniques	GIS-based
Based on sampling in a national grid	no
Responsible Organisation	Federal Environment Agency Ltd.
First Survey	2002
Frequency	one-off
Published maps of the data	yes, in print
Web Link	www.umweltbundesamt.at

3.4. Landscape, spatial and other considerations

The designation of PAs in Austria always demands a balance of interests between all interest groups of land-users. Conflicts among stakeholders of nature protection, landowners and public authorities are

based on different interests with respect to the natural resources: commercial exploitation (e.g. of forests), hunting (a right which is derived from the property of land), social demands like recreation or leisure-sports, the establishment of tourist infrastructure (e.g. cable cars) and scientific based protection efforts. All these interests have to be considered, assessed and discussed in a political (public) process. Restrictions formulated in the ordinances according to Nature Acts have to be stipulated, and if necessary and adequate, the landowners get a single or yearly compensation for their abandonment of commercial use. In general these processes need a lot of time: an important criterion for a successful outcome is the skill of the authority to implement all interest-groups in time.

The designation of Landscape Protection Areas (LPAs) doesn't follow any common guidelines in Austria. Due to responsibility of implementation of Protected Areas to the nine Austrian Provinces different methods and therefore outcomes all over Austria have occurred: Some provinces have many large areas designated, some only very few. In general LPAs contain characteristic landscapes with either forests or extensive agricultural areas, e.g. vine cultivating areas. Mostly they show landscape patterns developed through traditional kinds of land-use during the last centuries. The purpose of protection is often on the one hand to maintain these landscapes and protect them against overdevelopment by settlements, and on the other to give these regions new economic impetus e.g. in (sustainable) tourism. That's why one aspect of the designation of LPAs can also be considered as an instrument of spatial planning.

Instruments of forest policy

An Austrian National Forest Plan doesn't yet exist, it will be one of the results of the 'Dialog on Forests', which is taking place at the moment (2004).

The Austrian Forest Act provides three instruments of forest-related spatial planning, but which have no direct regard to an explicit designation of PFAs for the purpose of nature or biodiversity protection. The forest land uses plans provided for in section 2 of the Austrian Forest Act include the Forest Development Plan, the Hazard Zone Plan, and the Forest Management Plan, which currently plays a minor role.

The **Forest Development Plan** was only completed in 1991. It can be thought of as a forest expert opinion describing the major functions of Austrian forests for the whole national territory, establishing these functions, and, if required, prescribing measures which can guarantee that such public-interest forest functions are sustainably secured and improved. The FDP covers the entire national territory and can be used as a guideline for economic, land use and forest-political decisions. It serves as a decision framework in forest legislation and has a directive effect upon the Authority because the heads of the provincial governments will submit each and every forest development plan to the Federal Minister of Agriculture and Forestry for approval. The FDP is not directly binding upon forest owners; the latter are only subject to the provisions of the Forest Act.

Forest benefits are categorised as economic, protective, social, and recreational functions. Depending on the directions under the Forest Act the surveyor has to assign to forest areas with equal functions and with a minimum size of 10 ha the predominant of these 4 functions, delimit the area and register it in a working map 1:50,000. The reasons why a particular major function is assigned to an area, the description of the area to which the function is assigned, details about any impairments of these functions and resulting counter-measures as well as the urgency of such counter-measures are laid down in the text component of the FDP. The first generation of the FDP was completed in 1990. Since 1991, digital mapping of all functional areas on the basis of the Austria map 1:50,000 has been possible.

For one individual partial plan (applicable to one forest district), the period of revision is 10 years. Prior to the expiry of this period, counted from the date of approval, the FDP is to be updated by the Forest Authority and, after that, has to be re-submitted to the Federal Minister of Agriculture and Forestry. Since 1996, most provincial forest authorities enter all revised partial plans into a GIS and the text components into a database. At the Federal Forest Research Centre in Vienna the data from the individual provinces are combined to form the national data. Revision and data transfer are subject to guidelines which are adjusted to current requirements after joint annual discussions of all those responsible for forest land use from the provinces, with the representative of the Federal Ministry.

Apart from the Forest Development Plan, the Austrian Forest Act provides for other "land use plans": the Forest Management Plan, which is intended as a local planning level including the forest owner, various interested parties, and the local forest authority but presently does not play an essential

role; and the Hazard Zone Plan, which is elaborated in the Provinces by the Forest-Technical Service for Torrent and Avalanche Control, an agency directly subordinate to the Federal Ministry of Agriculture and Forestry.

In the **Hazard Zone Plan**, areas endangered by rock fall, torrents, mudflow, sliding slopes, and avalanches are delimited and classified as hazard zones. Following approval by the Federal Minister of Agriculture and Forestry, it has to be adjusted only where conditions change. The Hazard Zone Plan has a direct effect on the dedication of municipal land as building land (land utilization plan) and, thus, can considerably influence the value of real estates.

The **Forest Management Plan** can be worked out from the forest owner and contains planning instruments for the use of the forest resources. It's a non legally binding instrument on voluntary basis.

4. Future developments

The history of nature protection in Austria is characterised by a great heterogeneity. This reflects on the one hand the various legislative regulations and on the other the historical development of the changes in understanding of nature protection activities. In general, the protection of forest ecosystems in specific areas was not a main purpose of nature conservation policies.

After having assessed the quality and quantity of the major part of PFAs in Austria, it seems to be necessary to find common goals about forest protection for the future. This should happen in a very broad way with involvement of all relevant stakeholders. Questions about further needs of PFAs, the type of protection (voluntary initiatives or by decree), protection categories, the intensification of forest protection measures in existing PFAs have to be answered in a common sense to be implemented in future policies.

The absolute number of forests in protected areas and also their distribution across the country give important information about the protection of biodiversity in Austrian forests: it also provides the opportunity to recognise the lack of protection policies related to forests in some areas and hence a need for action.

The separation of the responsibilities between the Federal Government (forestry) and the nine Provincial Governments (nature protection) sometimes makes it difficult to find common ground. The responsible persons of these institutions are called to strengthen cooperation in PFA policies.

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