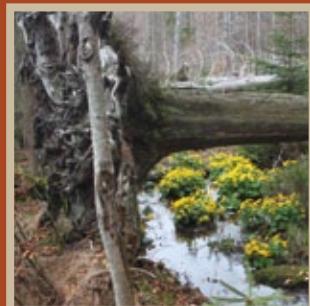


Integration of Nature Protection in Forest Policy in Austria

INTEGRATE Country Report



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Summary

This report describes the current state of the forest, forest functions, and the legal framework to ensure protection of forest and nature in Austria.

The geographical setting of Austria, as a country with around 60 % mountainous areas and a great topographical variety, various climatic regimes and different forms of historical and current land use, have resulted in a high diversity in niches and species. Nearly half of the Austrian territory (3.9 mio ha) is covered with forest, thus making Austria one of the Central European states with the highest share of forest. 15 % of the forest area belongs to the state, 3 % is community forest and the other 82 % of the forest is privately owned. The majority of the private forest land is small scale farm-forest and around 60% of the overall growing stock is standing in this category. The forest area as well as the growing stock is still increasing and generally follows the trend in other Central European Forest areas.

For centuries, most of the Austrian landscape has been influenced by **human activities**. In the middle Ages, alp farming with meadows and pastures at high elevations, was very common. Forest was pushed back by cutting trees, and by grazing and browsing cattle. The industrialization (mining, glass and iron works) and ongoing urbanization also led to a strong reduction in forest area and to maintain forest areas and wood production, sovereigns implemented a structured forest management, but this caused conflicts with the population. The revolution of 1848, has then led to many small scaled farm forests, a typical ownership structure in Austrian forests, since the farmers have become real land owners after the revolution. Furthermore, the liberal Forest Act from 1852 obliged all forest owners to act according to the ideas of “sustainable forestry”.

The Austrian forest-based sector is an **important employer** especially in rural areas. Compared to other European countries, the employment is rather constant or even increasing. Around 250.000 people (2% of the total population) are working directly or indirectly in this sector.

With 63,5% of the total forest area, coniferous **tree species** are still predominant in Austrian forests. However, Norway spruce has suffered from severe wind blows in 2007 and 2008 and furthermore, the share of broadleaved trees is increasing due to a trend in forest management of conversions from single-species stands to more mixed stands with deciduous tree species. A high share of Austrian mountain forests have protection functions against natural hazards and are often characterized by a lack of **regeneration** because of browsing and grazing, light, competitive vegetation and erosion.

Around 27% of the total land area is **protected** under different categories. Half of this area is covered with forest. Many of the ca. 13.000 species that are connected to forest ecosystems are **endangered** and can be found on the red list of threat categories. The main drivers for species and biotope loss are area

sealing, habitat cuttings through infrastructure (roads, railroad tracks, power plants) and intensification of agriculture, as well as loss of small and open landscape patterns.

The amount of lying and standing **dead wood**, as a crucial measure according to biodiversity aspects, has increased during the last two decades up to $\sim 20 \text{ m}^3/\text{ha}$ in productive forests. However, the distribution varies significantly across different regions and forest types.

The most important forest functions according to the Austrian Forest Act are: production, protection, benefit and recreation.

Wood production is a crucial economic factor in Austria, especially in rural areas. Beside sawn timber and wood for the pulp and paper industry; the use of wood for **energy** production has been constantly increasing in the recent years.

Austria, as an alpine state, is highly affected by natural hazards determined by alpine terrain conditions and the protection of settlements and their population against avalanches, landslides, floods and rock fall is of high priority in the country. Beside technical solutions, a vital mountain forest as a natural barrier plays a crucial role. Around 20% of the Austrian forest has a **protective function**. Another important service that Austrian forests provide is **recreation**. In Austria everybody has the right to enter forests for recreational purposes. Access limitations only exist with regard to planted or naturally regenerated young forest stands. However, for certain activities (e.g. horse riding and camping) it is mandatory to ask permission to the forest owner.

The 1975 **Forest Act** is the most important legal source concerning forest management, protection, wood production, and forest in general. It gives executive directives for the nine Austrian provinces, whereas a national act on the protection of nature does not exist. Hence, the protection of forests is regulated through the different **Nature Protection Acts** of each Austrian province and through the aforementioned Forest Act of 1975 with its executive directives for the nine provinces. Other important laws with impacts on biodiversity, are the National Park Laws and the Hunting and Fishery Laws. However the competences on these laws are declared in the provinces.

Furthermore, Austria has taking part in the Ministerial Conference on the Protection of Forests in Europe (MCPFE; FOREST EUROPE), and has signed several **international conventions** on nature and environmental protection and sustainable development, such as the Convention on Biological Diversity (1992) and the Alpine Convention (1991).

In April 2003, the Federal Ministry for Agriculture, Forestry, Environment and Water Management initiated the Austrian **Forest Dialogue** (Österreichischer Walddialog; ÖWAD) as a participative process with the aim to integrate all relevant stakeholders for important issues on forests. The main idea of this process was to find solutions on conflicts arising from different interests and use of forest functions and services. One main output was the development of the **Austrian National Forest Program**. Although this program is a legally non-binding document, it has a large impact on the forest-based sector in Austria. This

example could be seen as a modern democratic process, since The Ministry uses the outputs of the Austrian National Forest Program as a basis for further policies and programs.

The most important **funding** instrument for forest owners is the *Austrian program for rural development*. The program promotes ecological management methods in agriculture and forestry that enhance and maintain biodiversity in diverse landscapes. The overall budget of this program is around 8 billion € for one period, which lasts about 7 years.

An instrument for nature protection in forests is the *National Forest Reserve Program*. Forest owners can thus sign contracts on a voluntary basis to promote and maintain biodiversity relevant structures, while leaving such areas unmanaged. The program offers to forest owners around 850.000 € per year if they **manage** existing areas and designate new areas within the frame of the program.

The *Austrian Forest Society* (*Österreichischer Forstverein*) is the roof organization of six forestry societies at the federal level. The main objectives and tasks of this society are lobbying for woods and forestry in legislature and public relations, education and training for all members within the forest sector and informing the public about forests and forestry. Moreover, the *Austrian Forest Society* provides important advisory services for the public and for forest owners.

The *Austrian Forest Association* (*Waldverband Österreich*) belongs to the Agricultural Chamber Austria, and consists of eight regional associations. Its main tasks are the coordination and representation of the interests of the regional forest associations at the federal level, and the increase of the Austrian forest sector's profit.

Another organization within the forest sector is *Pro Silva Austria*, the national organization of *Pro Silva Europe*. *Pro Silva* promotes forest management strategies that optimize the maintenance, conservation and utilisation of forest ecosystems in such a way that the ecological and socio-economic functions are sustainable and profitable. The organisation offers excursions in and outside Austria, but also promotes and fosters the exchange of knowledge and experience between members on close to nature forestry.

The main **certification** labels in Austria are the Forest Stewardship Council (FSC) and the Programme for Endorsement of Forest Certification Schemes (PEFC). In Austria, both certification systems are represented, but PEFC is more common. In 2010, more than 3.5 million ha of the Austrian forest area are certified under the PEFC scheme, whereas only 5000 ha are certified under FSC.

Since 1961, the **National Forest Inventory** (*ÖWI*) collects data in regular intervals that comprises increment and use, tree species composition and regeneration. The last *ÖWI* (2007-2009), has also included the survey of biodiversity parameters, such as dead wood and structural measures. The *ÖWI* allows the observation of variations and trends over a longer period of time and is therefore an important basis for political and economical plans and decisions.

The **Forest Development Plan**, provides information on the different forest functions according to a value category (high, middle, low) and should be used as a state-wide basic information source that aims to give a complete overview on different forest functions system.

The **Technical Forestry Plan**, can be drafted by a forest owners or by certain experts and deals mainly with forest management issues, but also involves other forest functions, e.g. nature conservation or cultural aspects.

Another important issue in Austrian forests is to increase awareness and preparedness predicted **changes in climate** and its possible consequences on forest ecosystems. Amongst others issues, it is expected that it will negatively affect the forest at lower elevations. Commercial tree species (e.g. Norway spruce) might especially suffer from frequent droughts, storms and forest fires. With increasing storm damage and reduced vitality of trees, insect calamities like bark beetle outbreaks should then be expected. An adapted forest management and long-term measures are therefore needed. In addition, it is crucial to have a close network and interaction with forest owners to consult them about climate change issues and their consequences.

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List of Abbreviations

CAP	Common Agriculture Policy
CBD	Convention on Biological Diversity
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GVA	Gross Value Added
ISDW	Initiative Durch Schutz Wald (Initiative protection through forests)
MCPFE	Ministerial Conference on the Protection of Forests in Europe
ÖWAD	Österreichischer Walddialog
ÖWI	Österreichische Waldinventur - National Forest Inventory
PEFC	Programme for the Endorsement of Forest Certification
SFM	Sustainable Forest Management
SME	Small- and Medium-sized Enterprises
WAF	Waldfachplanung
WEP	Waldentwicklungsplan

1 Introduction

Austria is a very species-rich country, amongst others by its topography, which results in different environmental conditions at a small spatial scale. The forest harbors many species, but has more than a protective function for biodiversity alone.

This report describes the current state of the forest, forest functions, and the legal framework to ensure protection of forest and nature in Austria.

The structure of this report is as follows. Chapter 2 gives a short introduction on the geographical situation and historical development of forest management, and provides facts and figures about forests and biodiversity. Chapter 3 addresses the four major forest functions, and potential conflicts between them. In Chapter 4, the legal framework is being described. Further, Chapter 5 gives an overview about the financial instruments, and Chapter 6 about education and advisory services. Chapter 7 is on forest certification and Chapter 8 on monitoring and planning tools.

2 Forests, forest management and nature conservation

2.1 Geographical position and climate

Austria is located in the southeast of Central Europe. The country is characterised by a mostly mountainous landscape, which has been used intensively for centuries. Roundabout two thirds of the national territory is 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. Mountain areas are predominant mainly in the western and southwestern part of the country. The highest elevation is 3798 m. Besides, the country contains several lakes and watercourses, of which the Danube River is the biggest and most important watercourse, located in the plain northeast.

Austria is located in the temperate zone. The main climate types are the Atlantic climate in the west, the continental climate in the east and the Illyrian climate in the south. Because of the altitudinal differences, we can further find mountain or alpine climate at higher elevations.

The geographical position and the varied topography are causing different natural situations. So often soil, vegetation and climate properties are changing on a small scale, what resulted in different and diverse land use systems and cultural developments. All these different properties make Austria, compared to its small size, a species-rich country in Europe. (Umweltbundesamt, 2013a)

2.2 History of forest management

Almost everywhere, the Austrian landscape has been influenced by human activities. Up to the middle ages, land use systems were diverse. The scale of use differed in place ("here and there"), time ("every now and then") and intensity (extensive use). People were settling also in high elevations and lived from agriculture. Alp farming was very common, and meadows and pastures were therefore typical in mountain areas. Forest was pushed back by cutting trees, and by grazing and browsing cattle. In general, this system was rather sustainable even if on local level degradation occurred.

Industrialization (mining, glass and iron works) led to a strong reduction in forest area. Namely, wood was needed as stabilizers in the mineshafts and as fuel in the works (BFW, 2012). Besides, an ongoing urbanization demanded for more wood and timber, next to large-scale agricultural land-use systems to feed a growing population.

To maintain forest areas and wood production, sovereigns implemented a structured forest management. This clear target of forest production for industry sites was enforced by the authorities and caused conflicts with the population, who needed the forest for their existential purposes. After the revolution of 1848, farmers became real owners of their land. Therefore, the typical forest

owner structure in Austria was and still is a small-scale farm-forest. The farmers used their forestland for fuel wood and timber. Cattle, goats and sheep were brought to the forests for grazing. (Pregerig & Weiss, 1998) The liberal Forest Act from 1852 obliged all forest owners to act according to the ideas of "sustainable forestry".

2.3 Facts and figures about forests and biodiversity

2.3.1 Forests and forestry at a glance

Almost half of the land area, 3.991 million ha, is covered with forest (Figs. 1 and 2). This makes Austria one of the Central European states with the highest share of forest (47,6 %). The forest area per capita is 0,5 ha. Since the start of the Austrian Forest Inventory in 1961, the forested area has steadily increased. Currently, the increase of forest area is around 4.500 ha/year. In forest-poor areas an increase has been remarkable (Lebensministerium, 2011b), especially at elevations above 1800 m a.s.l (Russ, 2011). The main reason for this can be found in structural changes in agriculture. More and more farmland and pastures are not cultivated anymore, and these areas are afforested or natural succession takes place. This explains also why around 80% of reforestation takes place in privately owned small-scale (farm) forests. On natural devastated areas (e.g. avalanches) and steep slopes, trees are invading naturally (Russ, 2011).

Figure 1: Forest area (million ha) and share (percent) of land area by country, 2010



Figure 1: Forest area and share of land area by country (FOREST EUROPE, 2011)

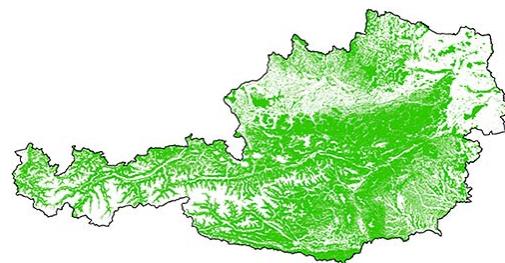


Figure 2: Forest map of Austria (BFW, 2011a)

2.3.2 Forest sector

Ownership. Of the forest area in Austria, 15% belongs to the state and 3% is community forest, owned by provinces, or communities. The other 82 % of the forests are privately owned (Fig. 3; Lebensministerium, 2011a; BFW, 2011b). About 21 % of the total forested area belong to the category 200 ha or more

(forest enterprises), but the majority of the private forestland is small-scale farm-forest. These latter areas are generally family-managed (Lebensministerium, 2008; Russ, 2011). Only 3,3 % is commonly owned (communal forests) secondary owned by provinces (Länder). As a specific ownership category, about 10 % of the total forested area is privately owned by local owner associations (jointly owned private forests, agricultural communities).

Like in other Central European countries (e.g. Germany), forest ownership has been subject to several changes. Globalization and internationalization as well as structural (urbanization of forest owners) and demographical changes (high age of forest owners) have an influence on ownership structures and, as a consequence, an impact on forest management (Hogl et al., 2003).

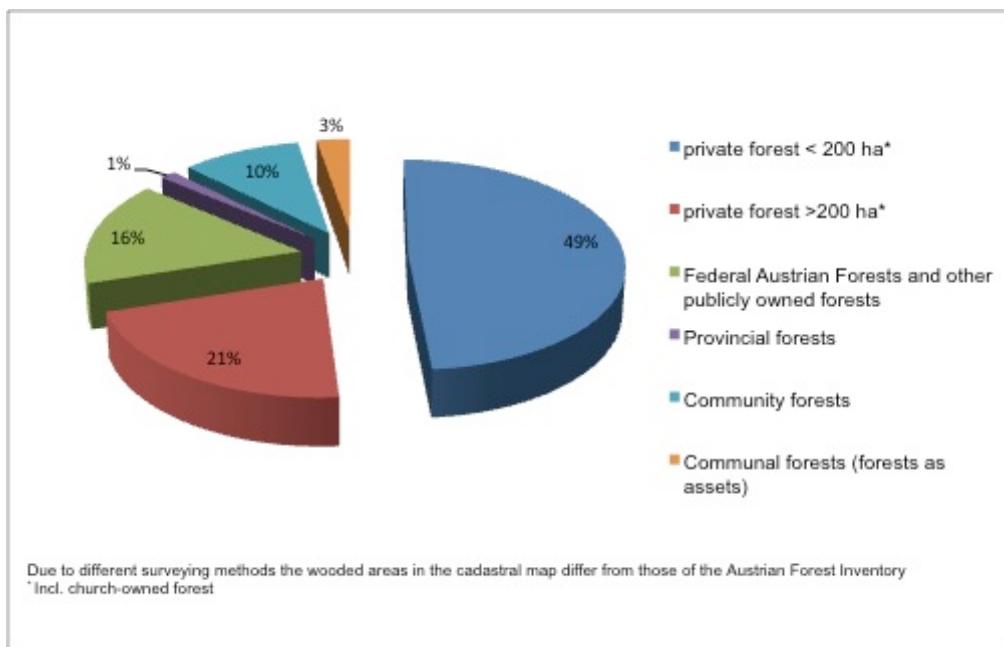


Figure 3: Types of forest ownership in Austria according to the cadastral map (in % of total forest area, slight differences to ÖWI-data due to different assessment methodology)

Growing stock, increment and harvest. For many years the growing stock in Austria has increased. In the last national inventory, the growing stock was more than 1.135 billion m³ (Fig. 4). However, the annual increment decreased between the periods 2000-2002 and 2007-2009 by about 1 million m³ (Fig. 5). Büchsenmeister (2011) accounts this fact to a higher rate of felling and a decrease of productive age classes in the later period. The higher use, 5,4 m³/ha in 1992 and 7 m³/ha in 2010 (Büchsenmeister, 2011), was caused by attractive timber prices, extension of wood mobilization for energy use, but especially by the severe storm disasters of the last decade. 60 % of the stock is located in small-scale private forests (354 m³/ha). The state-owned forest (ÖBF-AG) has a stock of 316 m³/ha.

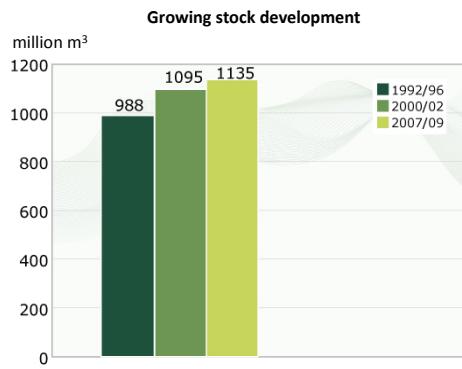


Figure 4: Growing stock development (BFW, 2011b)

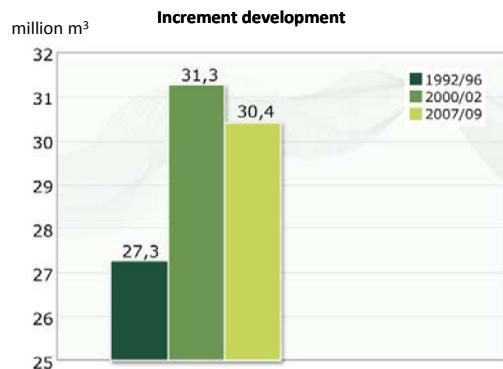


Figure 5: Increment development (BFW, 2011b)

Economic importance. In 2010, 2% of the Gross Domestic Product (GDP) was generated by the forest-based sector (FOREST EUROPE, 2011). The amount increased from 3.4 billion € in 1990 up to 5 billion € in 2010. On the other hand, the percentage of the national Gross Value Added (GVA) was decreasing slightly from 2.8 to 2% in the last 20 years. With 2.3 billion € in 2010, the manufacture of wood and articles in wood were the strongest group in the sector. The pulp and paper industry generated a gross value of 1.6 billion € and forestry of 1.1 billion Euro. (FOREST EUROPE, 2011)

The forest-based sector is an important employer in Austria. Compared to other European countries, employment in the forest-based sector is rather constant or even increasing. Around 250.000 people (2% of the total population) are working directly or indirectly in the sector (Lebensministerium, 2008). In 2010, 74.000 persons were directly working in forestry, or in the timber or pulp and paper industry (FOREST EUROPE, 2011). These jobs are spread over 157.000 companies, including many small businesses. Small- and Medium-sized Enterprises (SME) play a crucial role in the forest-based sector. Further, the sector takes care of a large employment in rural areas, and for more than 145.000 forest owners their forests offer an additional income.

Table 1: Employment in the forest-based sector in Austria (FOREST EUROPE, 2011)

Category	Year	Employment (# persons)
Forestry	2010	11.200
	2005	9.600
	2000	6.700
	1990	n.a.
Manufacture of wood and articles in wood	2010	44.700
	2005	40.800
	2000	34.800
	1990	n.a.
Manufacture of paper and paper products	2010	17.900
	2005	17.900
	2000	19.700
	1990	n.a.

2.3.3 Nature protection and biodiversity

Tree species composition. Austria's forests are naturally conifer-dominated. This has been increased to some extent through human activity for economic reasons, but the extent of conifer-dominance has been declining over the last decade. With 63.5% of the total forest area, coniferous tree species are still predominant in Austrian forests (Fig. 6), although they are decreasing since years. Particularly Norway spruce (*Picea abies* (L.) Karst.) has suffered from severe wind blows in 2007 and 2008. Between the inventory of 2000-2002 and that from 2007-2009, the area with spruce decreased with more than 100.000 ha. Since 1986-1990, the decline of coniferous tree species was around 200.000 ha. But, during the same period, deciduous trees increased with around 134.000 ha. Beech (*Fagus sylvatica* L.) had the highest gain with 40.000 ha and other hard wood increased with 80.000 ha.

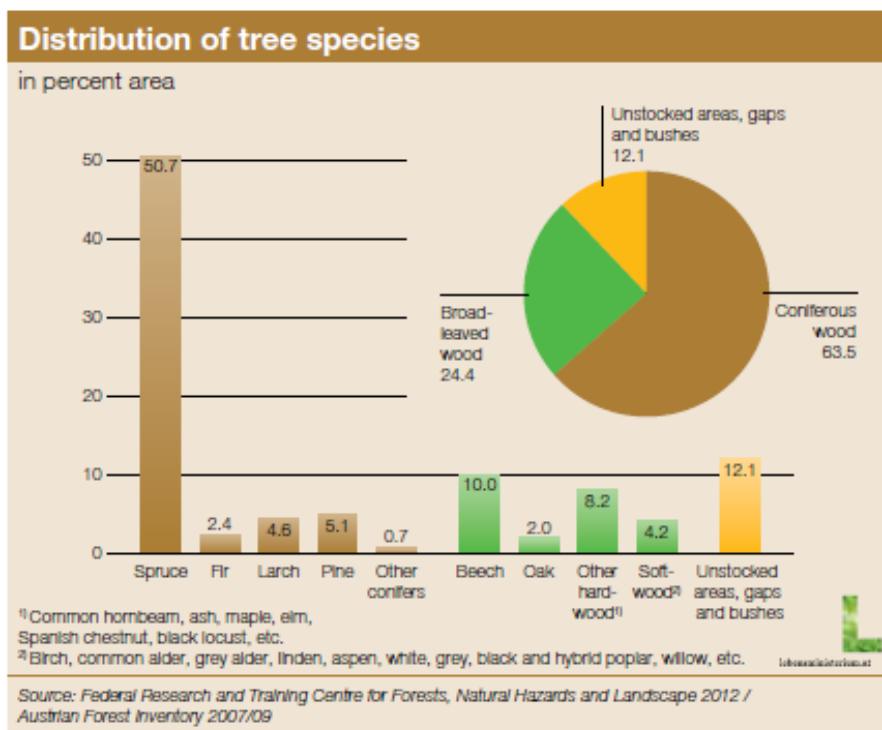


Figure 6: Tree species distribution (% of total forest area)

There is an obvious trend from single-species stands (Norway spruce) to more mixed stands with deciduous tree species (Fig. 7). In the latest Austrian Forest Inventory (AFI; 2007-2009), it is the first time that productive forests have a higher proportion of mixed-stands than of single-species pure stands. Spruce and pine are decreasing in area and stem number, whereas beech is heavily and other broadleaved species are slightly increasing (Hauk, 2011). In addition, the storm disaster of 2007 and 2008 left gaps and shrub areas on former coniferous stands (95.000 ha) (Russ, 2011).

Silver fir, which originally covered a much larger proportion of the forested area, becomes regionally an endangered species mainly by lack of natural

regeneration, caused by game browsing, and management practices that disfavor silver fir.

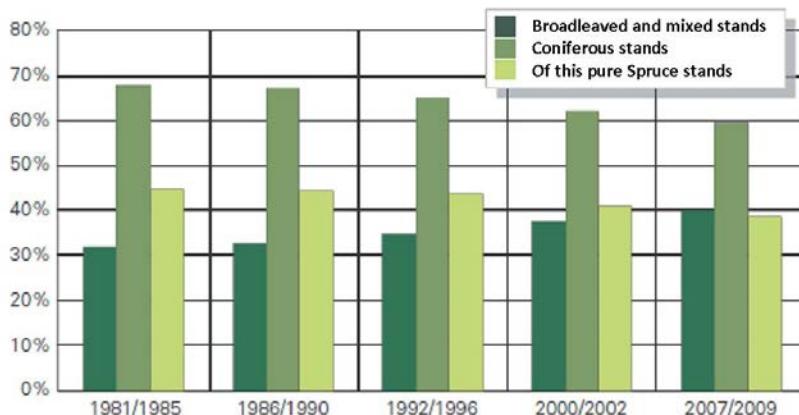


Figure 7: Development of tree species composition in productive forests (Russ, 2011)

Regeneration. In the National Forest Inventory (ÖWI) of 2007-2009, data for regeneration indicators were collected. Around 16% of the total forest is under the category “regeneration”, which is a slight increase compared to the last inventory. The regeneration deficit (that means where regeneration is needed but not existing) was decreasing between the two periods from 7 to 6%. However, the lack of regeneration in protective forests that are in use is three times, and in protective forests that are out of use four times higher than in productive/commercial forests. The main constraints are browsing and grazing, light, competitive vegetation and erosion. Browsing by game causes severe damages and hinders mixed stands (Schodterer, 2011). But as hunting is a big and emotional political issue, comments and conclusions have to be done quite carefully.

Naturalness / biotope quality assessment. When trying to assess naturalness, a comparison between the potential natural vegetation (PNV) and the existing tree species composition is an important tool. In the last National Forest Inventory, it was found that on 44% of the productive forest area the target tree species are missing (Hauk, 2011). The ecological important species silver fir is often missing as a target species, both in spruce-fir stands as well as in spruce-beech-fir stands. On the other hand, spruce is never and beech is seldom missing. Reasons for this phenomenon are sub-optimal adaptation of fir to management systems (competition with light demanding trees, too much light in harvest systems) and the preferred browsing of roe and red deer. For enhancing the conditions for fir, a protection of individual trees and multi-storey stand management is necessary (Hauk, 2011).

According to the ÖWAD-Indicators (Lebensministerium, 2011b) there exists a lack of data concerning invasive species in the herb layer. That makes it quite difficult to assess the criteria of “no introduced or invasive species in the herb layer”. Also exact data is missing on introduced and invasive species in forests within

protected areas. In general, the forest area stocked with introduced species and (or) invasive species is growing. In 2010, 60.000 ha of forest area were covered with introduced species and out of that 29.000 ha with invasive species. Although the size is rather small compared to the total area, it has almost doubled since 1990 (Lebensministerium, 2011b). Especially the alluvial forests in the lowlands of the continental regions are affected by invasive species. Black Locust (*Robinia pseudoacacia* L.) causes most damage, as it is able to change site conditions strongly (nitrogen fixing, and converting dry places, and shading ground) (Lebensministerium, 2008). The proportions of other invasive neophytes (e.g. *Ailanthus altissima*, *Acer negundo*, *Fraxinus pensylvanica*) are increasing slowly, but constantly. Severe changes in species composition, specifically in the flood forests of the larger floodplain-ecosystems are expected. The Environmental Agency developed a study called “Neobiota” and an action plan on controlling invasive species (Essl & Rabitsch, 2004).

Protected areas. Around 27% of the total land area is protected under different categories (Umweltbundesamt, 2013b). Half of this area is covered with forest (Schwartzl & Aubrecht, 2004). Austria has 6 National Parks (Table 2). It is the only category with an extra legislation. Only a very little amount of forests is out of any use, and these parts are located mostly within the National Parks or in so-called Natural Forest Reserves. 16% of the land area is designated under the European Network “Natura 2000”. From this, 43% is covered with forest (Lebensministerium, 2012).

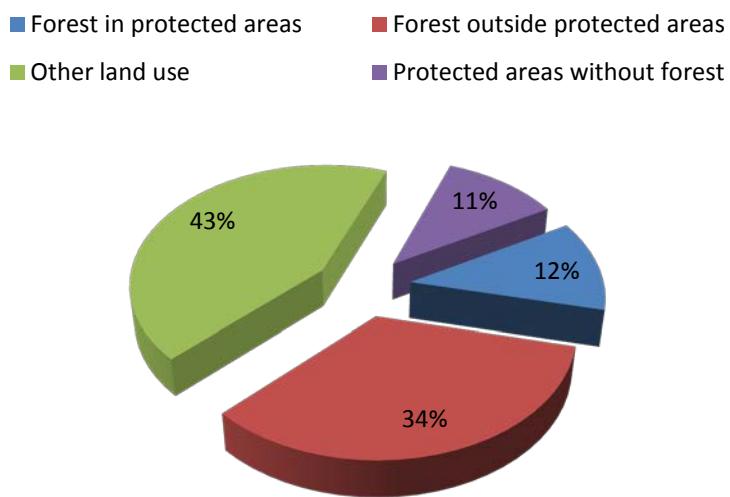
Table 2: Conservation areas in Austria in 2009 (Umweltbundesamt, 2013b)

Site category	Number	Area (km ²)	% of national territory*
National parks	6	2353	2,8
Natura 2000 sites**	159	11.557	13,8
Nature conservation areas	442	2.992	3,6
Landscape conservation areas	247	12.696	15,1
Nature and landscape conservation areas	4	506	0,6
Protected parts of landscapes	347	86	0,1
Nature parks	48	4.143	4,9
Ramsar sites	19	1.380	1,6
Biosphere parks	6	1.525	1,8
Other conservation areas (excl. nature reserves)	40	1.507	1,8

*Any overlapping conservation areas in different categories are not included in the table.

**Legally registered Natura 2000 sites; Austria has, however, nominated a total of 218 Natura 2000 sites.

In 2004, the forest area in Austria was around 47% of the total land area. Protected areas were up to 23%. Around 10.919 km², more than 50% of those protected areas, were covered with forest. In other words, 12% of the Austrian land area consists of forest in protected areas (Fig. 8; Schwartzl & Aubrecht, 2004).

**Figure 8: Forest in protected areas (Schwartzl & Aubrecht, 2004)**

The reference figures from 2002 (Lebensministerium, 2011b, showed that 26,2% of the total forest area was protected forest according to the MCPFE classifications (Table 3).

Table 3: Overview of MCPFE-classes and its share in the Austrian forest (Lebensministerium, 2011b)

Forest Europe (MCPFE)-Class	% of total forest area		%
	2002	*2008	
Class 1.1: No active intervention	0	0	0
Class 1.2: Minimum intervention	0,7	0,8	0,1
Class 1.3: Conservation through active management	2,3	6,5	4,2
Class 2: Landscape protection	23,2	9,7	-13,5
Total	26,2	17	-9,2

*Without natural forest reserves (around 8500 ha in Class 1.2)

Regarding the development and changes between the years 2002 and 2008, there was a positive trend for the class 1.2 and 1.3. In these classes, the preferred minimum value (1% in class 1.2 including natural forest reserves and 4% in class 1.3) was fulfilled. The class 1.3 increased because of nominations of large Natura 2000 areas in Lower Austria. The changes in class 2 resulted from conversion to higher classes and due to legal changes concerning landscape conservation areas in Styria (Lebensministerium, 2011b).

The *Natural Forest Reserve programme* has the aim to preserve and maintain at least all existent forest associations in Austria. The legal base of these reserves is a private law contract between the state of Austria and the forest owner for a period of 20 years. To guarantee a long-term perspective the contract contains an option for prolongation after 20 years. Any economic use (except game hunting) is completely stopped in these areas during that period. The forest owner receives an annual amount of money determined by an assessment of the forest authorities.

These Natural Forest Reserves serve as research areas where natural dynamics can be observed and investigated and future scenarios can be developed, further they can be used as reference areas for productive forests and for giving recommendations. The Federal Forest Research Centre was charged with the technical and scientific implementation of the programme (Frank & Müller, 2003; Frank, 2009).

Until 2012, 198 Natural Forest Reserves were implemented. This complies 8.441 ha or 0,21% of the whole forest area. So far there is an uneven distribution of the areas concerning the natural growth regions. In the northern and southern Limestone Alps, large areas with for this region important forest associations were registered. But, in the agricultural and industrial dominated pre-Alps and parts of Styria not all associations are represented, because it is difficult to find appropriate areas that are taken out of use. The long term objective of a representative network including all forest types of Austria is on the way but not reached so far (Frank et al., 2010).

Beside this voluntary concept (enabled through a financial instrument), two laws exist on area protection and species protection, which are the two other main objectives in nature conservation.

Threatened forest species. Covering parts of the Alpine region but also parts of continental Europe, Austria is a species-rich country within Central Europe. Extreme variations in altitude and the different climatic influences enable diverse biotopes and habitats on a relatively small area. Around 45.000 animal species and over 6.000 fern and flowering plant species as well as mosses and lichens are found in Austria. Over 13.000 species are connected to forest ecosystems (Umweltbundesamt, 2010). Many of those species are endangered and put on the red list of threat categories. The situation for the forest species indicated in the “Red lists” was not enhanced significantly in the last decades. The number of threatened species stayed on the same level or even increased (Lebensministerium, 2011b).

Main drivers for species and biotope loss are area sealing, habitat cuttings through infrastructure (roads, railroad tracks, power plants...) and intensification of agriculture, and loss of small and open landscape patterns. But not only species are categorised on the red list, also biotopes are (Essl et al., 2002). From 93 forest biotopes listed, 57% are under the category “(heavily) endangered” or “at immediate risk”. Also open woodland and shrub land as forest related biotope types was registered (Table 4).

Endangered are primarily forests in intensively-used low land areas. Especially in alluvial ecosystems the situation is very tense, whereas a more favourable situation is found in mountain forests (Lebensministerium, 2008).

Based on the red lists a variety of habitat and species programs was started. A very ambitious one was the national biodiversity campaign “vielfaltleben” in

2010, where measures for the conservation of some rare species (e.g. wild cat, longhorn beetle, and sea eagle) were implemented.

Table 4: Number of biotopes classified by threat category (Lebensministerium, 2011b)

Threat categories	Biotope type	
	Open wood and shrub land	Woods and Forests
Completely destroyed	0	0
At immediate risk	3	5
Heavily endangered	3	20
Endangered	21	28
Potentially endangered	0	0
Not endangered	9	22
"Not worth protecting"	12	18

Dead wood. Standing and lying dead wood is enhancing the biodiversity and the number of species within a forest ecosystem. It offers shelter, nutrition and other services for many insects, birds, fungi and other species.

Even though the assessment in the last National Forest Inventory was adapted to international standards (that means that in the inventory from 2007-2009 also lying dead wood <10 cm diameter was measured), the amount of lying and standing dead wood has increased during the last two decades. In 2010, the total amount was around 20 m³/ha in productive forests (Fig. 9), but the distribution between regions varies significantly. The highest amount of dead wood was found in the alpine mountain forests, especially in deep canyons. Very little dead wood was found in the highly managed forests in the growth areas of "Mühlviertel" and "Waldviertel". The less steep the sites are and the easier heavy machines can be used, the less dead wood is found (Hauk, 2011).



Figure 9: Amount of dead wood (m³/ha) (Lebensministerium, 2011b)

Genetic resources. One core issue of biodiversity is the diversity on the hierarchical level of genes, as a higher variety allows better adaptation to changing conditions, in particular climate change. Genetic variation is seen as a prerequisite for the adaptability of forest ecosystems to climate change.

In forest genetics the idea is to ensure in-situ gene material. That means that the original gene material is transferred to next generations via natural regeneration. Because of the specific characteristics of forest trees in situ conservation strategies are preferred to maintain genetic diversity. Austria has established a Programme on Gene Conservation Forest in already in 1986 as a part of a comprehensive programme of conservation of forest resources (Müller, 1993; Frank and Müller, 2003).

Another method is plantations/tree nurseries or seed-collection stands (often located in the aforementioned gene reserve forests) where seedlings and seeds for afforestation can be gathered. This should guarantee that in the long run the genetic material is adapted to the site. However, a large amount of seeds is still imported from other countries and the performance is very uncertain (Lebensministerium, 2008).

3 Forest functions

The multifunctional Austrian forest ecosystems provide many different products and services, of which some are listed below. The functions are described more extensively in the following sections.

Products – “Use”

- Wood
- Christmas trees and decoration branches
- Bio energy
- Berries, herbs and mushrooms
- Game, hides and skins

Protection services – “Protection”

- Water quality and quantity
- Erosion protection
- Natural hazard protection
- Climate regulation and protection

Cultural and social services – “Benefit” & “Recreation”

- Recreation and sports
- Education and training
- Tourism
- Characteristics of landscapes

(Lebensministerium, 2009)

3.1 Wood production and energy from wood

Wood production is a crucial economic factor in Austria, especially for rural areas. 84,4% of the forest area is productive or commercial forest. In 2011, there was again a harvest increase compared to the year before. The small-scale private forest owners harvested 60% of the total harvest, which might be caused by several initiatives from the authorities in previous years to mobilize wood in small-scale private forests. 27% was used for bio energy purposes. A large amount is still sawn timber with 55% and industrial wood 17%. Timber of coniferous species accounts for 84%, whereas timber from broadleaved trees was around 17% only (Lebensministerium, 2012a).

The use of wood for energy production is constantly increasing. In 2010, almost 20 million m³ were used for energy purposes (traditionally heating in decentralized plants, but also bigger combined heat and power plants are occurring) (Lebensministerium, 2010). The Austrian Energy Agency expects an

increase of 5 million m³ that leads to more than 25 million m³ in the year 2020 (Fig. 10).

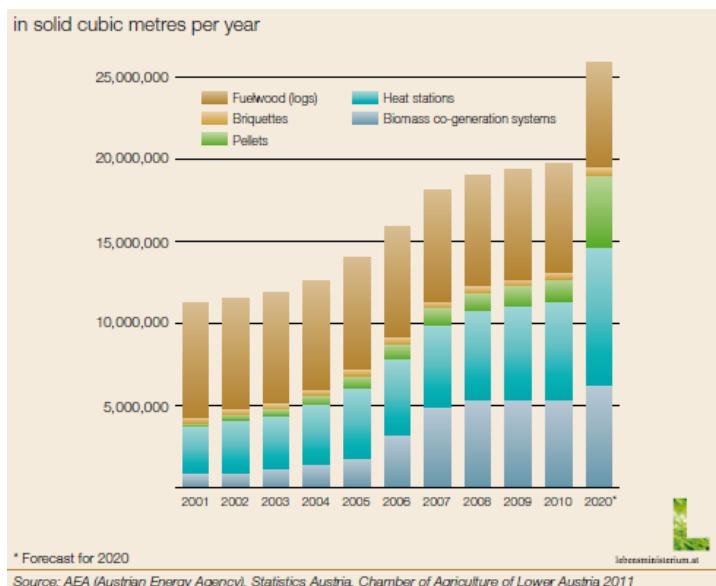


Figure 10: Wood required for energy production in Austria

3.2 Protective function of forests

Austria, as an alpine state, is affected by natural hazards coming from the mountains. The protection of settlements and their population against avalanches, landslides, floods and rock fall is of high priority in the country. Beside technical solutions, a vital mountain forest as a natural barrier plays a crucial role. Around 20% of the Austrian forest has a protective function.

In the amendment of the Forest Act in 2002 there was a change in the definition of protective forest. It now distinguishes between site-protective forest and object-protective forest. The first one is protecting the site itself; the second is protecting anthropogenic infrastructure and land.

In the last National Forest Inventory, Niese (2011) indicated an alarming “over-age” of the majority of the protective forests. Severe threats for regeneration of protective forests are game browsing (red deer, roe deer, chamois, moufflon and others) and erosion.

3.3 Cultural and multiple use of forests

Beside wood production, forests offer many other products and services. In Austria everybody has free entry rights to forests for recreation purposes (such as walking, hiking, running, playing and cycling on official and indicated ways, relaxing and enjoying nature). Access restrictions only exist for specific circumstances, e.g. young regeneration stands. Recreation in the natural environment is very common, but of course not without conflicts. For activities such as horse riding or camping, the permission of the forest owner is needed. Also

mountain biking is a matter of conflict, as mountain bikers often go cross-country and cause severe damage and erosion in stands.

The use of non-wood forest products such as mushrooms is regulated in the Forest Act. Further, game plays a crucial cultural and traditional role, and also the economic value generated by selling game and hunting leases is remarkable. Hunting has own legislations written down in the hunting law of each province (Lebensministerium, 2008).

3.4 Potential conflicts between nature protection and other functions

The conflict potential on bio energy issue is very high and the arguments are well known. The competition on raw wood between energy and material use is raising or has started already. From a nature protection perspective severe pressures on forest ecosystems are expected because more organic material such as canopy wood, thin brunches, decayed wood, stubs and roots is removed and not let in the stands and are not available in the natural cycle any more. Another concern is the stocking of open land such as former meadows and pastures with short rotation plantations or substitute food crops by energy plants (Umweltbundesamt, 2009).

Conflicts may also arise with recreation. To make forests and nature accessible for people, roads and parking spaces must be available. Cars cause air pollution and noise, and visitors may disturb birds and other animals. Also winter sports have a strong impact on its environment, e.g. construction of ski trails and lifts.

Conflicts between hunting and nature protection may arise not only when protected species are concerned, but also when vulnerable tree species like silver fir or rare broadleaved tree species disappear due to browsing by roe and red deer.

4 Legal framework

4.1 Forest act

Forestry and forest management are within the competence of the Federal Government. Legal requirements are covered by the forest act (BGBl. 440/1957 amended by 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.

The Forest Act (1975) and an amendment of the Forest act in 2002 also includes a general commitment concerning sustainable use in the sense of Resolution H1 of the Ministerial Conference on the Protection of Forests in Europe. It is the most important legal source concerning forest management, protection, wood production, and forest in general.

The principles of forest management are the maintenance of forest (deforestation restrictions), sustainable forest management, afforestation of harvested areas, afforestation of new areas (previously non-forestland) and enhancing the quality of the forests state. These goals guarantee a constant wood production and supply.

Maintenance of forest through sustainable forest management (SFM). The general deforestation and devastations restrictions ensure a constant forest area. Also strict protection legislations guarantee the vitality of forest stands. SFM should guarantee multi-functionality of forests. Especially the “use” of forest resources must be done in a way that the forest serves also further generations, with all its functions.

Principles regulated in the Forest Act are:

- On large forest properties forest management via professional staff (foresters)
- Restriction of large clear cuts (>2 ha)
- Small clear cuts (>0,5 ha) only with permission
- General restrictions in protection forests (avoiding erosion, avalanches and floods)
- Restriction of felling of immature stands (before the end of rotation period)

Afforestation enhancing quality of forest state. The forest owner is obligated to afforest harvested areas: plantings within 5 years with site appropriate tree

species, and natural regeneration within 10 years. Afforestations and the enhancement of forest stands have the goal to keep forest area, to protect against natural hazards and to enhance the microclimate and water balance.

4.2 Legislation on biodiversity and nature protection in Austria

4.2.1 National Laws

In Austria, species protection, area conservation and sustainable use are the three pillars of nature protection and biodiversity maintenance. A national act on the protection of nature does not exist. Hence, the protection of forests is regulated through the different Nature Protection Acts of each province and the Forest Act of 1975 with its executive directives for the nine provinces.

Other important laws for biodiversity are the National Park Laws, the Hunting and Fishery Laws that are in the provinces' area of competence, and the Environmental Liability Law (*Umwelthaftungsgesetz*).

4.2.2 European context

In Europe, there exists no binding convention on the protection of forests or any common policy like we know for Agriculture (Common Agriculture Policy (CAP)). But, important instruments towards a coherent European forest policy are the European Forest Strategy with the European Forest Action Plan and the FOREST EUROPE process. Although all these are not binding legislations, they have special importance for European forests. The process started with the Resolution of the Ministerial Conference on the Protection of Forests in Europe (MCPFE) in 1990. 46 states, including Austria, signed so far. A Ministerial Conference is organized at regular intervals. In 2011 it was held in Oslo, where a mandate was given to the ministers to start negotiations about a binding European forest convention.

4.3 Other relevant laws

- Act on Forest Reproductive Material 2002 (Agricultural Law Amendment Act 2002 regulating how to deal with forest reproductive material (seed and plants) on the basis of EU Directives, and replacing the cancelled Section XI of the 1975 Forestry Act)
- Federal Law on the creation of a quality label for wood and wood products from sustainably managed forests (1993) amended in 2002
- Act on the new regulation of the legal form of the Austrian Federal Forests and the establishment of a stock corporation for continuation of the "Austrian Federal Forests" enterprise (1996 Act on Federal Forests). This legal act transformed the federal forests to a stock corporation in 1997. It pays 50% of the net profit of the usefruct compensation to the Republic every year and a special dividend almost every year. Sole

owner and shareholder is the Republic of Austria (Österreichische Bundesforste, 2012).

4.4 (Inter)national agreements and programs

Austria has signed several international conventions on nature and environmental protection and sustainable development. The most relevant concerning forests are the Convention on Biological Diversity (1992) and the Alpine Convention (1991).

The United Nations Convention on Biological Diversity (CBD) has the aim to maintain biodiversity and stop the loss of species worldwide. Austria is party since 1995 and worked out a correspondent National Biodiversity Strategy (1998-2005). Special importance is also given to forest ecosystems. In the strategy concrete measures are listed.

The Alpine Convention was signed by eight Alpine states in 1991. In Austria it entered into force in 1995. The goal is the sustainable development of the Alpine region. The convention is not only a nature protection law; it is a rather holistic approach that covers also economical, social and other aspects of the Alpine region.

Further, measures in the different sectors are regulated in the protocols of the convention. Of crucial importance for Austrian forests are the “Mountain Forests Protocol” and the “Soil Conservation Protocol”. Both were ratified in 2000 and entered into force two years later. But also other protocols, such as nature and landscape conservation, tourism, energy and spatial planning, have a direct or indirect impact on forests and forest management. (Alpenkonvention, 2013) Ratified in most of the party states, the alpine convention with its protocols is a binding law.

Other conventions concerning forest and biodiversity:

Name	Full name/ content	Austria...
Ramsar Convention (1971)	Convention on Wetlands	Is party since 1983
UNESCO World Heritage Convention (1972)	Registration and conservation of cultural and natural heritage monuments and sites for coming generations	Is party since 1993
CITES (1975)	Convention on International Trade in Endangered Species of Wild Fauna and Flora	is party since 1982
Bonn Convention (1979)	Convention on Migration Species	Is party since 2005
Bern convention (1979)	Convention on the Conservation of European Wildlife and Natural Habitats	Is party since 1983. The objectives were integrated in Austrian nature protection and hunting laws
Danube River Protection Convention (1998)	The protection and sustainable use of the Danube River	Ratified in 1996
European Landscape Convention (2004)	Conservation of European natural and cultural landscapes	Austria did not sign or ratify so far

(Naturschutz.at, 2013)

4.5 Strategies and action plans

The following strategies, action plans are related to forests and its biodiversity:

- National Biodiversity strategy (1998), updated in 2005
- EU-Biodiversity Strategy and Action Plan (2011)
- National Action Plan on Neobiota (2005)
- National Water Management Plan (2009)
- Climate Strategy (2002), up-dated in 2007
- Austrian Strategy and Action Plan on Climate Change Adaptation, draft version (2012)
- Austrian Energy Strategy (2010)
- National Strategy for Sustainability, NSTRAT (2002), in revision
- Sustainability Strategy of the Federal State and the Provinces, ÖSTRAT (2010) with its work programme and progress report 2011
- Resource Efficiency Plan (2012)

4.6 Forest Dialogue and National Forest Programme

In April 2003, the Federal Ministry for Agriculture, Forestry, Environment and Water Management initiated the Austrian Forest Dialogue (Österreichische Walddialog; ÖWAD) as a participative process with the aim to integrate all relevant stakeholders in important issues on forests. The process is open for governmental, other public and private organizations and all other interested stakeholders. The main idea is to find solutions and compromises on conflicts due to different interests and uses on forest functions and services. The forest dialogue is defined as a clearly structured, transparent, continuous, dynamic and flexible process. In several committees, such as the “round table” as the core institution, and different module-groups (module 1: protection forests – forest protection, module 2: economy, module 3: environment and society) important topics are discussed and objectives are formulated. “Hot topics” where no solution could be found, can be re-discussed again in the ongoing process. The adaptive approach enables the inclusion of new emerging topics. In discussions and sessions, principles and goals of the main topics are announced and specified as concrete actions in work programs.

One part of the working program was the elaboration of an indicator-set that consists of the indicators of the FOREST EUROPE initiative and was created in 2003 at the MCPFE conference in Vienna. The status quo (2003) was compared to the current state (2009 and 2011) and the progress trends of the indicators were analyzed.

A first evaluation of the Forest Dialogue concept as a whole and a second evaluation of the indicator-set were completed in the year 2010-2011.

The Forest Dialogue is still going on. The phases of describing status quo, setting targets, generating actions, implementation and evaluation, is a cycling process and restarting again. At regular intervals, conferences and meetings on important

forest issues are organized. The theme of the latest forest forum was the better integration of forestland in the programs for rural development.

One main output was the development of the Austrian National Forest Programme. Although it is a legally non-binding document, the National Forest Programme has a large impact on the forest-based sector in Austria. It is seen as a milestone in a modern democratic process (Lebensministerium, 2008), amongst others as the Ministry uses the outputs of the Austrian National Forest Programme as a basis for further policies and programs.

Recently, there was a first evaluation of the process (Hogl & Kvarda, 2011). The main findings were:

- The coordination and leader role of the Ministry and the Forest Administration, as well as the in advance compiled and established basics and rules for the whole process, was rated as positive and successful
- There was a wide range of participants and an intensive exchange, at least in the first phase of the process
- The whole process enhanced the “discussion culture” and generated more appreciation for the opinions of others
- In the first phase until the adoption of the National Forest Programme, engagement was very time intensive for the participants but with positive outcomes
- In the second phase, the Forest Dialogue converted more and more into an information platform. That means less workload, but also the absence of some relevant organizations and stakeholders
- The work program is mainly implemented
- Outlook: regionalization, special topics, better communication, implementation, relevance in decision making process

Hogl & Kvarda (2011) see the future perspective of this participatory instrument in the question of political relevance in decision-making process and agenda setting.

5 Financial instruments

The most important funding instrument for forest owners is the *Austrian programme for rural development*, as forests and wooden areas are found in rural and remote areas. The government is supporting rural areas to offer perspectives. The program promotes ecological management methods in agriculture and forestry that enhance and maintain biodiversity in diverse landscapes. The current period goes from 2007 to 2013. The overall budget of the Austrian programme is around 8 billion € in 7 years (Lebensministerium 2010a). The funding theme "Forest and Water" was allowed with only 2% (Fig. 11; Knieling, 2012).

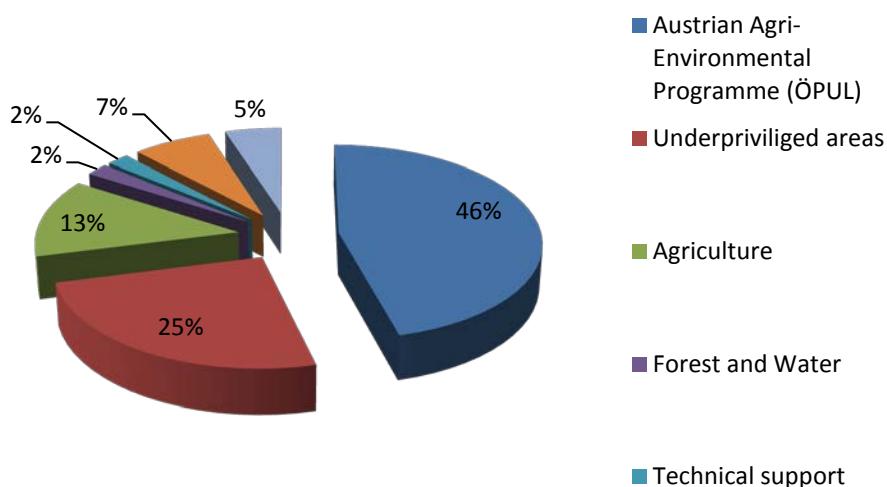


Figure 11: Funding by sectors; Austrian programme for rural development 2007-2013 (Knieling, 2012)

In Austria, investments in protection infrastructure are essential. In the year 2011, around 160 million € were spent on torrent, avalanche and flood control projects. (Lebensministerium, 2011). Only 35 million € were spent on protective forest maintenance, although Singer (2012) states that a sound and vital protective forest would have the same effect for 100 times lower costs. For 2010, Grill (2011) assumed 275 million € of expenses and mentioned 10 times lower expenses for forests (10 €/ha) compared to technical facilities (100 €/ha).

The funding of protective forest projects is coordinated by the ISDW ('Initiative protection through forests') that is supported by the Austrian programme with around 5.7 million €/year. All projects are realized in close cooperation with provinces, municipalities and stakeholders (forest owners).

Considering the coming end of the programme period, the negotiations on the next period 2014-2020 are in full play. The aim of the "forest side" is to increase the 2-4% part for forest-related issues in the next funding period.

Therefore, the 8th forest forum within the Forest Dialogue initiative discussed the topics for the upcoming program period.

For the *National Forest Reserve Programme*, the Republic of Austria offers about 850.000 € per year.

6 Informational instruments

6.1 Education

In Austria, there are various levels of forestry education. Forest wardens are educated at the federal forest education centre in Waidhofen an der Ybbs. The training takes one year. The school for higher education in Bruck/Mur educates foresters. The study takes 5 years, and it is followed by a two-year practical period and an examination. The only place where one can study forestry at university level is at the University of Natural Resources and Life Sciences (BOKU) in Vienna where students can obtain a Bachelor and Master degree.

Forest training centres in Ossiach, Gmunden and Pichl offer a wide range of courses and seminars both on forestry but also on nature protection and biodiversity related topics.

6.2 Advisory services

The *Austrian Forest Society* is the roof organization on national level. Containing six forestry societies on the federal level, founded in 1852. The main topics of the society are lobbying for woods and forestry in legislature and PR, education and training for all members within the forest sector and information of the public concerning woods and forestry. Both the Austrian Forest Society and its societies on the federal level arrange seminars, annual congresses and other education events. There are active teams of specialist dealing with forest technology, silviculture and nature protection, forest economics, forest protection, forest history and other topics.

The *Forest Association Austria* (Waldverband Österreich) is a technical organization of the Agricultural Chamber Austria. It has eight regional associations. The main tasks of the Forest Association Austria are the coordination and representation of the interests of the regional forest associations at the federal level. Besides, the Forest Association tries through several activities to increase the profit of the Austrian forest sector.

Pro Silva Austria is the national organization of Pro Silva Europe. Pro Silva promotes forest management strategies that optimise the maintenance, conservation and utilisation of forest ecosystems in such a way that the ecological and socio-economic functions are sustainable and profitable. The general approach to management that is advocated by Pro Silva, includes market and non-market objectives, and takes the whole forest ecosystem into consideration. Pro Silva Austria offers excursions inside Austria, and to the neighbouring countries and fosters the exchange of knowledge and experiences on close to nature forestry between its members.

7 Certification

In 1993, the Forest Stewardship Council (FSC) was established on an international level. The idea was to stop illegal logging, especially in tropical forests. It resulted in a voluntary market instrument that allows the customer a transparency concerning the origin of wood and wooden products. It also guarantees the production of wood under social, ecological and economical sustainable conditions.

The main certification labels are FSC and the Programme for Endorsement of Forest Certification Schemes (PEFC). In Austria, both certification systems are represented, but PEFC is more common. More than 3.5 million ha of forest are certified under the PEFC scheme, whereas in 2010 only 5000 ha of Austrian forests were certified under FSC (Lebensministerium, 2010b).

Both systems follow a holistic approach that certifies not only forests, but also the proceeding product chain.

8 Monitoring and planning tools

The different interests and demands on the same forest ecosystem are increasing and so a detailed planning concept is needed. In the Forest Act three concepts are defined: the Forest Development Plan, the Hazard Zone Plan and the Technical Forestry Plan. But first, the National Forest Inventory as a monitoring tool is discussed.

8.1 National Forest Inventory

The Austrian Forest Inventory (ÖWI) is done at regular intervals on a national level since 1961. It is a very important data assessment (and evaluation) concerning forest ecosystem parameters. Collected are date of increment and use, tree species composition and regeneration. In the last inventory, which took place from 2007-2009, also biodiversity parameters were measured (e.g. dead wood), besides parameters and data on the province level.

The ÖWI allows the observation of variations and trends over a longer period of time. It is the basis for measures, policies and economical plans on a national and international level.

8.2 The Forest Development Plan

The Forest Development Plan (Waldentwicklungsplan; WEP) is based on the Forest Act (1975) and provides information on the four different forest functions (use, protection, benefits and recreation; Fig. 12) and their value category (high, middle, low). These data form the basis for further planning and decision-making. The Forest Development Plan is a state-wide and mandatory framework with the aim to show the complete system of different forest functions.

The Forest Development Plan is created and updated by the forests authorities and is valid for 10 years. Since 1990, the sub-plans of the forest development plan are also accessible to the public. Beside these analogue maps, sub-plans and explanatory texts, all the data is also fed into a digital geographical information system (GIS). This allows an easier comparison of the actual situation and the one you target upon. Further, it enhances fast data exchange and it can be used by other disciplines, like general landscape and infrastructure planning.

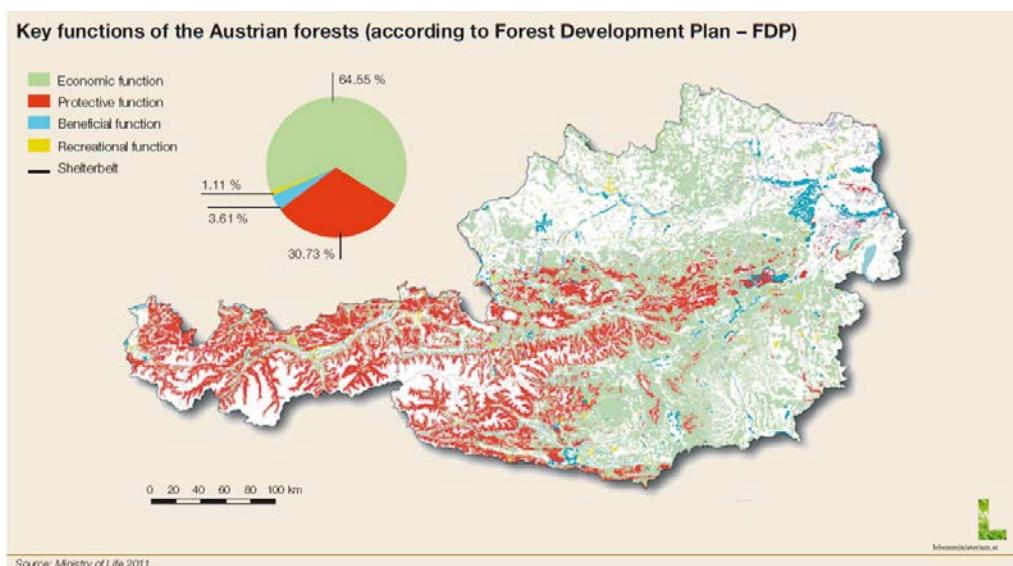


Figure 12: Forest Development Plan (Lebensministerium, 2011)

8.3 The Hazard Zone Plan

The Hazard Zone Plan (Gefahrenzonenplan) is a plan that maps potential risks (torrents, avalanches, erosion, etc) for each municipality, and is used in land-use planning. Red and yellow zones indicate the risk level. A Red Hazard Zone consists of areas that are so endangered that they cannot be used for transport and settlement. The Yellow Hazard Zones comprises all other risky areas, where transport and settlement is possible to a limited extent. The plan also contains blue (reserved for protection measures), brown (danger of falling rocks or slides), and violet (e.g. necessary for drainage) areas. (Lebensministerium, 2013)

8.4 The Technical Forestry Plan

Today, forest owners are confronted with more and more issues that influence forest management (nature conservation, biodiversity, cultural aspects, etc), the Technical Forestry Plan (Waldfachplanung; WAF) has been prepared. The Technical Forestry Plan is a forestry plan drafted by the owner or by experts appropriate for this purpose. It is a planning instrument that describes a.o. the goals of the company, but also deals with topics that are not directly related to forest management. For example, the development of a demonstration site for public visitors of the forest. In this way, the foresters may go along with the different functions the forests are used for nowadays. And by using a planning tool, this will happen in a structured and sustainable way. (Lebensministerium, 2013)

8.5 Management plan

In productive and also in protective forests it is not obliged by law to develop a management plan, but in general, larger entities compile a management plan every 10 years as part of their forest inventory. Smaller forest holdings have the possibility to get advisory support from the public forest authorities, and financial

support from the national fund for rural areas (Lebensministerium, 2008). In figures: nearly 50% of the Austrian forest has a management plan (Lebensministerium, 2011b).

9 Outlook

Climate change predictions and scenarios expect higher temperatures and seasonal and local changes in precipitation distribution and an increase of extreme weather events (e.g. storms, draughts). Already now effects of changing climate conditions on forests are observed, and it is expected to increase in the future. (Lebensministerium, 2012) For example, at higher elevations forests might profit, as the timberline may shift to higher elevations. At lower elevations, especially commercial tree species (e.g. spruce) might suffer from frequent droughts, storms and forest fires. And with increasing storm damage and reduced vitality of trees, insect calamities like bark beetle outbreaks are expected. Also invasive animal and plant species, which were held back previously by low temperatures and frost, could invade massively and change species composition in forest ecosystems. For this reason, an adaptive forest management and long-term measures are needed. In silviculture, the diversification of tree species composition and adaptation of tree species to site conditions are just two examples. A close network and interaction with forest owners is crucial to consult them in issues of climate change.

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