

Andreas Häusler, Michael Scherer-Lorenzen

Sustainable Forest Management in Germany: The Ecosystem Approach of the Biodiversity Convention reconsidered

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Author's addresses:

Dr. Michael Scherer-Lorenzen: Institut für Biodiversität – Netzwerk e.V. (ibn), Dr.-Johann-Maier-Str. 4, D-93049 Regensburg Tel.: +49-(0)941-23091, Fax: +49-(0)941-23092, eM InstBN@t-online.de

Andreas Häusler: Wald-Holz-Umwelt Consulting Neidlein-Häusler, Hartlweg 9a, D-86650 Wemding Tel.: +49-(0)9092-911603, Fax: +49-(0)9092-911603, eM AndreasHaeusler@aol.com

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1 Summary

In past years, the recognition has increasingly prevailed that biological diversity in its different varieties can be successfully sustained only if it is understood in connection with the ecosystem, and if one takes into consideration the multitude of its interactions with humans living in and subsisting on ecosystems. Therefore, within the framework of the Convention on Biological Diversity (CBD), what is now referred to as the “ecosystem approach“ was developed as basis for the implementation of the convention.

This substudy, prepared within the scope of the R&D project “Developing Concepts for ‘Sustainable Use’ in Selected Subdomains of Biological Diversity“, aims at analysing the current state of forest use in Germany with regard to its compatibility with the frame of reference set by the ecosystem approach. A general summary of the current situation and management of the German forest is given in a first chapter, providing the basis for a better understanding of the evaluation of forest use with regard to the ecosystem approach.

Today, almost one third of the territory of Germany is covered with forest, and forested areas have gradually increased over the past decades. Contrary to the natural potential vegetation, only about one third of the total forest area is now stocked with broadleaf trees. The other two thirds are predominantly pure or mixed conifer forests. In Germany there exists an extensive system of legal provisions pertaining to the forest sector, according to which all forest owners are under the obligation of “sustainable, proper management”. Besides the economic utility of the forest, “the continuous capacity of the natural resources” and other functions of the forests (conservational and recreational functions) need to be taken into account, too.

Based on the concept of “multifunctional forest use”, several management systems were developed in Germany, which are setting different priorities concerning the functions of the forests, however. All types of management ensure the quantitative sustainability (harvest \leq regrowth, i.e. material safeguarding of raw material), but differ in their fulfilment of extensive ecological and social criteria of sustainability. In future, these criteria should be taken more into account through the introduction of certification measures or through the initiation of Forest Programmes on a national and federal state level.

While, by and large, the principles of the ecosystem approach of the CBD are being taken into consideration in German forest management, there is certainly a need for further development in some fields.

The societal choice regarding the objectives of ecosystem management as postulated in Principle 1 is mainly affected by the existing ownership structure. While in privately owned forests the consideration of claims from different actors is usually restricted to the legal requirements, those claims are generally dealt with more appropriately in state-owned forests. Nevertheless, there are often rivalling claims to use, which frequently result in conflicts. The involvement of the various stakeholders in management decision within the scope of the National Forest Programme, and of certification activities, may be a feasible method to help solve such conflicts.

In accordance with Principle 2, decentralized structures involving comparatively small areas, in the form of local forest authorities, are in charge of all management activities regarding Germany’s forest ecosystem. Although with regard to decisions made on the basis of global or national effects, local management is limited in its authority. However, local groups, owing to their competence, can contribute

to the solution of urgent issues. That is why in individual cases or areas, centralized and decentralized approaches should ideally coexist or be interlinked.

Ecosystems are connected with each other, both locally and globally. Therefore, management activities in any ecosystem inevitably have effects on other systems, which according to Principle 3 should be considered by ecosystem managers. In order to be able to assess those effects, a sound knowledge of the functional interactions between the individual ecosystems is required. Even though interactions of this kind are comparatively well known with regard to Central European forests, there is a need for further research in this area. With the mapping of forest biotopes, a first step has been taken in the direction of avoiding negative effects on special biotopes within forest stocks. However, the present inventory of such biotopes, together with appropriate recommendations for their maintenance, is far from comprehensive.

The vast majority of German forests must be regarded as fully managed forests, which have been understood in a purely economic context and managed intensively for a long time (Principle 4). In the meantime, previous subsidization programmes with an unfavourable impact on forest biodiversity have been revised and complemented with new criteria directed at the ecological management and conversion of forests. While there are promising efforts directed at a reduction of market distortions and the creating of positive incentives, there is still room for improvement as regards the internalisation of costs and benefits in the given ecosystem.

Apart from “ecosystem goods”, forests also provide a number of “ecosystem services”. Therefore, conservation of structures and functions should be a priority target of the ecosystem approach (Principle 5). While in the past there has been a distinct focus on the commercial function of forests – leading to a form of management aiming at the maximization of ecosystem goods production – the significance of the conservational, recreational and nature protection functions is now growing in Germany. While the ideal of multifunctional forest use takes the importance of ecosystem services into account, the ecosystem services significantly lag behind the ecosystem goods in reality, contrary to this ideal.

The requirement that ecosystems must be managed within the limits of their functioning (Principle 6) is consistent with the requirement for management within the limits of sustainability. This means that an assessment depends on a tangible and measurable definition of sustainability. In the sense of quantitative sustainability within a forest-economic framework, this principle has already been implemented in Germany.

A look at the natural life cycle in the forest ecosystem, ranging from the regeneration phase and the optimum phase to the old-growth stages, tells us that this process may easily take several centuries. Thus, the development of the sustainability in forest management was based upon the integration of time intervals encompassing several generations (Principle 7). In various developmental stages of the forest, however, the managing forest owners are unable to attain “useful” wood assortments. Consequently, certain phases are being deliberately shortened (regeneration phase) or even eliminated (old-growth phase) as a result of management activities, but also of e.g. the legal obligation for reforestation.

Due to the ownership structure, forest management in Germany is practised on areas of extremely inhomogeneous size (ranging from a few ares to several thousand hectares). For the purpose of forest management, the forests of Germany are furthermore divided into various planning and operational units. Therefore, the implementation of appropriate spatial scales of management as postulated in Principle 7

will be a rather slow and lengthy process. On the model of a natural Central European forest, which can be described as a “mosaic” of various stages of succession, the area size chosen for interventions of forest management should primarily be aligned with the dimensions of this natural mosaic.

In view of the long temporal scales of ecosystem processes in forests, it goes without saying that appropriate management too must inevitably be set for the long term (Principle 8). This Principle is a logical consequence of Principle 7, and it seems therefore appropriate to treat those two principles as one.

Silviculture recognizes that management is dependent on the natural site conditions, on disturbances due to natural events, and on the resulting changes in the ecosystem (Principle 9). In addition, man-made phenomena will have to be increasingly considered in future, although they are largely beyond management on a local level (e.g. climate change, atmospheric pollution, etc.), and must therefore continue to be discussed and dealt with on a higher level of both society and politics in order to arrive at strategies for their solution. Nevertheless, forestry will have to deal intensively with the issue of how silviculture can contribute to an improved capacity for response and adaptation to changed and changing basic ecological conditions.

Principle 10 bears on the objectives of the CBD, that is, the conservation and sustainable, equitable use of biodiversity. Likewise, the ideal of multifunctional forest use allots equal importance to the aspects of use and protection. However, this model of equivalence can hardly become operational in practice since as yet 90% of the proceeds from our commercial forests are obtained from the sale of wood alone. Thus, forest owners make little if any “investments” in the conservational functions, and nature conservation in the forest is still often practised within the meaning of the “wake theory”. Concepts to launch a system of remuneration of ecological services, in particular in privately owned forests, should therefore be developed without delay. In addition to that, the implementation of zoning concepts must be followed up, comprising areas with different intensity levels of utilization provided that comprehensive criteria for sustainability are met (“protection in spite of utilization”). It must be ensured, however, that such a zoning model is more than just a segregative approach involving the designation of areas under strict protection on one hand and areas that are set aside to be managed, and do not fulfil any conservational functions, on the other hand.

Forest management in Germany is based on a long tradition of experience, traditional knowledge, and research, and is therefore compatible with Principle 11. Although there has always been some sort of feedback from research to practice, it is mainly the communicative aspect of the know-how transfer that needs to be improved in Germany in order to be able to consistently implement this principle. In the field of forest research, intersectoral and multidisciplinary projects should to be developed and promoted more than ever.

The involvement of all relevant sectors of society and scientific disciplines (Principle 12) has been, fairly successfully in this domain, put into practice predominantly on a regional, national, or even international level, whereas the involvement on a local level must be rated as rather poor, due to the ownership structure prevailing in Germany. Since the involvement of the various relevant sectors of society is usually dependent on the consideration of knowledge and information, Principles 11 and 12 should also be treated as one.

The five operational guidelines of the ecosystem approach, which are meant to be applied in the implementation of the principles, are only briefly dealt with since their content greatly resembles the preceding rationales regarding the principles, and since their wording is sometimes even more general.

In the assessment of forest use in Germany on the basis of the ecosystem approach, we encounter the basic problem that the wording of the principles and guidelines is held so general that it permits a host of different interpretations. Thus, the ecosystem approach in its current form may serve as a superordinate ideal for further ecological optimisation of sustainable forest management in Germany. However, its wording is not tangible enough to be able to promote or assess concrete activities for securing biological diversity in forestry.

To sum up, the ecosystem approach should be understood as a basic guideline for the integrated management of ecosystems but not as a *modus operandi*. While it is certainly possible to successfully employ the ecosystem approach for introducing the concerns of the CBD into relevant areas of politics, it is not adequate as guidance for tangible projects, due to its highly theoretical organization. Therefore, to ensure the progress of this approach, it is concrete rules for action, or for restraint from action, directed at specific ecosystems and forms of use that need to be elaborated and implemented.

The strong points of the ecosystem approach are to be seen primarily in the promotion of communication and discussion between the various stakeholders and actors. This approach may therefore, similar to the international approach for a National Forest Programme, serve to win the support of as many stakeholders as possible for the implementation of a broad range of sustainability objectives.

2 Introduction

2.1 Introduction and Situation Report

In the Convention on Biological Diversity (CBD),

- the conservation of biological diversity,
- the sustainable use of its components, and
- the fair and equitable sharing of the benefits arising out of the utilization of genetic resources are regarded as the three fundamental, interconnected objectives.

The term “sustainable use” runs through all thematical sections of the convention as a cross-cutting issue. Article 10 deals with this theme separately. Many of the decisions of the Conference of the Parties and the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) recur to the integration of the sustainability approach into sectoral strategies for the use of biological diversity, and propose to the Secretariat and the Parties the elaboration and further development of substantial themes such as tourism under the aspect of sustainability. “Sustainability“ in this context does not describe a desirable goal, but rather a course for a constructive change that sustains and enhances both biological diversity/ecosystem productivity and human welfare. In this spirit, the CBD defines “sustainable use“ as “the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations“ (CBD, homepage www.biodiv.org/convention/articles.asp?lg=0&a=cbd-02). Therefore, the sustainable use of biological diversity interlinks ecological, economic, social, and political concerns.

This cross-cutting character is also taken into account by Decision V/24 of the V. Conference of the Parties to the CBD, in which on the basis of the experiences of the Parties regarding the thematic area “Sustainable use as cross-cutting issue“ the Secretariat called upon “to gather, compile and disseminate through the clearing-house mechanism and other means, case-studies on best practices and lessons learned from the use of biological diversity under the thematic areas of the Convention.“ (SECRETARIAT OF THE CBD, 2000, p. 115). On the basis of those case studies, “practical principles, operational guidelines and associated instruments, and guidance specific to sectors and biomes [are to be assembled], which would assist Parties and Governments to develop ways to achieve the sustainable use of biological diversity, within the framework of the ecosystem approach, and to present a progress report for consideration by the Subsidiary Body on Scientific, Technical and Technological Advice prior to the sixth meeting of the Conference of the Parties” (SECRETARIAT OF THE CBD, 2000, p. 116). In this context the Parties are also called upon to identify indicators and incentive measures for sectors relevant to the conservation and sustainable use of biodiversity, particularly giving consideration to the fact that sustainable use provides a special opportunity for attaching an economical value to biodiversity.

This substudy, prepared within the scope of the R&D project “Developing Concepts for ‘Sustainable Use’ in Selected Subdomains of Biological Diversity“, considered a case study, aims at analysing the current state of forest use in Germany with regard to its compatibility with the frame of reference set by the ecosystem approach of the Convention on Biological Diversity (CBD). The study hereby intends to complement, by focusing on the sustainability principles of the ecosystem approach of the CBD, the expert report “Forest Use in Germany – Implementation of Sustainable Development“ (HOFMANN et

al., 2000), published by the German Council of Environmental Advisors (SRU), which provides an excellent summary of the current discussions about sustainable forest use.

Other case studies on the topics of “Protected Areas“ and “Mountain Areas“ will follow. Eventually, they shall form the basis for an integrated, thematical and comprehensive concept of sustainable use under the ecosystem approach, that concept being applicable at a bioregional scale, and put in its relation to other national and international concepts.

2.2 Frame of Reference: The Ecosystem Approach

In past years, the recognition has increasingly prevailed that biological diversity in its different varieties can be successfully sustained only if it is understood in connection with the ecosystem, and if one takes into consideration the multitude of its interactions with humans living in and subsisting on ecosystems (see e.g. BfN, 1997; WRI, 2000). Therefore, at the V. Conference of the Parties to the CBD the participating states and other organizations were called upon to take the “ecosystem approach“ as basis for the implementation of the convention. This approach is intended to describe a strategy for the integrated management of soil, water, and living resources, which fosters conservation and sustainable use in a balanced way, and is intended to help deliver the three essential objectives of the Convention in practice (see Box 1). Moreover, the approach explicitly recognizes that humans, with their cultural diversity, are an integral component of many ecosystems, and that conservation and sustainable use can only be implemented together with the humans involved. Thus, the reality is taken into account that human activities have been affecting and shaping the biological diversity of many ecosystems for thousands of years. This is particularly true of the cultivated landscape of Central Europe.

The principles, which have been defined through the ecosystem approach of the CBD according to Decision V/6, and which were taken as basis for the elaboration of this project, must be regarded as those principles for the sustainable use of biological diversity that reflect this interconnection. The concept of the ecosystem approach, encompassing the twelve principles, which are also referred to as the Malawi Principles, and the five operational guidelines shall, according to Decision V/6, be reviewed by way of case studies, and experience gathered as to its feasibility.

Generally, the idea of an integrative ecosystem approach to the conservation and use of biological resources increasingly is given consideration, even if for the time being there is neither a distinct definition of the term nor a consistent view as regards its substance (WBGU, 2001). By way of example, an alternative description as endorsed by the World Resources Institute (WRI, 2000) is given in Box 2.

Description of the ecosystem approach:

1. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
2. An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.
3. This focus on structure, processes, functions and interactions is consistent with the definition of "ecosystem" provided in Article 2 of the Convention on Biological Diversity:

„Ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."

This definition does not specify any particular spatial unit or scale, in contrast to the Convention definition of "habitat" . Thus, the term "ecosystem" does not, necessarily, correspond to the terms "biome" or "ecological zone", but can refer to any functioning unit at any scale. Indeed, the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a grain of soil, a pond, a forest, a biome or the entire biosphere.
4. The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time-lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically.
5. The ecosystem approach does not preclude other management and conservation approaches, such as biosphere reserves, protected areas, and single-species conservation programmes, as well as other approaches carried out under existing national policy and legislative frameworks, but could, rather, integrate all these approaches and other methodologies to deal with complex situations. There is no single way to implement the ecosystem approach, as it depends on local, provincial, national, regional or global conditions. Indeed, there are many ways in which ecosystem approaches may be used as the framework for delivering the objectives of the Convention in practice.

Box 1: Description of the ecosystem approach according to decision V/6 of the Conference of the Parties to the CBD (SECRETARIAT OF THE CBD, 2000, p. 36).

What is an ecosystem approach?

An ecosystem approach broadly evaluates how people's use of an ecosystem affects its functioning and productivity.

- *An ecosystem approach is an integrated approach.* Currently, we tend to manage ecosystems for one dominant good or service such as fish, timber, or hydropower without fully realizing the tradeoffs we are making. In doing so, we may be sacrificing goods and services more valuable than those we receive – often those goods and services that are not yet valued in the marketplace such as biodiversity or flood control. An ecosystem approach considers the entire range of possible goods and services and attempts to optimize the mix of benefits for a given ecosystem. Its purpose is to make tradeoffs efficient, transparent, and sustainable.
- *An ecosystem approach reorients the boundaries that traditionally have defined our management of ecosystems.* It emphasizes a systemic approach, recognizing that ecosystems function as whole entities and need to be managed as such, not in pieces. Thus it looks beyond traditional jurisdictional boundaries, since ecosystems often cross state and national lines.
- *An ecosystem approach takes the long view.* It respects ecosystem processes at the micro level, but sees them in the larger frame of landscapes and decades, working across a variety of scales and time dimensions.
- *An ecosystem approach includes people.* It integrates social and economic information with environmental information about the ecosystem. It thus explicitly links human needs to the biological capacity of ecosystems to fulfill those needs. Although it is attentive to ecosystem processes and biological thresholds, it acknowledges an appropriate place for human modification of ecosystems.
- *An ecosystem approach maintains the productive potential of ecosystems.* An ecosystem approach is not focused on production alone. It views production of goods and services as the natural product of a healthy ecosystem, not as an end in itself. Within this approach, management is not successful unless it preserves or increases the capacity of an ecosystem to produce the desired benefits in the future.

Box 2: Description of an ecosystem approach according to the World Resources Institute (WRI, 2000, p. 226).

3 Forests and Forest Use in Germany

3.1 Data and Facts on the Forest in Germany

The account given in this chapter is intended as general summary of the current situation and management of the German forest. This constitutes the basis for a better understanding of the evaluation of forest use in Germany with regard to the ecosystem approach, as represented in chapter C, as well as of the still following studies (see chapter 2.1). There is no claim to the completeness of the following data and facts within the scope of this study. For further information please resort to the bibliography in the appendix.

3.1.1 German Forests – the Status Quo

30.8% of Germany, i.e. an area of approx. 10.7 million hectares, are covered with forest. While on a global scale, particularly in the tropics, the amount of woodlands continues to dwindle, forested areas in Germany have increased over the past decades. As a result of agricultural reorganization, more and more cultivated grassland has either been afforested or abandoned to the course of natural succession. The large number of afforestations that have been carried out as ecological measure to compensate preceding interventions have also been instrumental in the increment of forested areas. In the federal states of former West Germany alone, the share of forests in the total area has increased by around 500,000 hectares, i.e. approx. 4.9%, from 1950 to 1993 (BMELF, 1998).

Contrary to the natural potential vegetation (see also Chapter 3.1.2), only about one third of this forested area is now stocked with broadleaf trees. The other two thirds are predominantly pure or mixed conifer forests. Particularly in the densely settled cultivated landscape of Germany, forests constitute important areas of ecological compensation. On one hand, they form large-scale, coherent, and comparatively “close-to-nature” ecosystems. On the other hand, especially in less forested regions, they serve as refuges for many species whose habitats outside of forests have been increasingly impaired (BMELF, 2000d). Moreover, forests also are a vital economic factor, particularly in rural regions. In 1999, the timber industry alone provided about 648,000 jobs, and accounted for sales valuing 171 billion DM (BMELF, 2000a). The importance of forests in their function as suppliers of wood, i.e. a renewable and, by comparison, ecologically sound raw material, is likely to further increase in future. Furthermore, the wood reserves in German forests have been thriving for decades. E.g., the average reserves of rough wood amount to approx. 270 m³ per hectare, and according to the latest estimates (EUROSTAT, 2000), approx. 79 million cubic meters on average are reproduced every year. With merely about 37.2 million m³ being currently used each year, it would be theoretically possible to yet increase this huge potential of available wood by almost 50% without at all reducing the wood reserves (BMELF, 2000b).

3.1.2 Types of Forest in Germany

According to the concept of natural potential vegetation, more than 90% of Germany would have to be covered with forests. The natural types of forest dominating in Germany are mixed beech forests in the lowlands, in parts with a strong abundance of oaks, and pure beech forests in the uplands. In the mountainous regions, too, beech forests dominate in their subalpine form with fir and spruce. Apart from that, we find pine forests in the sandy regions of North-Eastern Germany, and riparian forests and marsh or paludal forests in some areas (general classification of natural vegetation according to ELLENBERG, 1973).

3.1.2.1 Beech Forests and Mixed Beech Forests

The type of vegetation with the largest natural distribution in Germany is beech forest (*Fagus sylvatica*), which makes Germany the country with the highest proportion of beech forests in the world. Thus, Germany in particular plays a vital part for the protection of that type of forests. This is also reflected in the EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (FFH), by which almost every type of beech-wood (woodrush-beech forest, woodruff-beech forest, orchid-beech forest, etc.) is placed under special protection. Especially old beech-woods rich in structural diversity are of great importance for the diversity of species. The figures of the latest National Forest Inventory (1987) show that the better part of Germany's forests is still in its state of youth. Only 13.59 percent of our broadleaved forest are between 120 and 160 years old, and a mere 2.79 percent are older than 160 years.. Broadleaf forests, naturally predominant in our country, now cover a mere 37 percent of its area..

3.1.2.2 Mixed Oak Forests

Oak forests, found in the lowlands and lower highlands, usually stand on brown soils, on which the beech is less vital due to their dryness. Associated with pedunculate oak (*Quercus robur*) and sessile oak (*Quercus petraea*), hornbeam (*Carpinus betulus*, oak-hornbeam forest), small-leaved lime (*Tilia cordata*) and hazel (*Coryllus avellana*) are frequently found, as well as birch (*Betula sp.*) and some species of the genus *Sorbus* in the pioneer stages. Today, oak occurs in about 9% of the forested area.

3.1.2.3 Spruce Forests and Conifer-Dominated Mixed Forests

The spruce (*Picea abies*) is an extremely cold-resistant tree. Considering the influence of the climate and of competing tree species such as beech, natural spruce forests are or were therefore found in Germany only

- in humid regions between 700 and 1900 meters above mean sea level,
- in pools of cold air in the mountainous range, even below 700 meters above mean sea level,
- at the edges of ombrogenic bogs in the mountainous range, and
- in floodplains of alpine rivers in the extraalpine, mountainous and colline zones that are no longer flooded.

As a result of century-long fostering on the part of the forest management far beyond the above natural ranges, spruce currently holds a share of about 34% in the total forest area. Spruce forms the basis of life for some 150 specialized insect species, among them 44 capricorn beetles and 44 bark beetle species.

3.1.2.4 Marsh Forests and Riparian Forests

Marsh or paludal forests grow on wet, peaty locations, and feature a very high level of groundwater all year round. They can also be flooded for longer stretches of time. Commonly found tree species are alder (*Alnus sp.*, alder marsh forests) and crack-willow (*Salix sp.*) in nutrient-rich locations, and also birch (*Betula sp.*) on poorer soils.

Just like marsh forests, riparian or floodplain forests are tied to water. However, they stand next to running water on gravel or alluvial loam. Naturally, they are very distinctly structured in dependence on the water level in vertical and horizontal direction. Besides, the varying dynamics of the river plays an essential role in their formation. Close to the water (softwood floodplains) willows (*Salix sp.*) are predominant, sustaining numerous specialized insect species and other animals. In a distance from the

water, ash (*Fraxinus excelsior*), elm (*Ulmus sp.*) and pedunculate oak (*Quercus robur*) follow (hardwood floodplains).

Many of Germany's marsh forests and floodplain forests have been destroyed by interventions in water bodies (regulation of rivers, lowering of the groundwater level), drainage measures, or conversion into stands of non-native trees (e.g. of poplar and spruce). As of 1994, there remained only about 50,000 ha of floodplain forests plus about the same area of small river-accompanying forests resembling floodplain forests. This translates into barely 1 percent of the total forest area. Moreover, most of it is no longer in a state that truly conforms to the natural community. Thus, floodplain forests and marsh forests count among the communities most worthy of protection, and are designated as particularly protected biotopes pursuant to § 20c BnatSchG (Federal Nature Conservation Law).

3.1.2.5 Forests/Plantations

The term of “artificial forest associations”, coined by TÜXEN in 1950 as distinction from the “natural forest associations”, is still disputed in plant sociology. This term defines “tree stands of artificially established types of wood not native to that particular area or association, which directly or via other substitute associations have taken the place of the natural forest association (...)” (TÜXEN, 1950, p. 218, our translation). This applies particularly to areas stocked with spruce, a tree that has been planted far beyond its natural range in the course of forest management practiced in the past 150 years or so (see also Chapter 3.1.2.3). Visionary foresters such as KARL GAYER have cautioned against the negative consequences of this type of cultivation as early as in the 19th century. Nonetheless, in the federal states of former West Germany we currently have 1.1 million hectares of conifer forest associations in need of conversion, which are aged between 60-120 years with a mixture ratio of up to 10% (National Forest Inventory 1987). Spruce cultivated in the low plains is usually harvested at the age of 80-100 years, in the uplands at a higher age. Consequently, only 3.1% of our spruce forests are over 120 years old. With a maximum of some 2000 animal and plant species, the diversity of species in such age-bracket monocultures lacking in variety is the lowest by comparison.

3.1.3 Legal Provisions

In Germany there exists an extensive system of legal provisions pertaining to the forest sector, which on the basis of centuries of experience in forest management is being refined continuously. The allocation of responsibility between the national administration and the federal states, which is set down in the German constitution, renders possible the required adjustments to regional conditions, and has led to a certain degree of diversification in forest legislation. The Act on the Preservation of Forests and the Furtherance of Forest Management (National Forest Act (BWaldG) of May 2, 1975 in its current form of 08/26/98), for instance, not only contains immediately effective provisions, but also the regulative framework that is then laid down in detail and put into effect by way of federal state laws. A number of additional provisions such as ordinances and administrative regulations apply to the state-owned forest, i.e. 34% of total forests.

According to the National Forest Act, all forest owners are under the obligation of “sustainable, proper management”. Besides the economic utility of the forest (supply of wood), the other functions of the forests, which in the public debate are increasingly gaining importance, for example “the continuous capacity of the natural resources”, need to be taken into account, too (see also Box 3).

§1 Purpose

The purpose of this law is in particular,

1. to preserve and, if required, to augment forests, and to safeguard their proper management in a sustainable manner, due to their economic utility (utility function) and their importance for the environment, especially for the continuous capacity of the natural resources, the climate, the water economy, the abatement of air pollution, the fertility of the soil, the appearance of the landscape, the agricultural and infrastructure, and the recreation of the public (conservational and recreational function),
2. [...]
3. to reconcile the public interest with the concerns of forest owners.

Box 3: §1 of the National Forest Act

Besides the forest laws there is a number of other laws directly or indirectly affecting forest management, in particular federal laws such as the National Act on Nature Conservation (BNatSchG), the Act on Compensation of Damage to the Forest, the Act on Forest Seeds and Seedling Plants, the Water Act, the National Hunting Act, the Act on Regional Development, the Act on Waste Disposal, and a large number of state laws and other legal provisions on a federal state level.

3.1.4 Property Structure and Responsibilities in the Forest Sector

Ownership of forests in Germany is characterized by a highly diversified property structure. Currently 46% of the total forest area are privately owned (450,000¹ establishments, of which approx. 65% are farms with forest property as additional source of income), 34% are state-owned, held by the national administration and the federal states, and the remaining 20% are owned by public corporations (local administrations, churches, and charitable foundations) (BMELF, 2000b). This property structure also affects the way of utilization, as within the scope of law the owner is free to decide which type of management he wishes to choose.

The jurisdiction over the forests rests primarily with the ministries of the federal states and with the forest administrations of the federal states as executive bodies. On a national level, the Federal Department for Consumer Affairs, Food and Agriculture (BMVEL) is responsible for providing and coordinating a legal framework and international forest management policies, as well as for incentive measures. The ministries of the federal states and the regional forest authorities are in charge of regional legislation, of monitoring the implementation of legal requirements, of participating in the planning process, of providing consultancy and support to private forest owners, and of managing the state-owned forests. The state forest administrations render consulting services to a large portion of the corporate and privately owned forest, and are often commissioned to manage those forests.

While for privately owned and corporate forests the economic responsibility rests with the owner, as regards state-owned forests there is currently a change going on. So far, the state forest authorities have been fulfilling both jurisdictional and managerial functions. However, the federal states of Saarland and Hessen have recently transferred the management function to autonomous limited liability companies

¹ Only establishments larger than 1 ha were taken into account.

(with the federal state as associate). The state forest authorities of those federal states now exclusively fulfil jurisdictional and advisory functions.

3.1.5 New Types of Forest Decline

What is now called “new types of forest decline” actually denotes a whole complex of harmful effects on the forest. In addition to the harmful effects caused by man, such as sulphur emissions (“acid rain”), excessive input of nutrients (nitrogen), and ozone stress, forests are exposed to both “natural” abiotic damage (frost, droughts, etc.) and secondary biotic damage (insects, fungi).

The proportion of damaged trees in Germany’s forests increased by yet another 2% in 2000, and has now reached 65%. The evident incidents of damage increased by 1% to 23%. While the favourable trend in the condition of the oak, with now 35% evidently damaged trees, is continuing, the beech is currently the worst affected tree. Since the first Survey of Damage to the Forest was carried out in 1984, the proportion of evidently damaged beech-trees has risen, with interim fluctuations, from 29% to 40%. Damage to the most common tree in Germany’s forests, the spruce, has slightly increased, with now 66% of the total stock damaged, 25% of it heavily. 13% of the pine stock are evidently damaged (BMVEL, 2001).

According to the results of the Survey of Damage to the Forest in 30 European countries that were published by the European Commission in the year 2000, the proportion of damaged forest trees continues to increase – most dramatically in Italy. In August 1999, 63.7% of 128,977 examined trees at 9,892 locations featured thinned-out crowns. The tree most affected on a European scale is fir with now 86.3% of the total stock damaged, 43.4% of it heavily, followed by pedunculate oak with 82.6% and 28.5% respectively. With 77.8% and 24.2% respectively, beech, the most afflicted tree in Germany, ranks third in the European damage statistics. For spruce, with 73.6 and 34.8% respectively, as well as for forest pine, with 65.6 and 14.6% respectively, the progression of needle-leaf loss appears to have come to a halt (UN/ECE & EK, 2000).

Though at a slower rate than 20 years ago, the acidification of forest soils in Germany today continues to progress on 80% of the total area, according to the consistent findings of all institutions involved. The adverse impact of ozone in the surface layer also continues to increase. Another issue that endangers the species in the forests is the continued eutrophication of the soil, which is caused by the input of nutrients (nitrogen) from the atmosphere. The atmospheric nitrogen deposition in forest stands reaches values of up to $60\text{kg N ha}^{-1} \text{ a}^{-1}$, leading not only to further acidification of the soil, but also to nutrient imbalances and the release of nitrate (FLAIG & MOHR, 1996; SCHULZE, 1989). Especially on locations with meagre soil, this additionally causes a decline of species diversity. This can be verified very distinctly even on open land in the example of the well-investigated family of orchids, which show extremely sensitive reactions to such changes in habitat (AHO THÜRINGEN, 1997). In forest stands in mountainous zones, too, an increasing “grassification”, caused by the continuous replacement of herbaceous species on the part of nitrophilic grasses, can be observed (SCHERER-LORENZEN et al., 2000).

3.2 Multifunctional Forest Use in Germany

There is a long tradition of forest use in Germany. In addition to historical forms of utilization such as forest pasture or use of litter, which developed as early as the Middle Ages, or the extraction of resin and tannic acid, the utilization of wood has always been of greatest importance (KÜSTER 1998). Particularly in the preindustrial era between the 16th and 18th centuries, wood consumption (in connection with the

production of salt, charcoal, glass, metal, etc.) reached such a level that the very existence of the German forest was in jeopardy, and that there was a great scarceness of wood. However, this did not result in the extinction of tree species. Following the successful introduction of “sustainable” forest management (see Chapter B 2.1) some 250 years ago, the wood reserves, and thus the forests, visibly recovered. When the historical types of utilization later lost their former significance, the conservational, utility and recreational functions of the forest gradually gained momentum. Regarded from a purely pecuniary point of view, the utilization of the forest has today been reduced to little more than the utilization of wood. For if we take the income structure of the state forest administrations as parameter (not considering jurisdictional tasks), the sale of wood is seen to account for about 90% of proceeds (BMVEL, 2001). On the other hand, income from hunting, the exploitation of decorative brushwood, and other types of utilization only play a minor role. For forest owners, the forests are likely to constitute an essential source of income, and countless farms and forestry establishments depend on the forests for their subsistence.

3.2.1 The Principle of Sustainability

Shaped in his thinking by German forestry, CARLOWITZ, in his book “*Sylvicultura Oeconomica*”, as far back as 1713 was the first to use the term “sustainability” in the forestry of Central Europe. Born out of a desperate want for wood – following decades of uncontrolled utilization, the forests of Central Europe were nearly devastated – this term initially meant nothing else than the material safeguarding of raw material, that is, the amount of wood taken out of the forest was not supposed to exceed the amount that could be replenished in the same period of time (quantitative sustainability). It was only much later in this century that this approach gave way to a holistic view of multiple (social, economic, and ecological) utilization. The English term “sustainable development” as we use it now signifies a comprehensive form of sustainability that does not only refer to the forests. Sustainable development thus means the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission on Environment and Development, 1987, the BRUNDTLAND Commission). In 1993, the Conference of Ministers for the Protection of the Forests in Europe, held in Helsinki, emphasized that sustainable forest management denotes the maintenance and utilization of forest lands in such a way and to such a measure that they retain their biological diversity, productivity, capability for regeneration, and vitality, as well as their capacity for fulfilling major ecological, economic and social functions on a local, national, and global level, and that no damage is done to other ecosystems (Resolution H1, Item D).

Consequently, the quantitative increase in the utilization of wood that is theoretically feasible (see also Chapter 3.1.1) is time and again brought forward in the debate as an aspect of sustainability. Although this kind of sustainability apparently refers exclusively to the utilization of wood, it forms the basis for statements such as “the degree of utilization can be increased by almost 50% without impairing the multiple functions of the forest” (BMELF, 2000b, p. 31), that is, a far more comprehensive approach. Moreover, the assertions as to the additional potential for utilization vary. In the National Forest Programme 2000, for instance, the additional annual wood cutting reserve for Germany is stated as merely one third. This difference is attributable to the fact that according to extrapolations, the forests of Germany grow at a much faster rate than had been suggested as yet (e.g. in yield charts). Only the National Forest Inventory, initiated in 2001, will produce definitive results. For the time being, it is advisable to use quantitative statements regarding the potential sustainable utilization of wood with discretion.

3.2.2 Functions of the Forest

Prerequisite to a multifunctional forest use that meets all requirements of society with respect to the forests is that equal importance is attached to the various functions of forests. Due to the reasoning stated above, which ties the use of forest primarily to its profitability, it is frequently doubtful whether this prerequisite is fulfilled in the practical application. Thus, the requirement in §1 of the BWaldG, which calls for the “sustainable safeguarding” of utility, conservational, and recreational functions to an equal degree, is not often met in practice. As one result thereof, it needs to be considered on principle whether the conventional division into the three areas of utility, conservational, and recreational function still makes sense in our day. According to this division, the function of nature conservation in a broad sense is generally regarded as only one of many conservational functions, which does not fully reflect the vital importance of forests for the conservation of biotopes and species. For these reasons, a fourth function, that is, the function of nature conservation, needs to be included in the formal division of the functions of multiple forest use, in order to appropriately emphasize the rank of the preservation and furtherance of biodiversity, which is often underrated. Therefore, in the following representation the conventional division has been modified accordingly.

Beyond the preservation of the services (functions) of forests overall, priority areas have been established in Germany that are of special significance for particular benefits. Those areas are reflected in the so-called Forest Function Mapping. Their distribution is given below in the examples of Bavaria and Baden-Württemberg (Table 1). Multiple functions of one and the same area are common as a rule.

In order to facilitate a review of sustainable forest management concepts, a further division of the functions should be made in the course of the debate. That is, with respect to the importance of forest management for the furtherance and preservation of differentiated utility, conservational, nature, and recreational functions, a distinction ought to be made between “benefits from forests”, i.e. the services that forests would be capable of rendering even if there were no forest management, and “benefits from forest management”.

	Bavaria (STEMELF/LFV, 1999)	Baden-Württemberg (MLR/LFV, 2000)
Water conservation	30.6	49.1
Recreation	17.6	28.9*
Soil conservation	14.2	16.2
Climate, immission & noise protection	10.9	8.7
Other	5.4	0.3

Table 1: Share of the types of protected forest in the total forest area (in percent). * = 1998

3.2.2.1 Utility Function

The forests of Germany have been utilized for centuries (see also Chapter 3.2). The utility function in a narrow sense of the word implies economic utilization, i.e. the utilization of natural resources. Those resources are wood (fuelwood, timber, etc.), game (hunting) and other products such as Christmas trees, decorative brushwood, berries, mushrooms, etc. However, with a share of 90%, the utilization of wood constitutes the primary and economically most significant utility function of forests.

3.2.2.2 Conservational Function

In times, in which our environment suffers the continuous adverse impact of, inter alia, the ongoing growth of industry and an increase in the traffic load, and in which climate change becomes more and more evident, the conservational functions of the forest become ever more important. The degree to which those functions can become operative partially depends on the form of forest management. However, even an uncultivated forest would probably be able to sufficiently warrant the larger part of conservational functions, in particular the regulation of the water and nutrient economy or the protection from noise and immissions. For the purpose of fostering the conservational functions of the forests as described below by implementing certain measures or by preventing potentially dangerous impacts, forest areas can be declared protected forest by law (BWaldG §12, see also Table 1):

- **Regulation of the Water Balance**

Forests and forest soils filter and store water, thus aiding the replenishment of the ground water. A particularly favourable effect is given by the fact that the stored water is released into the environment in a very slow and steady manner. In this way, forests can also contribute to flood protection.

- **Regulation of the Climate**

As to the regulation of the climate, forests can make an impact on all levels. For one thing, they can very directly affect the local climate or mesoclimate, for instance by acting as wind brakes or by reducing temperature amplitudes (climate in the interior and the exterior of forests).

For another thing, forests by their natural growth (photosynthesis) extract CO₂ from the atmosphere, storing it up in the wood of their trees for a long time to come. In Germany roughly 6.1 billion tons of CO₂ equivalent are stored in the forests (tree biomass + rough wood), and by the net expansion of our forests, another 18.7 million tons are added every year (BURSCHEL et al., 1993). Around another fifth of that amount, that is approx. 1.25 billion tons, is stored in the wood products that are currently in use (FRÜHWALD & WEGENER, 1993).

Therefore, the United Nations, last but not least by way of the Kyoto Protocol of the Climate Convention, have ascribed the forests a vital role as carbon sinks. Considering, though, the annual output of CO₂ produced by Germany as one of the “top emitters” (997 million tons in 1990), it becomes evident that the reduction made possible by a different utilization of wood or by the increment of forests (see also Chapter 3.1.1), which amounts to a mere 1.9%, must not be overrated. This must also be seen against the background that in the debate this function of the forest is increasingly brought forward as argument for the intensification of forest utilization (and against uncultivated reference areas, etc.) or even for the introduction of wood plantations. Such reasoning must not only be questioned from a nature conservation practitioner’s point of view, but needs to be challenged on principle (WBGU, 1998).

- **Protection from Avalanches and Erosion**

With regard to Germany, this function of forests for the protection of man-made structures (roads, villages, etc.) is largely confined to the Alps, where obviously it is of particular significance. Alpine forests mainly serve to prevent avalanches from starting, but they are also capable of slowing down or even stopping avalanches once they fall. On the other hand, the significance of the forest’s function of protection from soil abrasion (erosion) applies not just to the mountains, but also to the hilly country making up a large portion of Germany’s topography.

- **Protection from Noise**

Forests serve to protect from noise and to reduce excessive noise impact, which becomes particularly relevant in the vicinity of built-up areas.

- **Protection from Immissions**

By absorbing, degrading, and modifying airborne pollutants (aerosols, gases, and radiation) or by acting as a simple filter (for dust), forests help to preserve or improve air quality.

3.2.2.3 The Recreational Function

The recreational function of forests is above all characterized by the physical and psychological benefits to recreation-seekers, as well as by the sensation of nature experienced by those visiting the forest. About 41% of Germans spontaneously associate a particular sensation with the word “forest” (SUDA, 1997). Unlike some of the other conservational functions of forests, recreational activities in forests in many cases depend on the prior services of forestry, since access to the forest provided via roads and tracks is prerequisite to recreation for the majority of visitors (see also Chapter 3.2.2). In addition to hiking, traditionally known to be a favourite pastime of Germans, outdoor sports that usually involve the forest (e.g. mountain biking, horseback riding, cross-country skiing, climbing, etc.) are becoming increasingly popular, frequently leading to new conflict areas with nature conservationists or hunters. In the eyes of recreation-seekers, it goes without saying that forests make a considerable contribution to the favourable appearance of the landscape. Moreover, forests, or groups of trees, can act as screen, helping to offset visual nuisances or to organize the landscape. In order “to protect, to cultivate or to shape forest lands for recreational purposes” (BWaldG §13), forest can be declared recreational forest by law (see also Table 1).

3.2.2.4 The Nature Protection Function

Forests are common in most of Germany, and in their capacity as widespread network of ecosystems that are still fairly close to nature compared with other “cultivated areas”, they are essential for the conservation of biotopes and species. STURM (1993) has formulated the following objectives for the conservation of forest nature in Central Europe:

"Nature conservation in forests must aim at warranting the dynamics of the forest as ecosystem with all its ecologically characteristic features and processes in all its stages in space and time, covering the entire area of all biotopes typical of this ecosystem in the smallest possible units of space and time, and in consideration also of forest ecosystems conditioned by the course of history (coppice-with-standards or middle forests, coppice or low forests, etc.)." (STURM, 1993, p. 182 f., our translation)

The Forest Act not only calls for the protection of particularly worthy areas (e.g. pursuant to BNatSchG § 20c, NSG, FFH), but also for all forest management to be executed with such care that the existence of no species is jeopardized. The guiding principle of “protecting by utilizing” can be applied to the forestlands that do not have protected status, i.e. the majority of forests. In the current situation, forest owners receive compensation payments for providing ecological services along the lines of the nature conservation function, be it active measures or abstention from certain practices only in exceptional cases (e.g. in protected areas, for nature conservation under contract, etc.).

The highly complex function of nature conservation can be subdivided into three categories: species, biotope, and process conservation. Sometimes, these forms of conservation pursue conflicting objectives, which makes a comprehensive discussion of the objectives appear necessary.

- **Species Conservation**

In Central Europe, forests are the ecosystems richest in species. Thus, they play an important part for the conservation of species typical of their habitat, and of rare or endangered species. For instance, between 513 and 613 species of vascular plants, depending on definition, are typical forest species from a plant-sociological point of view (ELLENBERG, 1997). For centuries, our forests have been affected by human activity (see also Chapter 3.2). As, in some areas, this effect materialized at a comparatively slow rate up to the middle of the 20th century, numerous species were able to adapt themselves to these forms of cultivation, or even to develop new habitats. To name an example: while low and middle forests are able to exist only as long as humans tend to them, they can shelter an extremely high diversity of species, and therefore are particularly worthy of protection from the aspect of species conservation. That is why even a progressive degradation of forests, which would have to be rated negative in the overall perspective, could conceivably yield an increase in biological diversity.

- **Biotope Conservation**

Due to the diverse conditions of their habitats, forests constitute a rich pattern (“mosaic”) of a whole variety of individual biotopes (running water, xerophytic forests, edges of forests, woody debris, springs, etc.). Thus the assertion that species conservation nowadays always equals biotope conservation also applies to the forests. For a species can only survive in the long run if it encounters an appropriate biotope with corresponding environmental conditions. Therefore, even cultivated forests as comparatively “close-to-nature” ecosystems are bound to make a valuable contribution to biotope conservation.

- **Process Conservation**

Beyond conventional biotope and species conservation in the narrow sense of the word, forests afford a comparatively large scope for natural development processes that humans interfere with only to some extent. These processes are at the very origin of all present habitats (biotopes) and species in need of protection, and therefore need to be incorporated into today’s conservational strategies. The most consistent way of ensuring this is by establishing a sufficient amount of “total reservations” (e.g. core zones of national parks, restricted-access forests, etc.). When using the multiple functions of forests, one is certainly going to aim at integrating process conservation with forest management as much as possible. However, one can probably not do entirely without “strict reserves”.

3.2.3 Forest Management and Diversity of Species

Ever since the introduction of conventional forest management, particularly in the past few decades, a large number of forest animal and plant species are being regarded as highly endangered, in danger of extinction, or already extinct. Overall, forestry and hunting are second only to agriculture as cause of the dying out of species in Germany. 338 out of the 711 ferns and phanerogams that are endangered (KORNECK & SUKOPP, 1988), and some 800 out of approx. 1700 endangered animal species (BODE, 1997) are imperilled by forestry. A particularly high proportion of those species belong to the natural old growth stage, a forest phase that is almost entirely suppressed by forest management. Indeed, decaying wood constitutes the habitat of as many as 25% of all forest animal species, and is a structural feature

essential for their survival (LWF, 1999). For instance, more than half of some 1200 species of xylobiont beetles native to Germany have been classified as “endangered” or “in danger of extermination”. The stand initiation stage, too, is dramatically curtailed by regular forest management. Consequentially, the under-representation of natural development phases further adds to the endangerment of certain species. Of an estimated 620 vascular plant species of the forest, some 17% are regarded as “endangered” or even worse affected (ELLENBERG, 1997). In spite of all those alarming exemplary figures, one should not fail to mention that forests as part of Germany’s cultivated landscape still rank among the habitats with the highest variety of species.

3.2.4 Types of Silvicultural Forest Utilization

3.2.4.1 Utilization of the Coppice Forest

The term coppice forest or “low forest” (“Niederwald”) denotes forests that have emerged from stump-shoots and are harvested in comparatively short cycles (approx. 20-30 years). The utilization of the coppice forest is one of the oldest forms of forest management. It used to primarily serve to secure the supply of fuelwood. Apart from that, low forests with shares of oak were utilized for the extraction of tanning bark (tannic acid), e.g. in the so called “Haubergwirtschaft”. Today, coppice forests are no longer of commercial interest and have therefore declined rapidly (currently 1% of forest lands in the federal states of former West Germany). However, because these forests can shelter a great variety of species and constitute a potential habitat of rare species such as grouses, the remaining areas on which this type of utilization still exists should be preserved – also for socio-historical reasons.

3.2.4.2 Utilization of the Coppice-with-Standards Forest

The coppice-with-standards forest or “middle forest” (“Mittelwald”) still features many elements of the coppice forest. In addition to that, it contains trees that are allowed to grow, and which as so-called standards serve to supply stock wood. With a current share of 0.05% in the total area, the middle forest has lost its importance in Germany altogether.

3.2.4.3 Utilization of the High Standard Forest

The high standard forest, timber forest or “high forest” (“Hochwald”) is a forest with trees that have propagated from seeds. According to BURSCHEL & HUSS (1987), there are two types (management types) of high forest: forest with cutting areas, and single-tree selection forest (“Plenterwald”). SCHMALTZ (1992) names a third management type, the nature-conforming managed forest.

3.2.4.3.1 *Single-Tree and Group Selection Cutting*

Single-tree selection cutting is practiced in only about 1.4% of German forests (on the basis of wood ground area) (STATISTISCHES JAHRBUCH, 1996). In forestry we speak of a single-tree selection system when trees of all age classes simultaneously coexist on one and the same area. In the conventional type of single-tree selection forest we find all three main tree species, i.e. beech, fir and spruce. Since they are shade tolerant, enough scope is left for sound volume-building in multiple layers. In Germany, due to the requirements as to climate and site locations, this comparatively “close-to-nature” form of management can be practiced only in limited areas. This form of management generally involves a wood harvest tree by tree. In this system, the tree canopy always remains entirely intact, and there are no gaps like those occurring in places during the old growth phase of virgin forests.

However, such gaps provide the habitat for many important species, and are of great significance for the self-induced succession of areas cleared by storms or forest fires. Therefore, the removal of small groups

of trees up to a certain size, also called group selection cutting, can have a favourable effect on biodiversity. This way, the cleared areas do not reach the size that would cause the notorious problems in the clear cutting system, that is, changes to the mesoclimate and the soil (see also 3.2.4.3.2).

3.2.4.3.2 High Standard Forest with Cutting Areas - Clear Cutting

Timber forest with cutting areas denotes a forested area that is subdivided into cutting areas (stands, divisions), in which the composition of the tree stock is rather uniform, especially in terms of age, and in which silvicultural measures such as regeneration, tending, and thinning are carried out as independent activities. Another method of regeneration is the clear cutting system, which involves clearing an entire area and then replanting it in a uniform and homogeneous fashion. By forest management in cutting areas, the vast majority of our forests (approx. 97%) has been converted into one-age-cohort plantations (cultivated forests) or into similar structures (see also 3.2.4.3.3). Nowadays, clear cutting measures are restricted by law requiring special permission by the forest authority of the respective federal state if they exceed a certain size. The arrangements pertaining thereto vary from state to state. For example, in Nordrhein-Westfalen clear cutting is limited to a size of three hectares (§10 Abs. 2 LFoG), whereas in Baden-Württemberg permission is required for clear cutting areas larger than one hectare (§15 Abs. 3 LWaldG). Compared to other countries, Germany applies strict standards regarding this issue.

In the clear cutting system, the vegetation on the forest floor and the soil are, for a time, exposed to a climate that differs greatly from the climate normally prevailing in the interior of a forest, particularly by a much wider temperature range. As a result of increased temperatures, the humus soil decomposes more rapidly, causing the soil to become compacted. Moreover, due to the decomposition of humus considerable amounts of soil-bound nutrients (e.g. nitrate) are leached out with water seepage. This means that those nutrients are no longer available for the future growth of the forest, but rather have a negative impact on the ground water and consequently the drinking water. In short, clear cutting does not have the same effects as the natural processes in Central European forests. Furthermore it involves employment of heavy machinery, potentially causing severe damage to the soft forest soil and the vegetation, including any stage of natural restocking. Increasing recognition of these concerns may be the reason why in forestry practice the number of clear cutting activities is constantly declining.

3.2.4.3.3 One-age-cohort Management

Founded on the theory of net soil yield (“Bodenreinertragslehre“) propagandised in the past century, the conventional type of forest management in one-age-cohort plantations has made, so to speak, a victorious campaign in German forestry. In combination with the clear-cutting management method, the growing demand for wood could be met very efficiently, and the reforestation of devastated areas was rendered possible. Although as early as at the end of the 19th century the first environmental disasters occurred, challenging the claim to sustainability of this form of forest management, those methods continued to be pursued even until the present day, with the result that at some point in time 97% of our forests were mono-aged plantations. Forests of that type very successfully fulfil the aim of sustainability regarding wood production (quantitative sustainability). However, due to the clear cutting methods and equivalent forms of management (strip cutting) it employs, one-age-cohort management is not sustainable from an ecological point of view. Thus, that particular form of management is now considered outdated, and has been abandoned by the forest administrations of all federal states, granted that one-age-cohort forests of that type still largely shape the present-day appearance of our forests due to long time-lags.

3.2.5 Forms and Conceptual Framework of Sustainable Forest Use

Starting from the mid-19th century, professor KARL GAYER, in recognition of the negative effects of one-age-cohort and clear-cutting management as well as from a forest economist's point of view (reduction of overall costs), was the first to develop the idea of "close-to-nature" forest management (1886). Following the ideal of a "permanent forest", MÖLLER (1923) defined the antecedent to the model of "nature-conforming" forest management, which still serves as a model for organizations like the Study Group for Nature-Conforming Forest Management (ANW).

Although those models and ideals took a long time to become widely accepted, nowadays all concepts of forest use in one way or another claim that they implement the principle of extended comprehensive sustainability. Looking at their working principles and at the different "actors" involved, we are now able to distinguish between the various concepts currently used, such as "close-to-nature", "nature-conforming", "nature-compatible" or "ecological" use of the forests (Table 2). For instance, an unambiguous definition of the term "close-to-nature", used by the majority of the forest administrations of federal states and likewise by many private forest owners, did not exist for a long time. That is why some environmentalist organizations tried to define their ideal of "sustainable close-to-nature" forest management by way of the term "nature-compatible forest use" along the lines of a number of demands (BUND, 1995).

"Label"	"Actors"
Sustainable forest management	German Forestry Council (DFWR)
Close-to-nature forest management	Forest administrations of the federal states
Nature-conforming forest management	ANW
Nature-compatible forest use / ecological forest use	BUND, GP, WWF, Robin Wood

Table 2: Concepts of "sustainable" forest use in Germany

However, if we are to compare these forest management concepts, which below are described in detail, we frequently find that the defining criteria in their more or less broadly held formulations leave enough scope for actual differences in the practical application to be hardly recognizable. Only when it comes to certification (see also chapter 2.3), "measurable" differences become evident.

3.2.5.1 Sustainable Forest Management

"Today the silvicultural principle of sustainability means that wood is utilized only to the extent which is permanently reproduced, and that forests are managed in such a way that soil, fauna and flora remain intact, too. I.e., besides the utility function of the forests, the conservational and recreational functions are also taken into account. This ensures that forests are preserved as natural habitat, while at the same time they remain useful for common welfare - with regard to the future along the lines of the covenant between the generations. Though the term 'sustainability' has undergone an evolution in the course of time, and is now used in an extended ecological, economical and social meaning, the words of Carlowitz and Hartig are today as valid and topical as ever" (HAF, 2000, p. 2, our translation).

The problem posed by the lack of a detailed definition becomes evident in the example of “sustainable forest management”. For instance, the German forest sector had been using this term for a number of years without having formulated a definition, e.g. in the light of concrete standards for action. The definition of sustainable forest management attempted in 1998 at the EU Conference of Ministers in Helsinki (Box 4) has been put in such a general wording that for example it does not necessarily stipulate measures for the protection of biodiversity beyond the legal provisions already existing.

The Helsinki Criteria:

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles.
2. Maintenance of forest ecosystems' health and vitality.
3. Maintenance and encouragement of production functions of forests (wood and nonwood).
4. Maintenance, conservation and appropriate enhancement of biodiversity in forest ecosystems.
5. Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water).
6. Maintenance of other socio-economic functions and conditions.

Box 4: Helsinki Criteria, EU Conference of Ministers for the Protection of Forests in Europe, 1998

Today, the concept of sustainable forest management does not constitute a concrete, original management concept, but rather can be regarded as wider concept, incorporating the following management models. Therefore, no further reference to this effect will be made to “sustainable forest management” in this study.

3.2.5.2 Close-to-nature Forest Management

Almost all the forest administrations of the federal states in Germany call their forest management “close-to-nature” (“naturnah”). “From a semantic point of view, the term ‘close-to-nature’ is derived from a humanistic interpretation of nature with regard to culture, and ultimately man, in contrast to the biocentrally-minded perception, which is stricter and can be called fundamentalist” (SCHÜTZ, 1999, our translation). However, in the final consequence close-to-nature forest management is defined by concrete prohibitions and standards for action as formulated in a score of forest management programmes or ordinances, which paraphrase the term “close-to-nature”. Examples are the programme for “long-term ecological forest development (LÖWE)” in the federal state of Niedersachsen, the concept “close-to-nature forest management” in Baden-Württemberg, Rheinland-Pfalz, and Hessen, or “Forest 2000” in Nordrhein-Westfalen.

A summary description of the objectives and principles of close-to-nature forest management in the example of the guidelines of the forest administration of Rheinland-Pfalz is given below (MUF, 1994):

- Stable and flexible forest ecosystems as prerequisite to the preservation and furtherance of the capacity of the forests' entire natural resources.

- Multiple functions of forests, secured by the optimum performance of conservational and recreational tasks in connection with a sustainable production and utilization of valuable wood.
- Establishment of diversified, valuable forests sheltering a great variety of species, by means of mixed stocks with a high percentage of broadleaf trees.
- Consistently ecological orientation of the strategies for tending, thinning and utilization.
- Selection of tree species that are appropriate to the individual sites, and preservation of natural soil fertility.
- Ecosystem-compatible game management.
- Increase of harvest age and targeted trunk thickness.
- Furtherance of the natural regeneration of forests.
- Avoidance of clear cutting, and improvement of the forest structure.
- Ecologically correct shaping and tending of forest edges.
- Integrated forest conservation.
- Preservation of old trees and tree groups, retention of a certain percentage of woody debris, protection and promotion of rare elements of the flora.
- Expansion of the network of natural forest reservations (natural forest cells).
- Support to the development of natural successions.

3.2.5.3 Nature-Conforming Forest Management

This forest use concept was developed about 50 years ago by the Study Group for Nature-Conforming Forest Management (ANW). The ideal of this group was the concept of the “permanent forest” (denoting a vertically structured, ecologically valuable forest which features trees of different ages and species, which is stocked with a standing volume of the best possible quality, and in which the self-regulation mechanisms of nature are utilized and preserved), with the aim of putting into practice a particularly responsible form of forestry, which is oriented towards the comprehensive concept of sustainability, and is therefore nature-conforming (“naturgemäß”) (ANW, 1993). Consequently, nature-conforming forest management is defined by adherence to the following principles:

- Prudent handling of the habitat potential.
- Tree species of natural forest associations, which are appropriate to the habitat are preferred, while non-native tree species are not completely excluded.
- Mixture of tree species of different size and age, which are appropriate to the habitat.
- Tree-by-tree maintenance and utilization (principle of single-tree cutting) along the lines of permanent selection and stock maintenance.
- Population density of hoofed game that can be tolerated by the forest.
- Continuity of production and matter conversion.
- Consideration even of small-scale habitat divergences by promoting the adequate tree species.
- Optimum biodiversity by way of a horizontal and vertical mixture of plants over the entire area.
- High diversity of species owing to differentiated light-ecological conditions.
- Increment of “biotope wood”.
- Total abstention from the use of biocides.

The basic ideal of nature-conforming forest management is based on the holistic view of forests as permanent, multiform, dynamic, and useful ecosystems. Nature-conforming forest management aspires to

optimise forest management by utilizing the natural processes operating in forest ecosystems. It accomplishes this goal by uniting ecological and economic requirements (ANW, n.d.). In this system, the individual forestry enterprise is able to specifically determine the functions to be performed by a particular forest according to that forest's location, size, site, and type of ownership. Here, the various development stages indispensable for the continuity of the forest ecosystem are not separated by areas, but rather arranged in time and space next to and/or on top of one another within one and the same management unit.

The essential importance of the definition of nature-conforming forest management and of nature conservation is given by its demand for the preservation of the forests' dynamics. The natural dynamics of forests is the result of processes appertaining to the forest ecosystem, and manifests itself in diversified and ever-changing "forest patterns" (see also SALISCH, 1911). There is no final state in which the forest persists agelessly and unvarying ("stable"). So-called nature-conforming forest management, however, generally aims at establishing a static, permanent mixed forest. As opposed to nature-conforming forest management the consequence for ecological forest management (see chapter 3.2.5.4) is that it does not intend to perpetuate or establish static forest patterns, but rather aims for dynamic systems within the framework of the internal changes of forest habitats (successions). This approach is based on the assumption that the habitat types of all forest associations with their specific animal and plant species as well as their whole potential for succession are continuously re-emerging through natural processes, and that as a continuum they are also available in the entire forest area (mosaic-cycle model, REMMERT, 1989). If they are not, this is generally due to modified basic conditions, and a fundamental change takes place in the overall system.

Neither within the scope of static nature conservation nor of so-called nature-conforming forest management, each of which always involves a great amount of tending to the forest, the survival of all species is warranted under modified basic conditions (see e.g. ELLENBERG et al., 1986). Thus, forest structures that remain static for a long time are in need of human intervention. Unless priority is assigned to local or special targets, they are no longer "the protected object" of the management concept that is formulated here.

3.2.5.4 "Nature-Compatible" or "Ecological" Forest Use

The concept of ecological forest use was developed mainly with the aim of countering the conventional utilization concept of one-age-cohort management. It focuses on the natural processes of the forest, and follows the ideal of potential natural diversity as result of natural forest dynamics. This model is derived from the "process conservation concept" (STURM, 1993, 1994). While the statements about the process conservation concept are still of general and abstract character, mostly just describing objectives or consequences of process conservation concepts without pointing out their consequences for the concerns or action of those actually managing the forest (OESTEN et al., 1996), beyond the ideal itself a concrete catalogue of criteria, the policy paper on "ecological forest use" (BUND et al., 1996) has been formulated with regard to an eventual certification (see also Chapter B 3). At the same time, this paper constitutes the consistent ecological advancement of the objectives and principles of "nature-conforming forest management", a concept which is already attempting, inter alia, to draw economical benefit from natural processes (see chapter 3.2.5.3).

According to STURM (1994), by the concept of process conservation the ecological forest management “[...] primarily pursues the aim of greatest possible closeness to nature, and thus also of allowing, to the degree possible, undisturbed natural forest ecosystem processes. Whenever for the purpose of wood harvesting there is an intervention in the forests, this is largely done in harmony with the dynamics of natural forests or virgin forests. This potential intervention must seek to utilize natural resilience, and its extent must absolutely be in line with the sensitivity of that particular natural forest ecosystem. The permissible deviations from the actual natural forest dynamics must be kept as low as possible. The defined deviations do always reflect just the present level of knowledge about natural forests and virgin forests. The higher the level of knowledge about natural forests and virgin forests (reference areas), the more will the proposed forest management be in a position to grow close to nature” (STURM, 1994, p. 21, our translation). This means that the principle of “adaptive management”, which enables adjustments and modifications in utilization upon a change in the level of knowledge, is also pursued here.

Contrary to one-age-cohort management as well as to the so-called “nature-conforming” silviculture, it is not a static condition of the forest, but rather a dynamic system that ecological forest use is aiming for. Succession, variation in the composition of tree species, and natural disturbances such as blowdowns, fires, inundations, or insect calamities are permitted intentionally. Owing to dynamic processes of that sort, the natural broadleaf forest ecosystems of the temperate zone of Central Europe can be described as a mosaic of various stages of succession, differing only in size, shape, and composition. STURM (1993) called them “haphazard, multivariable mosaics of succession”. For an ecological forest management which is supposed to meet the objectives of nature conservation, this implies that it is not primarily states, but rather conditions of development that need to be preserved. Managed forests are meant to resemble uncultivated forests as much as possible, and to offer a habitat also to endangered animal and plant species. However, because the question of whether a forest stock is close to nature is difficult to answer, and because there is still very little known about ecosystem processes, reference areas should be designated in which the forest is left to itself and is protected from direct human intervention.

The following criteria form the basis of ecological forest use:

- Abstention from clear cutting, defined by the height of superior trees. This involves abstention from clearing (also by regeneration), strip cutting, and clear cutting of sections etc. with a radius larger than the height of one tree. A new cut in adjoining areas is made only after the natural regeneration of the first cutting area has been secured.
- Abstention from planting activities: Priority is given to natural regeneration. No establishment of monocultures and plantations. Abstention from the introduction of non-native plants as well as of organisms altered by genetic engineering. Abstention from large-scale clearing and/or burning of biomass.
- Designation of reference areas in the public forest with a size of at least 10% of the total area under cultivation, which serve for the comparison with the utilized forests and accordingly for the assessment of the utilization concept. In privately-owned forests, the designation of reference areas is desirable for certification; in any case a comparison with adjacent reference areas must be documented.
- Woody debris strategy: It aims at increasing the proportion of decaying wood, with the age structure and species composition of dead snags and woody debris being representative of the individual forest. Therefore, small-scale blowdowns of grown wood and single lost trees are generally not utilized

before a woody debris volume that warrants the permanent protection of natural diversity, especially of species dependant on decaying wood, has been reached.

- Abstention from the use of pesticides, mineral fertilizer, manure, sewage sludge, and lime.
- Gentle management technology: Abstention from vehicle use on extensive areas of forest soil, and from interfering with the grown structure of the soil. Employment of pull-horses and low-impact forest machinery. Low density of roads and tracks. Abstention from reconstruction and maintenance of drainages, as well as from further infrastructure measures in the forest. Employment of locally available, trained manpower.
- In the measure of the possible, the forest owner warrants a population density of hooped game that can be ecologically tolerated by the forest. Abstention from introduction and keeping of non-native animals as well as from feeding wild animals.
- If there is any danger of an intervention causing permanent damage to the ecosystem, this measure is abandoned as a matter of precaution (precautionary principle).

3.3 Forest Certification Systems

The certification of forests can be an effective means of furthering the principle of sustainability in forest management by setting “management standards”. In the past few years, the certification of forests and of wood products from certified forests (Chain of Custody) has become an important issue for the forest industry on a world-wide scale. While the certification debate has obviously come out of the discussion about tropical wood from sustainable supplies, it is today increasingly recognized that through certification ecological, social and economic benefits can be achieved in European forest management, too.

Currently there are three different certification systems in Germany. The first of them is the “Naturland Certificate”, which was developed in 1996 by the environmentalist organizations Greenpeace, German Association for Environmental and Nature Conservation (BUND), World Wide Fund for Nature, and Robin Wood. The Naturland Guidelines for Ecological Forest Use (see also Chapter 3.2.5.4) form the basis for this certification. Those guidelines currently refer exclusively to Germany, where 17,644 hectares of forest have already been certified. Secondly, there is the system of the Forest Stewardship Council (FSC), founded internationally in 1993, which has received the most attention globally and so far has certified 248,332 hectares in Germany. With a total 3.85 million hectares of certified forest, the Pan-European Forest Certification (PEFC), founded as recently as 1999 on the basis of the EU Conference of Ministers for the Protection of Europe’s Forests, which was held 1993 in Helsinki, is the seal which currently covers the largest share of area in Germany. All three labels surpass the legal requirements, and thus are supposed to certify sustainable utilization. In table 3, the criteria that could conceivably have a direct or indirect effect on biodiversity are summarized in comparison to each other.

In terms of biodiversity it can be safely assumed that forests complying with the Naturland criteria are able to make the greatest overall contribution to the preservation and furtherance of the diversity of species. This results, inter alia, from the requirement for the designation of 10% reference areas, which are widely proven to be of great significance as protected areas, from strict requirements for biotope conservation (while both Naturland and FSC aim for an improvement, PEFC only maintains the legal standard), as well as from strict requirements concerning cutting time (soil conservation, protection of breeding birds).




Criterion			
Reference area	Close to 10% (only in publicly owned forests)	At least 5% (in publicly owned & large privately-owned forests)	No provision made
Use of pesticides	Totally prohibited	No chemical biocides are used	Permissible as “last resort” within the scope of integrated forest conservation
Manuring (except for liming)	Not permissible	Prohibited only “for the purpose of obtaining increased yield”	Prohibited only “for the purpose of obtaining increased yield”
Soil cultivation	Only of the humus layer, subject to special permission	Only of the humus layer, not the subsoil	No large-scale cultivation that interferes with the mineral soil
Clear cutting	Not permissible	Not practiced as a general principle	Not practiced as a general principle (exceptions permissible)
Time of cutting	Preferably in winter	Preferably in suitable weather conditions	No provision made
Biotope conservation	Preservation of special biotopes beyond the protection provided by law	Management activities in forests with high protective value ought to preserve or augment their characteristic features	Forest management makes special allowance for protected biotopes
Biologically degradable chain oil	Obligatory (only on vegetal basis)	No provision made	Yes, if technologically feasible
Cultivation of non-native trees	Not permissible	Permissible, but only as minority share	Permissible
Woody debris strategy	Target: 10% of the standing wood volume	Preservation and enhancement, but no target	Ought to be retained to a sufficient extent
Natural regeneration	Should be aimed for, planting and sowing as an exception to the rule	Is given priority	Is given priority
Natural succession	Allowed	Allowed	Not mentioned

Table 3: Comparison of forest certification systems

Apart from explicitly formulated qualitative differences, divergences in practice are also the consequence of “soft” wording (e.g. “needs to be aimed for”, “appropriate”, “ought to”, etc.), whereas the Naturland requirements for instance, as opposed to the other certificates, contain a clear quantitative target regarding the share of woody debris.

Meanwhile, the first products made of certified wood have been introduced to the German market. However, the dispute between environmentalist organizations and forest owners about the various certification systems is delaying a broad campaign to make citizens aware of the fact that by their consumptive behaviour they can make a favourable impact on global forest management. It can further be observed that public awareness or debate depends on the origin of the wood. For the time being, the broad public demands certification only for tropical wood. Therefore, German wood-working industry (sawmills and timber product manufacturers) has so far shown very little interest in the certification systems existing in Germany. Only companies with direct marketing structures targeting the end user show an increased interest and thus register demand for certified wood. While on the supplier side German companies, by founding the association “Gruppe 98”, have at an early stage opted for offering FSC-products, a look at the range of goods actually offered tells us that those are mainly products from tropical wood. This could lead us to believe that some of those companies are simply regarding certification as a means for staying in the declining tropical wood business. In reality, the reason is more likely that as yet there is still very little FSC-certified wood of German origin on offer.

3.4 National Forest Programme Germany (NFP)

For the implementation of the obligations regarding forest policies resulting for all participating countries from the United Nations Conference on Environment and Development (UNCED), which was held in 1992 in Rio de Janeiro, and from its successor conferences, the Intergovernmental Panel on Forest (IPF) of the United Nations was founded in 1995. The package containing 146 proposals for action regarding the implementation of sustainable forest management, which the panel submitted to the Commission for Sustainable Development (CSD), was passed as international consensus by the Special Session of the United Nations General Assembly in June of 1997. The institution of forest programmes on a national level is an essential element of the implementation of global requirements aimed at forest conservation and sustainable forest use to be put into practice locally. Those proposals for action form the basis for the activities of the Intergovernmental Forum on Forests (IFF), which has carried on the IPF process. This innovative and holistic approach for the first time explicitly emphasizes purposeful cross-sectoral action with the participation of all interested actors. In order to promote prudent handling of the forest, and to continue fulfilling the diverse stakes in the utilization of forests in future, this is intended to have a favourable effect on the discourse regarding forest policies, by furthering mutual understanding between the actors with respect to their individual concerns (BMELF, 2000d).

In Germany, work on a first paper, the “National Forest Programme for Germany” (BMELF, 2000d), continued from autumn 1999 until October 2000 with the contributions of a variety of stakeholders. However, contrary to the intentions on an international scale, this first written result cannot be regarded as consensus paper, as the majority of the environmentalist organizations held back their full approval for the time being. This stance was justified, *inter alia*, with the failure to put equal emphasis on nature conservation and on commercially oriented utilization (AG WÄLDER., 2001). Besides surveying the

basic conditions given in Germany, the NFP mainly serves to identify “areas of action regarding forest policies”, and to formulate the need for action in the individual areas, which are subdivided as follows:

- Forests and Society.
- Forests and biological diversity.
- The role of forest in the global carbon economy.
- The importance of wood as reproductive raw material.
- The contribution of the forest and timber industry for the development of rural areas.

Practically synchronous with the process on a national level, a “Regional Forest Programme” was drawn up in Baden-Württemberg. This was the outcome of the “Six-State Initiative”, established in 1998, which, inter alia, involved the resolution for Baden-Württemberg, as an example for Germany, to carry out a case study on the IPF Proposals for Action. Therefore, Baden-Württemberg as early as in September of 2000 was able to present its own forest programme (MLR, 2001), which the state government of Baden-Württemberg officially acknowledged on September 19, 2000. In particular, it was agreed to take the jointly formulated objectives of the forest programme as basis for future forest policies, and to carry on the dialogue along the lines of the international requirements. Just recently, Bavaria also staged an initial event (May 2001) for the establishment of a “Bavarian Forest Programme”, and formed study groups to that effect.

The significance of national forest programmes is discussed in detail in the following debate of forest use according to the criteria of the ecosystem approach in the Convention on Biological Diversity (CBD).

4 Assessment of Forest Use on the Basis of the CBD Ecosystem Approach

The discussion of the types of forest use on the basis of the 12 Malawi Principles of the CBD largely refers – unless otherwise specified – to the model of “Close-to-Nature Forest Management”, which in terms of area predominates in Germany.

4.1 The 12 Malawi Principles

4.1.1 Principle 1

The objectives of management of land, water and living resources are a matter of societal choice.

Rationale: Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Practically all of Germany’s forests have been exposed to intense human impact and have been modified significantly in the process (KÜSTER, 1998). According to the socio-economic circumstances, various purposes have been pursued with the management and use of forest ecosystems (e.g. the utilization for fuelwood and timber, the feeding of livestock, recreation, nature conservation, etc.). Depending on ownership, different groups of society were involved to a varying extent in the course of time (e.g. common pasture and “no man’s land” in the Middle Ages, feudalistic structures in the late Middle Ages with severe restrictions for the rural population, forests under state or communal administration and privately owned forests in modern times). In all stages of history, the participation of locally divergent groups lacking an immediate connection with the forest has played only a minor role, for the targets and the way of forest management. As a rule, both the targets and the way of forest management have been oriented, often one-sidedly, towards the function of forests as suppliers of raw material, i.e. production and utilization of wood. Even today they are still largely determined by the specific forest owner, who is allowed, within the framework of applicable law, to manage his property as he pleases without any immediate participation of society. Hence, the forest administrations of the federal states, which manage about half of German forests directly, or indirectly by way of foresting contracts, are in a position to exact considerable influence regarding the way forests are utilized, whereas the immediate effect of society on the administrations is comparatively low. Conditions are somewhat different as regards the management of communal forests. Here, there is often much a more tangible opportunity for citizens to contribute to shaping social issues through their elected representatives in local bodies of government, depending on the size of the community. On the other hand, more and more groups from “outside”, which take a legitimate interest in forests, nowadays join in this process. Covering about 30% of the country’s area, forests are of increasing importance for the conservation of nature, in addition to tourism, sports, and recreation. In this case, local, private interests frequently are contrasting the interest of a broad public. This inevitably leads to rivalling claims to use, which frequently result in conflicts.

Example 1:

The National Forest Programme NFP (see also Chapter 3.4) could conceivably be a step towards the solution of such conflicts on a regional level. For such a programme, the environmental, social, and economic data of forests are analysed, and outlined in a transparent manner and with the participation of all relevant stakeholders on the basis of national priorities, strategies and measures for sustainable forest management (BMELF, 2000d). Forest Programmes are intended as a continuous process of political dialogue between different social groups. In Germany, representatives of all stakeholders have been involved in this process through a total of 10 “round tables” so far on a national level, and some on a federal state level, as well as through study groups. Besides the state forest administrations and civil-law forestry associations, these stakeholders also include environmentalist organizations, representatives of the timber industry, scientific bodies, and hunting and tourism associations, to name only a few. Hence, the instrument of the NFP promises to be basically capable of implementing Principle 1 of the ecosystem approach.

Therefore, the NFP process initially received a positive response from all parties involved. In the course of the “first round”, however, it turned out that the continuation of the dialogue, through which societal choices should be expressed as clearly as possible, stagnated increasingly. Ultimately, a number of environmentalist organizations even threatened to completely withdraw their support. Apart from discrepancies regarding subjects and issues, this was mainly due to the general procedural rules for the process of dialogue (see also comments by BMZ of 03/20/01; HOFMANN et al., 2001; GREENPEACE of 12/21/00). In order to be able to continue the NFP along the lines of the ecosystem approach it is therefore imperative to clarify any matters unsettled or controversial between all parties involved, such as for instance:

- Legally binding force and assignment of responsibilities: Do the results of mutual discussions have to be laid down in a binding form?
- Which way of consensus-finding in controversial issues should be aimed for? How are minority opinions dealt with?
- Safeguarding of the legal requirement of an equal status for utility, conservational, and recreational functions. The function of nature conservation in particular still appears underrepresented. Today, the concerns of species conservation need to be taken into consideration more than before. It is therefore essential that nature conservation authorities and environmentalist organizations, being the representatives of the concern for nature conservation, as well as the general public are anew included in the process. This is the only way that National Forest Programmes can fulfil the objective of the ecosystem approach.

Consequently, the NFP may serve as an example for the potential complexity of the “societal choice” in ecosystem-oriented management. In many cases, the implementation of the ecosystem approach will be less difficult in this respect. If, however, the institutions in charge and other actors involved are not willing or able to arrange for compromise solutions, the resulting conflicts can conceivably throw back the efforts of nature conservation practitioners by years (UBA, 2000).

Example 2:

Principle 1 of the ecosystem approach is already being formally implemented very successfully in Germany, also on a national level, owing, inter alia, to the international approach of forest certification according to the FSC (see also Chapter 3.3). The principles and criteria forming the basis of certification, for instance, are developed by a three-body-system. This is to say that the management objectives are discussed and determined by a structure reflecting society as a whole, i.e. the social, economic, and environmental bodies, all three of which enjoy equality of votes (FSC, 2001).

4.1.2 Principle 2

Management should be decentralized to the lowest appropriate level.

Rationale: Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

The administration of the forest ecosystem lies primarily with the forest administrations of the federal states (see also Chapter 3.1.4), and their subdivisions, the forest authorities, which monitor the legal requirements for the entire forest, and directly implement them in the state-owned forest as well as in most of the communal forest. In this way, a decentralized structure in terms of law has already been put into practice. Further decentralization in a sphere more significant to management is given by the various forms of forest ownership (see also Chapter 3.1.4). Particularly in highly fragmented areas with small plots of less than half a hectare on average in private ownership, efficient management is even impeded due to this fragmentation within a forest. For this reason, efforts are continuing in this domain for the establishment of forest owner associations or management cooperatives, and thus a certain degree of centralization.

Decentralization also applies to game management, which takes place in individual preserves, usually accounting for an excellent integration of local stakes and knowledge. The adjustment of the game stock (via hunting schedules) is controlled on a slightly more centralized level (Lower Hunting Authority, Lower Forest Authority), but still very locally and with the involvement of local jurisdiction and of the personal responsibility of hunters for their preserve.

When it comes to decisions due to national effects, the decentralized structures existing in Germany are a good foundation for dividing international requirements (e.g. FFH, Natura 2000) down to the levels involved with the participation of local management.

Thus, decentralized structures involving comparatively small areas are in charge of all management activities in the forest ecosystem. This leads to a high involvement of local stakes and makes it possible to take local knowledge and circumstances into consideration in each individual action. In addition to the experience gained in the individual regions, surveys on a state or sometimes national level (e.g. areas of growth, site mapping, forest biotope mapping, National Forest Inventory, etc.) facilitate management activities that are as close as possible to the ecosystem. However, the data collected in such surveys so far were largely limited to parameters relevant to the user. The forest biotope mapping and a wider range of data collected in the current National Forest Inventory (e.g. data on volumes of woody debris, lengths of forest edges, shrubs and ground vegetation) (FVA, 2001) form a sound basis for an enhanced in-situ

integration of ecological concerns into a future concept of forest use, which makes allowances even for slight differences on a decentralized level.

On the other hand, the fact that commercial stakes in forest use can well be opposed to nature conservation (see above) requires the framework of a high superregional legal standard of protection. With regard to decisions made on the basis of global or national effects (e.g. climate conservation, function of forests as carbon sink, forest decline as a result of nutrient imbalances and acidification by ubiquitous atmospheric pollution), regional or local management is limited in its authority. Nonetheless, the local scopes should be made the most of. Owing to their competence, local groups can then participate to the solution of urgent issues.

For the reasons stated, Principle 2 needs to be endorsed in general. The wording “the lowest appropriate” already takes into account that in individual cases or areas, centralized and decentralized approaches should ideally coexist or be interlinked (see also UBA, 2000).

4.1.3 Principle 3

Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Rationale: Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Every ecosystem is connected with other ecosystems, either by way of direct spatial contact or by indirect contact caused by itinerant animal species. In addition to that, there are also worldwide interconnections via global chemical cycles. Therefore, the management of any ecosystem inevitably affects other systems. In order to be able to assess those effects, a sound knowledge of the functional interactions between the individual ecosystems is required. For lack of this knowledge, there is frequently a need for further research to render the implementation of this principle possible. Interactions of this kind taking place in forests are comparatively well known as a result of long-standing observations and research projects (e.g. ecosystem research at Göttingen: ELLENBERG et al., 1986; ecosystem research at Bayreuth: MATZNER & KÖSTNER, 2001). Beyond ecological interconnections of that kind, social and, in particular, economic circumstances (e.g. suburban recreation, silviculture/agriculture) must also be considered along the lines of the ecosystem approach.

Example 1:

Forests encompass a great variety of ecologically “independent” structures (“special biotopes”). Looking at those structures as an autonomous ecosystem, we observe that forest management frequently has a very direct impact on the condition of adjacent ecosystems. By way of example, suffice it to mention the waters in forests in particular flowing waters. The choice of tree species and the degree to which the water is shadowed (e.g. afforestations with spruce up to the very edge of the water) both have an effect on factors such as ambient temperature and pH value, which are vital for the habitat of species. The use of fertilizers and pesticides also affect the water in a direct way. Forest management is obliged to take such influences into account in order to avoid damage to any adjacent or integrated aquatic ecosystems. To ensure this, a sound specialized knowledge, and frequently the co-operation with other disciplines (nature

conservation, aquatic ecology, etc.) will be necessary. This may require improved interconnection, or new ways of organization for institutions involved in decision-making.

A significant first step in this direction has already been taken with the mapping of forest biotopes. By the inventory of ecologically valuable special biotopes, together with recommendations for their maintenance, the careful implementation of in-situ activities on the part of the managers is facilitated. However, the present inventory is far from comprehensive, and mainly reflects only the current situation. Structures of potential ecological value, which again need to be “developed” in a close-to-nature manner, are often not inventoried, and therefore not perceived when carrying out management activities.

Example 2:

Forest management affects other ecosystems also in case of reduced utilization of wood as a consequence of local management concepts (for instance by exempting certain forest areas from cultivation). As a result, the import of wood from boreal and tropical regions might be increased, subjecting sensitive ecosystems in other parts of the world to additional utilization stress due to the management concepts in Germany and elsewhere, particularly if those forests are not managed according to sustainability criteria (see also HOFMANN et al., 2000). This does not mean that the necessity for total reservations (exempt from any form of utilization) should be questioned in any way. However, in the discussion about just how many of such areas are required for the conservation of forest biodiversity, this fact needs to be taken into consideration in the process of balancing the interests at stake. In general, though, a particular resource (wood) should always be produced in that part of the world, where it is possible with the most economic benefit and the least damage to the environment (HOFMANN et al. 2000).

4.1.4 Principle 4

Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

- (a) Reduce those market distortions that adversely affect biological diversity;*
- (b) Align incentives to promote biodiversity conservation and sustainable use;*
- (c) Internalize costs and benefits in the given ecosystem to the extent feasible.*

Rationale: The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems. Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

In principle, the utilization of wood along the lines of comprehensive sustainability must be viewed as extremely favourable, both from an ecological (wood being an environmentally sound substitute for non-renewable resources) and an economic (added value) or social (employment) point of view. However, when systematic forest management was introduced, it immediately involved almost every forested area, neglecting the fact that forests constitute a natural system. For this reason, no primeval forest whatsoever has remained in Germany, and there are only fragments left of close-to-nature forests that have suffered little human impact (BfN, 1999). Therefore, the vast majority of German forests must be regarded as fully

managed forests, which have been understood in a purely economic context and managed intensely for a long time.

Topical concepts of close-to-nature forestry in a form increasingly practised in state-owned and corporate forests (conversion of uniform forests managed in one-age-cohorts to multi-aged broadleaf or broadleaf-dominated forests in accordance with the general abiotic conditions, prolonged rotation intervals, natural regeneration, etc., see also Chapter 3.2.5.2), present the opportunity for the integration of general objectives of nature conservation (BfN, 1999). At the same time, those concepts lead to increased diversity of species and structure of our forests.

Example 1:

Article 1, paragraph 2 of the National Forest Act calls for the subsidization of forestry. Accordingly, afforestation activities, inter alia, have been promoted with state subsidies in the past, regardless of which tree species they involved, including conifer monocultures featuring a very limited diversity of species. In the meantime, though, the relevant guidelines for subsidization (co-financed via the EU Common Task of Improvement of the Agricultural Structure and Coastal Protection (GAK)) have been revised and complemented with new criteria directed at the ecological management and conversion of forests. For instance, eligibility for the subsidy granted for primary afforestation depends on a minimum share of broadleaf trees in the total area. This change in subsidization policy, along increasing recognition on the part of forest owners of the ecological instability of conifer monocultures, accounted for the fact that about 90% of the areas afflicted by the storms of 1990 were reforested with broadleaf or mixed cultures (BMELF, 1998).

Example 2:

“Covert” state subsidies constitute an indirect market distortion, which continues to foster in particular the cultivation of spruce monocultures. Granted that an one-age-cohort plantation is not destroyed by “natural disturbance events”, it is likely to earn its owner a sizeable financial profit within just 40 to 50 years. That is why mainly private forest owners now as ever pursue this particular form of management. On the other hand, nobody any longer challenges the fact that those one-age-cohort forests, especially if they are located on inappropriate sites, are far more vulnerable to storms than a mixed forest rich in structure. If, however, forests of that kind suffer large-scale losses, caused by such violent storms as “Vivian” and “Wibke” at the beginning of the 1990s, or just recently in December of 1999, when hurricane “Lothar” hit, forest owners get the benefit of tax breaks (§ 34b of the Income Tax Law), state financial aid (e.g. Emergency Aid Scheme “Lothar”), and the Act on Compensation of Damage to the Forest. That way, forest owners suffering heavy economic losses in some parts of Germany due to hurricane “Lothar” received several million DM in taxpayers’ money, whereas those forest owners would under normal circumstances be the only ones to benefit from any profits rendered by the sale of wood.

Example 3:

Mature beech forests, which today are rarely found in Germany, play a particularly important role for the diversity of structures and species (see also Chapter 3.1.2.1). This is partly due to the circumstance that many older beech-trees develop what is referred to as a “red core”. The stronger, taller, and older a beech-tree grows, the higher is the likelihood that the heartwood of its trunk turns a reddish colour. In terms of quality, this wood is in no way inferior to white beech-wood as we know it. Nevertheless, its colour is the

reason that this wood is automatically rated lower, last but not least out of “aesthetic reasons”, and therefore fetch considerably lower prices. If one were to succeed in getting consumers and producers more interested in this material, ensuring appropriate prices in the long run, it will be more appealing also from a commercial point of view to let beech-trees grow older. With the focus on the federal state of Baden-Württemberg, an exemplary campaign for an improved marketing of “red-core” beech-wood has been promoted for several years now as a joint effort of the forest and timber industry together with an environmentalist organization (HÄUSLER & NEIDLEIN, 1999). This approach leads the way for the generation of commercial incentives through marketing activities, with consequential benefits for the conservation and promotion of species diversity.

Example 4:

The certification of wood is another essential tool to create incentives for the conservation of biological diversity and for sustainable use. The introduction of certificates guaranteeing the consumers products from ecological forest management will ideally serve to fetch higher prices. This extra income will financially counterbalance the increased expenditure for forest management likely to occur in some cases, possibly involving additional costs (e.g. for exempting certain forest areas from cultivation, for controlling, etc.), or even boost profits. It is still questionable whether an approach of this kind will indeed provide a sufficient increase of takings for forest owners, especially in case that the majority of forested areas become certified.

As the above examples clearly show, the forest ecosystem in Germany cannot be dealt with without including a commercial perspective. Obviously, the system is largely governed by the rules of free enterprise, and can therefore be affected favourably or adversely. While there are promising efforts directed at a reduction of market distortions and the creating of positive incentives, there is room for improvement as regards the internalisation of costs and benefits in the given ecosystem. A feasible path to be followed would be for instance the remuneration of welfare services rendered to the public by forestry, tied to certain ecological purposes (see also Chapter 3.2.3), which so far have materialized almost exclusively through the price for wood (see also HOFMANN et al, 2000, p. 258 ff.). Much could be achieved for the conservation of biological diversity also by consistently amending the existing guidelines for subsidization in the light of ecologically relevant aspects (conversion of forests, natural succession, exclusively native tree species, woody debris, etc.), and by aligning incentives.

4.1.5 Principle 5

Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Rationale: Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Apart from “ecosystem goods” such as timber, game, non-timber products, etc. (utility or production function of forests), forests also provide a number of “ecosystem services”, including the conservation functions already mentioned (regulation of the climate, protection of ground water, etc.) as well as the

recreational function (see also Chapter 3.2.2). While in the past there has been a distinct focus on the commercial function of forests – leading to a form of management aiming at the maximization of ecosystem goods production – the significance of the conservational, recreational and nature protection functions is growing, especially in densely populated countries such as Germany. The ideal of multifunctional forest use takes the importance of ecosystem services into account.

If we are to regard the services rendered by forests primarily under the aspect of immediate pecuniary benefit to forest owners, in reality the ecosystem services significantly lag behind the ecosystem goods, contrary to the ideal stated above (see also Chapters 3.2 and 3.2.2). For forest owners to which forests in the first place represent a major source of income, the conservation and, where appropriate, the restoration of the interactions and processes between species and their abiotic environment is generally of secondary importance.

Example: The concept of “Close-to-Nature Forest Management”

The conservation of structures and functioning is partially secured through the concept of close-to-nature forest management (see also Chapter 3.2.5.2). As specified in Principle 5, the continuous conservation of the ecosystem, and also of its productivity, is only possible if the dynamics of the forest community are maintained. The term “dynamics” encompasses all communities at a given site. Whenever a species becomes eliminated from this natural network of mutual effects, this will inevitably result in a less differentiated response of the community to disturbances. The environmentalist organization BUND has even concluded that “this means that forest use can be truly sustainable only if it does not displace or exterminate a single species of the natural community” (BUND, 1995, p. 44, our translation). However, in close-to-nature forest management the phase of natural succession and “the old-growth phase [are currently] underrepresented” (Waldprogramm Baden-Württemberg). For example, the state-owned forest in Bavaria managed according to the “close-to-nature” principle has an average woody debris share of 3.3 cbm per hectare (LWF, 1999), whereas for a reference area that had not been cultivated for 50 years, 16.12 cbm of woody debris per hectare were established (FVA, 1993). This will unavoidably lead to a drop in the number of specialized xylobiotic species (see also Chapter 3.2.3). On the other hand, there are also opinions questioning the reason for this change in the forest community: “The cause for the decline in species [...] is not [...] the way forests are being managed” (STEMELF, 1999, p. 26, our translation). In any case, these different “forms of interpretation” prove that further research is required to distinguish natural, dynamic changes in the diversity and composition of the communities from changes caused by management (see also Principle 11). Uncultivated reference areas provide the opportunity for shedding a light on the functions and structures of ecosystems, and for identifying the limits of their functioning (see also Principle 6). This enables current and planned management activities to be put in correlation with the results of research in those reference areas.

Example: The Concept of “Ecological Forest Use”

Process conservation is defined as the preservation of the functionality of the natural resources to enable the control, growth and decomposition services of the ecosystem to unfold according to the abiotic and biotic conditions of the site. Thus it is not primarily states, but rather conditions of development that are being conserved (STURM, 1993). The concept of ecological forest use (see also Chapter 3.2.5.4), which is based on the concept of process conservation, also had to realize that the stipulated preservation of

natural forest dynamics with all its spatial and temporal variations cannot be implemented in the entire forest areas. Therefore, uncultivated reference areas constitute an essential feature in ecological forest use for the optimum implementation of the fifth principle of the ecosystem approach.

4.1.6 Principle 6

Ecosystems must be managed within the limits of their functioning.

Rationale: In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious.

The requirement that ecosystems must be managed within the limits of their functioning is consistent with the requirement for management within the limits of sustainability (UBA, 2000). This means that an assessment depends on a tangible and measurable definition of sustainability. In the sense of forest-economic, quantitative sustainability this principle has now been implemented to a large extent in Germany (see also Principle 5).

However, the attention on the limiting environmental conditions as postulated in the rationale of this principle is not sufficiently taken into account by the preceding statement. Limitations of that kind are often results of external impacts such as, for instance, deposition of atmospheric pollutants, climate change, or other adverse effects on the environment, which may affect the functioning of the forest ecosystem. The various forest management concepts, however, are only capable of responding partially and to a certain extent with precautions, e.g. by taking positive counter-measures (see also Principle 9). Therefore, the incontestable objective must be to avoid damages due to human impact. Since this can only be achieved through a societal process of discussion, Principle 6 as referring to forest management is directly connected with Principles 1 (e.g. NFP) and 12.

4.1.7 Principle 7

The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

Rationale: The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Temporal scale:

In forest management, the factor “time” generally constitutes a significant parameter for all planning deliberations. The development of the sustainability principle (see also Chapter 3.2.1) in forest management was already based upon the integration of time intervals encompassing several generations. A look at the natural life cycle in the forest ecosystem, which ranges from the regeneration phase and the optimum phase to the old-growth stage, shows us that this process may easily take several centuries. A natural spruce forest, for instance, will complete this cycle within around 400 to 600 years. This highly schematic or pattern-like representation of the development stages of a natural forest ecosystem is taking

place under undisturbed conditions in small-scale plots, temporally transposed and spatially adjacent. According to the ideal of process conservation, which is orientated on natural processes, this may mean that in individual cases the regeneration phase of certain forest stands (e.g. large storm-afflicted areas) might last for over 50 years. While there is a certain value for biodiversity in this, no “useful” wood assortments, i.e. profits, can be attained during this time, which will appear very long to managing forest owners (considering interest payments). In other words, the stage of profitable returns is postponed accordingly. This inevitably raises the fundamental question of whether modern society is able to “afford” such a form of management (see also Principle 3). In future, this question will need to be clarified along the lines of Principle 1 of the ecosystem approach, which calls for management to take both cultural and biological diversity into account, and for societal choices to be expressed as clearly as possible.

But even if we proceed from “close-to-nature” forest management as it is currently practised (see also Chapter 3.2.5.2), the time interval from the “birth” of a tree (natural regeneration) to its harvest (target size²) may still conceivably amount to between 100 and 180 (250) years (oak), depending on tree species and habitat. Although this is a comparatively short span as compared to the natural average age of 900 years easily reached by e.g. oak trees, we are here talking about a temporal scale significantly longer than the length of a generation by human standards. Thus the manager (forester) is forced to plan and act for coming generations. The latent danger that the “inherent conflict with the tendency of humans to favour short-term gains and immediate benefits over future ones” as described in Principle 8 might lead to decisions detrimental to ecosystems, particularly in forest management which by nature should take place on a long-term basis, has time and again become manifest in the past, and must be rated extremely high for the future.

Other examples are the conversion of mono-aged forests to “close-to-nature” forest stands, increasingly practised in public forests, or reforestation activities in the wake of storms. In the areas afflicted by the storms of 1990 it became particularly evident that many forest owners did not take the time to leave things to the natural dynamic processes (see also Principle 5). Around three quarters of the storm-afflicted areas were immediately recultivated with the intent of permitting profitable harvests within the shortest time possible. By and large, this proved to be a false conclusion. Observations of some areas show that even after ten years there is hardly any difference noticeable between areas left to natural succession and cultivated areas. This means that up to 10,000,- DM per hectare were basically wasted on the establishment and maintenance of new cultures (FA Schorndorf, oral information, 2001). By the year 2000, the forest authorities appeared to have learned their lesson. In the wake of hurricane “Lothar”, only about one third of the areas afflicted were reforested, mainly with broadleaf trees; the remaining two thirds were left to the natural regeneration process.

On the other hand, the practice of rapid reforestation is supported by the legal obligation for reforestation (BWaldG § 11) within a reasonable period (set at just 2 years in most forest laws on a federal state level). While this arrangement was originally intended to secure the continuity of forests, nowadays it means that

² Target size (targeted trunk thickness) signifies the minimum diameter a tree must have reached before it is harvested. The term “rotation intervals” which was in use until a few years ago is a remnant of the conventional one-age-cohort forest theory, which postulated that trees must be harvested at a certain age according to a rigid system. However, this does no longer fit in with the single-tree utilization concept nowadays pursued by “close-to-nature” forest management.

ecosystems are hampered by law in unfolding their natural dynamics. The postulate of the ecosystem approach for the consideration of appropriate temporal scales is to be advocated, and the laws mentioned should be amended accordingly.

On the other hand forest owners due to purely economic constraints are, for the time being, not in a position to immediately make a decisive shift towards broadleaf trees, the form of natural potential vegetation in Central Europe. This would lead to a transition period possibly lasting for a number of years, in which no sufficient earnings could be obtained from the sale of wood. Consequently, spruce will continue to rank within the “target types for forest development”, which makes sense considering the current state of the art in terms of the utilization of wood as an ecological building material. The result is that current conversion measures do not immediately make a visible impact on the forest pattern. The hypothesis of the Atlantic-continental climate change however, discussed under Principle 9, speaks another language. Since this dilemma cannot be comprehensively dealt with in this study, further discussion will be required on this topic.

Spatial scale:

It goes without saying that the spatial scales that definitely need to be considered by forest management primarily include the boundaries of the forests (which may be subject to fluctuations, see also Chapter 3.1.1). Of much greater importance, though, for the implementation of the ecosystem approach are the varieties in area size, which are caused by the extremely inhomogeneous ownership structure in Germany (see also Chapter 3.1.4), and range from privately-owned forests with sometimes very small areas of only a few ares to large privately-owned and state-owned forests managed by forest authorities with a total area in the region of several thousand hectares. Therefore, the implementation of ecologically sustainable management in the entire forested area will be a rather slow and lengthy process.

For the purpose of forest management, the forests of Germany are furthermore divided into various planning and operational units. In public forests, the organizational structure encompasses preserves, divisions, and subdivisions. This structure can also be made operational in ecological forest management. However, on the model of a natural Central European forest, which can be described as a “mosaic” of various stages of succession (REMMERT, 1989), the area size chosen for interventions of forest management should primarily be aligned with the dimensions of this natural mosaic, and should always take the adjacent area into consideration, too (see also Principle 3).

All of those diverse temporal and spatial scales need to be integrated into concepts for conservation and use along the lines of the ecosystem approach. Anticipative thinking, action for the long term, and – last but not least – patience are required to achieve an ecologically sustainable use of the forest ecosystem.

4.1.8 Principle 8

Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Rationale: Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 8 is a logical consequence of Principle 7, and has already been dealt with in detail, to the effect that appropriate temporal scales should be considered in management systems. In view of the various

temporal scales of ecosystem processes in forests as summarized above, it goes without saying that appropriate forest management too must inevitably be set for the long term (high age of trees). While the objectives pursued with this principle undoubtedly need to be endorsed, the postulate for management to be set for the long term coincides with Principle 7. Therefore, it seems appropriate to treat those two principles as one.

4.1.9 Principle 9

Management must recognize that change is inevitable.

Rationale: Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential “surprises” in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.

Silviculture recognizes that management is dependent on the natural site conditions and on disturbances due to natural events (storms, snow and ice breakage, insect calamities) (BMELF, n. y.). In addition, man-made phenomena will have to be increasingly considered in future, although they are largely beyond management on a local level (e.g. climate change, atmospheric pollution, etc.), and must therefore continue to be discussed and dealt with on “a higher level” of both society and politics in order to arrive at strategies for their solution (e.g. Climate Conferences of the UN).

Notwithstanding the discussion about if and how impacts of that kind can be avoided, this principle of the ecosystem approach raises the question of what silviculture can contribute to an improved capacity for response and adaptation to changed and changing basic ecological conditions. Management activities such as e.g. the conversion of homogeneous stocks into stocks rich in structure can help to reduce vulnerability to such globally effective impacts (e.g. vulnerability to storms) at least in the intermediate term, granted that this does not represent stabilization of an ecological kind, but rather of a merely physical and thus economic kind. As to the ecological safeguarding of forest ecosystems in the long term, possible solutions may be in the strategy of “shielding & dynamical” or “shaping & dynamical” type of conservation as postulated by SCHERZINGER (1990), or in the consistent application of the process conservation concept, rather than in a static, purely preserving type of conservation. Given the fact that the ecosystem approach explicitly aims for sustainable use, it should not pose a major problem to attain at least the physical type of stability also in the long term, provided that a management concept based on the principle of prevention facilitates diversity of species or entire biotopes to the degree possible. This must more and more also include genetic diversity, which until now has seldom been considered by forest management. In view of the increasingly evident phenomenon of global warming, it is imperative to promote the biodiversity of forests in order to ensure increased physical and, to a certain extent, ecological stability. Along the lines of the “insurance hypothesis” (MOONEY et al., 1995; YACHI & LOREAU, 1999), concerning tree species this signifies in the concrete that the higher the natural diversity of tree species there is in mixed forests, the more probable it becomes that the forest ecosystem is able to

adapt itself to the new environment and to avoid economic or even ecological collapse. In some cases, this may mean that some species entirely disappear from certain sectors. Supposing for instance that the climate in Central Europe is gradually shifting from a climate with Atlantic character towards a more continental, dry climate, it would appear useful in consequence to reduce the proportion of Atlantic tree species accordingly or to mix them with continental species so that the forest structure would be preserved even if the Atlantic tree species are lost. However, a statement of this kind regarding the climate change must be regarded as purely hypothetical considering the present level of knowledge, and since there are different scientific views on this topic, only tentative steps are taken in that direction. Therefore, one should resort to socio-political solutions that are more reliable and can be put into practice on short notice in order to prevent or mitigate the man-made environmental conditions adversely affecting forests.

4.1.10 Principle 10

The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Rationale: Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.

This principle bears on the objectives of the Convention on Biological Diversity, that is, the conservation and sustainable, equitable use of biodiversity. Likewise, the ideal of multifunctional forest use allots equal importance to the aspects of use and protection. Article 1 of the National Forest Act (BWaldG) also makes reference to this thought (see also Chapter 3.1.3), and the forest administrations endeavour to ensure this by applying multifunctional forest management.

In reality, i.e. in the tangible activities carried out in forests, it is often a different story. There is agreement on the fact that this theoretical model of equivalence can hardly become operational in practice (HOFMANN et al., 2000). As in most areas, the main reason for that appears to be the “obligation” of economical management, especially what regards privately owned forests. More precisely the problem is that as yet 90% of the proceeds from our forests are obtained from the sale of wood alone (see also Chapter 3.2). Whereas the conservation and recreational functions essential to all concepts are increasingly recognized by society, they do not immediately provide for income. Forest owners make little if any “investments” in the conservation functions, and nature conservation is still often practised within the meaning of the obsolete, and frequently misinterpreted, “wake theory” (see also HOFMANN, 2000, p. 165) or is a result of coincidences (for instance if biomass is left lying about due to lack of profitability when gathering fuel wood or wood from blowdowns on steep slopes). Supposing that the ideal of sustainable ecological forest management is suited best to meet the diverse needs of society (see also Chapter 3.2.2), state subsidies might conceivably be the right instrument to counterbalance this effect in privately owned forests. At least during the stage of conversion, in which profits will be considerably lower for a certain time interval, this appears to be the only way to ensure equity for multifunctional forest use. Increasingly efforts are made, most recently in the NFP, to identify and assess the pecuniary

value of those functions. On that basis, measures such as the frequently conjured “forest penny” (an extra tax), the reorganization of the present system of subsidies, or alternatively financed incentive schemes could be introduced, which would provide remuneration for the social and ecological services forest owner contribute to common welfare. Concepts to launch a system of remuneration of ecological services, in particular in privately owned forests, should therefore be developed without delay. A remuneration of that kind could be tied to an “ecopoint system” rewarding a certain desired state of the forest and the steps leading to it.

At the same time, the price for wood is still at a fairly low level. Thus, the economic pressure on forest managers, which frequently accounts for an adverse effect, could be relieved by an increase in wood prices. A method sustainable within the framework of free enterprise would be, for instance, to promote the gradual abolition of subsidies for wood substitutes (cheap power tariffs for big industrial enterprises, e.g. the aluminium industry).

In its annual expert report for 1999, titled “World in Transition: Conservation and Sustainable Use of the Biosphere”, the German Advisory Council on Global Change with eminent expertise and in great detail deals with the integration of conservation and use (WBGU, 2001). As to the implementation of this matter the Advisory Council recommends a graduated system for the level of intensity of conservation or use of individual areas or ecosystems, which is based on the categories “conservation before use”, “conservation despite use” and “conservation through use”, and aims for the involvement of all significant actors. Similar zonation concepts, such as the division into core area, buffer zone, and transition zone or area of co-operation within biosphere reserves, also proceed from different levels of intensity for protection and utilization. To what extent is spatial zoning of this kind suited for the implementation of the ecosystem approach in forests? In such a zonation approach, the selection of reference units, or area sizes, is essential. The larger the selected zones are, the more difficult it seems to warrant that “conservation despite use” is ensured in those areas set apart predominantly for “utilization”. This assessment is underpinned by the experiences made in German forestry, which has been pursuing “conservation despite use” for quite some time now, and still is being named the second most important cause for the decline of species. Moreover, there is a potential danger that management of the areas utilized is being intensified beyond the degree reasonable in order to compensate the losses incurred by not utilizing those areas set apart for ecological purposes (ecological priority areas). Furthermore, this may lead to the tendency of introducing or perpetuating systematic plantation management in order to assure production of the required amounts of certain types of wood while exempting “close-to-nature” forests from use. For Germany, though, as the problematic development of one-age-cohort forest management (see also Chapter 3.2.4.3.3) has proved, “conservation despite use” does not appear to be a sustainable model that also ensures the principle of multifunctionality. This theoretical approach becomes still more questionable if – as discussed for the utilization of tropical forests (e.g. Brazil) – a third zone is set apart for purely industrial use.

In consideration of the aspects stated above, a classification is still possible in principle, all the more since large-scale zoning, say on a federal state level, seems rather impracticable due to the complex structure of forest ownership in Germany (see also Chapter 3.1.4). In addition to the zones within biosphere reserves as mentioned above, quite a few authors advocate the designation of 3 levels of intensity in the utilization of forest areas, for instance PLACHTER and KILL (in HOFMANN et al., 2000, p. 159: priority areas for

nature conservation, priority areas for leisure and recreational purposes, priority areas for wood production) and STURM (1993: non-managed areas, sensitive non-commercial forests, commercial forests). Within the framework of ecological forest use, a 2-zone concept might conceivably be sufficient, according to which a certain percentage of the forest area for instance on the level of local forest authorities would be completely exempt from management (“conservation before use”), and at the same time would serve as reference area for the undisturbed development of the forest. This would enable the vast majority of areas to be utilized through ecological forest management, provided that comprehensive criteria for sustainability are met (“conservation despite use”), and is prerequisite if such a zoning model is to be more than just a segregative approach involving the designation of areas under strict protection on one hand and areas that are set aside to be managed, and do not fulfil any conservational functions, on the other (see also BfN, 1997). This means that the concept of forest management practised by forestry must be capable of considering all aspects of a multifunctional ecosystem along the lines of the ecosystem approach as much as possible. The conservation of multiple functions in one and the same area must then be ensured for the majority of forest areas by way of permanent improvement and flexibility in ecological forest management according to new knowledge (“adaptive management”). In this case, one does no longer distinguish explicitly between “conservation through use” and “conservation despite use”.

The determination of the shares designated to the individual zones in the total forest area needs to be done largely with socio-political instruments (see also Principle 1 and 12), because – as experience with the discussion about the certification of reference areas shows – only a small part of it is based on circumstances that can be explained biologically or ecologically, which also indicates that our knowledge of natural forest development is as yet insufficient. On this background, a total reservation share in the region of 10% appears to be entirely reasonable. This figure of around 10% of the country’s total area to be designated as protected areas has been stated by different sources on many occasions (SRU, 2000; WBGU 2001). In the draft for a Nature Conservation Act (May 2001), which in article 3, paragraph 1 calls for a network of biotopes on 10% of the country’s total area, this aspect is taken into account to a certain extent.

4.1.11 Principle 11

The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Rationale: Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Forest management in Germany is based on a long tradition of experience, traditional knowledge, and research (see also KÜSTER, 1998). Ever since the introduction of systematic forestry, the practical activities of forest managers have been accompanied by scientific research. There has always been some sort of feedback from research to practice. The first scientific books on silviculture, for instance, were published in the 18th century, and as a consequence of practical experience the methods of management

kept being modified accordingly. While early research was primarily aimed at the improvement of yield and quality, interdisciplinary concepts of research have been developed, and partially implemented, only in the past few years (e.g. the incentive scheme “sustainable forest management” of the BMBF). In view of the naturally long time intervals, on which forest management is based (see also Principle 7), inevitably the question arises of whether past modifications to the management concepts are not bound to have been premature due to the fact that they were not in a position to anticipate all resulting ecological consequences. Therefore, concepts thought to be innovative were frequently implemented even before previous research had been completed and could have been assessed in full consequence.

Nowadays forest administrations provide a close feedback to the relevant research. Varying from region to region (see also Principle 2), research institutions of relevance to this sector are in particular the forestry faculties of universities, the forestry colleges, and the research institutes of the federal states (e.g. LÖBF in NRW, FVA in Baden-Württemberg, and the State Institute of Bavaria for Forestry and Silviculture (LWF)). In addition to that, there is a fair number of societies (e.g. ANW, aid, etc.), research institutes (e.g. BFH, DGFH), and other bodies and institutions (e.g. IBN) that are devoted to both research and the dissemination of the resulting know-how. The transfer of know-how from those institutions to practitioners and the general public takes place on a variety of levels, but mainly through publications and events of further education (e.g. the annual “research days” or “colloquies” held in Baden-Württemberg). Other major “multipliers” are the forestry associations, which usually represent the only contact with the majority of small private forest owners apart from state services (see also e.g. § 65 (1) 3. LWaldG Baden-Württemberg).

The involvement of scientific, traditional and local knowledge, and of innovation and practices into further education is of course voluntary. Therefore, an immediate effect on the way of management will in most cases materialize only if the results of research are reflected for instance in forestry ordinances or other mandatory rules and regulations. On the other hand, other groups of society that are not directly involved in forest management (e.g. environmentalist organizations) are thus enabled to obtain information, which in turn fits in very well with this principle of the ecosystem approach by involving a broad range of scientists and stakeholders into the decision-making process.

However, all “methods of transfer” mentioned can always present just a small selection from the current results of research. A truly comprehensive description of all results has not yet come to hand. This may be connected with the fact that the mutual exchange among scientists, by means of forums, media of communication, publishing organs, and the like, still needs to be decisively improved in a structured way through alliances creating communication. This conclusion was recently drawn also by the German Council of Environmental Advisors (SRU), which sees another shortcoming “in the integration of other disciplines of science, in particular environmental research (ecology, biology) into forest research”. In other words, “only a few genuinely multidisciplinary approaches are perceivable. Wherever they are attempted, they generally disintegrate into isolated sectoral research in the course of practical application” (SRU, 2000, Chapter 3.1.8, p. 239).

The discussion about sustainable forest management concepts is further handicapped by the fact that a number of basic scientific issues in biodiversity research are still unsettled and have been clarified only to an insufficient degree (see also PLÄN, 1996, p. 18 ff). In order to ensure sustainable management of the

forest ecosystem, a lot of research remains to be done in spite of several centuries of concurrent forestry research. Two examples to this effect are given below:

- 1) Impact of the global climate change on forest development: The conceptions regarding “climax” forest associations and “potential natural vegetation” will probably have to be revised in the light of the man-made climate change. “The snapshots and descriptions of forests available at present, the observation of their dynamics, and the knowledge of their history”, for instance, lead STURM to believe “that ecosystem parameters such as the structure of vegetation and the composition of species are basically unique in their individual appearance, and cannot be predicted in detail” (STURM, 1994, p. 4, our translation). Consequently, statements concerning the intensity of fluctuations or shifts in what is currently referred to as “potential natural vegetation” (see also Chapter 3.1.2) are nothing else than hypothetical, and require more intensive research. Given the fact that the development of ecosystems is unpredictable, such research ought to focus on long-term observation. This again emphasizes the necessity for reference areas (national parks, requirements of the FSC and Naturland certification models (see also Chapter 3.3)) to ensure the continuous observation of natural forest development. Not including the reference areas of the FSC/Naturland certifications, the share of those areas (currently designated under labels differing from federal state to federal state as “restricted-access forests”, “natural forest cells” or “reservations”, etc.) on a national scale amounts to a mere 1% of the total forest areas of Germany. Since in many cases not enough financial resources are available for scientific monitoring of those areas, an expansion is currently not in sight. But it is also management activities that should continuously be monitored through independent scientific research, so that if necessary the practices can be modified or even reversed, particularly in view of global risks (see also Principle 9).
- 2) Significance of total reservations for biodiversity, in particular for the diversity of species: The complex effects of historical forms of land use on the diversity of species and the habitat have as yet not been sufficiently elucidated. Many findings, though, seem to support the thesis that while conventional forest management has certainly contributed to the undeniable decline of forest species (see also Chapter 3.2.3), to give full scope to natural processes does not necessarily translate into a richness in species. This controversial discussion flares up regularly when it comes to the designation of protected areas (e.g. demands for a national park at Hainich), as well as in connection with the reference areas of certification systems (see also Chapter 3.3). However, as yet it has not been possible to make scientifically founded, unambiguous assertions.

For the reasons stated, the importance of the stipulation contained in this principle must be emphasized. In order to be able to consistently implement this stipulation, in Germany with its comparatively advanced infrastructure of appropriate scientific institutions it is mainly the communicative aspect of the know-how transfer that needs to be improved.

4.1.12 Principle 12

The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Rationale: Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

If the ecosystem approach intends to involve all relevant sectors of society and scientific disciplines, this means that they should also participate in developing concepts for the management of the forest

ecosystem. The involvement of the various sectors of society can be attained, inter alia, on the basis of the ownership structure (see also Chapter 3.1.4 and Principle 7), or lately by certification systems (see also Chapter 3.3) and a broad societal dialogue (see also Chapter 3.4 (NFP) and Principle 1; and also the Forest Summit Conference scheduled for October of 2001). It is however remarkable that this kind of involvement has been, fairly successfully in this domain, put into practice predominantly on a regional, national, or even international level, whereas the involvement on a local level must be rated as rather poor (see also Principle 1). Any intentions to enhance local involvement must be discussed in view of the ownership rights established in Germany, which will ultimately be encroached on. At this point, increased local involvement seems only feasible on a voluntary basis and in specific cases.

As described in detail in Principle 11, the stipulation for the involvement of various scientific disciplines has generally been implemented successfully in Germany. With respect to communication and the interdisciplinary interconnection of the scientific disciplines, though, this involvement could still be enhanced within the framework of the ecosystem approach.

Since the involvement of the various relevant sectors is usually dependent on the level of their knowledge, Principles 11 and 12 should also be treated as one.

4.2 The Five Operational Guidelines

Decision V/6 of the Conference of the Parties to the Convention on Biological Diversity adds five operational guidelines to the 12 principles of the ecosystem approach, which are meant to be applied in the implementation of the principles. Since their content greatly resembles the preceding rationales regarding the principles, and since their wording is sometimes even more general, the relevant remarks to the guidelines are only briefly dealt with below and, if appropriate, explained by referring to the corresponding principles.

4.2.1 Operational Guideline 1

Focus on the functional relationships and processes within ecosystems

Rationale: The many components of biodiversity control the stores and flows of energy, water and nutrients within ecosystems, and provide resistance to major perturbations. A much better knowledge of ecosystem functions and structure, and the roles of the components of biological diversity in ecosystems, is required, especially to understand: (i) ecosystem resilience and the effects of biodiversity loss (species and genetic levels) and habitat fragmentation; (ii) underlying causes of biodiversity loss; and (iii) determinants of local biological diversity in management decisions. Functional biodiversity in ecosystems provides many goods and services of economic and social importance. While there is a need to accelerate efforts to gain new knowledge about functional biodiversity, ecosystem management has to be carried out even in the absence of such knowledge. The ecosystem approach can facilitate practical management by ecosystem managers (whether local communities or national policy makers).

Management of the forest ecosystem has always been practiced without proper knowledge of many of its ecosystem processes and functions. In spite of increased efforts to overcome these deficits in knowledge, now as ever there is plenty of ignorance that needs to be done away with. For the time being, the precautionary principle by abstaining from certain interventions should be applied more often (see also Principle 11(1)), particularly if there are diverging opinions or ambiguous results from research (see also

Chapter 3.2.1 and Principle 3). The stipulation of further fundamental research into forest ecosystems and of the application of the precautionary principle in the absence of knowledge about the functional correlations in ecosystems therefore remains an important component of a concept for the sustainable use of biological diversity in forests.

4.2.2 Operational Guideline 2

Enhance benefit-sharing

Rationale: Benefits that flow from the array of functions provided by biological diversity at the ecosystem level provide the basis of human environmental security and sustainability. The ecosystem approach seeks that the benefits derived from these functions are maintained or restored. In particular, these functions should benefit the stakeholders responsible for their production and management. This requires, inter alia: capacity-building, especially at the level of local communities managing biological diversity in ecosystems; the proper valuation of ecosystem goods and services; the removal of perverse incentives that devalue ecosystem goods and services; and, consistent with the provisions of the Convention on Biological Diversity, where appropriate, their replacement with local incentives for good management practices.

Benefits in forest management, especially those of a pecuniary nature (predominantly from the sale of wood), are mainly enjoyed by the owner (see also Chapter 3.1.4). This might be either a private person or the state. In latter case the benefits will indirectly go to the public. This perspective does not consider those “benefits” from the utility, conservational, recreational and nature conservation functions, which ultimately are enjoyed by every citizen. If one is to expect the managers to practice sustainable use in the long run, based on their own understanding, while preserving the entire biological diversity along the lines of the ecosystem approach, the goods, especially in the forest sector, need to be properly valued (in particular the price for wood), and harmful subsidies or incentives need to be removed (see also Principle 4).

4.2.3 Operational Guideline 3

Use adaptive management practices

Rationale: Ecosystem processes and functions are complex and variable. Their level of uncertainty is increased by the interaction with social constructs, which need to be better understood. Therefore, ecosystem management must involve a learning process, which helps to adapt methodologies and practices to the ways in which these systems are being managed and monitored. Implementation programmes should be designed to adjust to the unexpected, rather than to act on the basis of a belief in certainties. Ecosystem management needs to recognize the diversity of social and cultural factors affecting natural-resource use. Similarly, there is a need for flexibility in policy-making and implementation. Long-term, inflexible decisions are likely to be inadequate or even destructive. Ecosystem management should be envisaged as a long-term experiment that builds on its results as it progresses. This "learning-by-doing" will also serve as an important source of information to gain knowledge of how best to monitor the results of management and evaluate whether established goals are being attained. In this respect, it would be desirable to establish or strengthen capacities of Parties for monitoring.

This guideline merely emphasizes the previous stipulation for flexible management for reasons of unpredictable changes in ecosystem processes, as discussed in Principle 9. In particular as to forest management, the stipulation can be endorsed that while due to the temporal scales (see also Principle 7) long-term planning is prerequisite to the sustainability of any kind of ecosystem management, this management needs of course to be able at any time to respond to changes caused by external effects (“global change”). Those changes can be most reliably established by concurrent research (see also Principle 11) and status monitoring (e.g. National Forest Inventory, surveys of the state of the soil, Forest Damage Inventory, Level II – permanently monitored areas, etc.).

4.2.4 Operational Guideline 4

Carry out management actions at the scale appropriate for the issue being addressed, with decentralization to lowest level, as appropriate

Rationale: As noted in section A above, an ecosystem is a functioning unit that can operate at any scale, depending upon the problem or issue being addressed. This understanding should define the appropriate level for management decisions and actions. Often, this approach will imply decentralization to the level of local communities. Effective decentralization requires proper empowerment, which implies that the stakeholder both has the opportunity to assume responsibility and the capacity to carry out the appropriate action, and needs to be supported by enabling policy and legislative frameworks. Where common property resources are involved, the most appropriate scale for management decisions and actions would necessarily be large enough to encompass the effects of practices by all the relevant stakeholders. Appropriate institutions would be required for such decision-making and, where necessary, for conflict resolution. Some problems and issues may require action at still higher levels, through, for example, transboundary cooperation, or even cooperation at global levels.

The administration of the forest sector in Germany with its decentralized (“bottom up”) structures (see also Chapter 3.1.4) is rather well suited to match the principles of guideline 4. The legal framework, which is rightfully recognized as essential (see also Chapter 3.1.3), as well as a policy of capacity building (training and consulting offered by the forest administrations), can be regarded as sufficient for the majority of the managed forest areas in Germany. However, there still are deficiencies and shortcomings in some areas that are also discussed controversially at times (afforestations, commissioners for nature conservation, road and track building, etc.). In this context, it is advisable to involve different responsibilities (nature conservation and forest administration) in order to be able to balance any conflicting interests, which will inevitably occur, through mutual dialogue.

4.2.5 Operational Guideline 5

Ensure intersectoral cooperation

Rationale: As the primary framework of action to be taken under the Convention, the ecosystem approach should be fully taken into account in developing and reviewing national biodiversity strategies and action plans. There is also a need to integrate the ecosystem approach into agriculture, fisheries, forestry and other production systems that have an effect on biodiversity. Management of natural resources, according to the ecosystem approach, calls for increased intersectoral communication and cooperation at a range of

levels (government ministries, management agencies, etc.). This might be promoted through, for example, the formation of inter-ministerial bodies within the Government or the creation of networks for sharing information and experience.

Full consideration of the ecosystem approach in sustainable forest management is certainly an objective deserving support. As has become evident, inter alia, from the discussion about the legally established equivalence of the utility, conservational, recreational, and nature conservation functions (see also Chapter 3.2.2., Principles 5 and 10), it cannot be avoided in practice that some deductions from this ideal of multifunctional forest management and the zonation concepts mentioned in this context must be made in certain individual cases. This must however not impede our permanent efforts to act within the ecosystem approach during all interventions in forests.

Increased intersectoral communication and co-operation on various levels, as postulated in Principles 1, 11 and 12, are of great significance. The National Forest Programme (NFP), being the expression of societal choice, also contains the stipulation for “holistic and intersectoral approaches to the preservation and development of forests”, for obviously there is no sufficient co-operation across sectors in the practical application. Therefore, it will certainly be useful to establish or expand information networks, incorporating the National Clearinghouse Mechanism of the CBD. In addition to that, stakeholders associated with forests must also improve their communication culture. A control mechanism on a superordinate level, possibly incorporated in a national authority, would conceivably further this process. A positive example for productive communication between different scientific bodies and stakeholders is the expert report of HOFMANN et al. (2000), commissioned by the German Council of Environmental Advisors (SRU), which has already been referred on several occasions in this study, and which aims, inter alia, to “identify both common and diverging aspects in the views held by the two disciplines involved” (nature conservation and forest management) and to “elaborate topical recommendations for action in the field of environmental policies” (HOFMANN et al., 2000, p. 1, our translation).

4.3 Résumé and Outlook

In the final analysis can we already claim that the ecosystem approach has been put into practice in German forestry? When looking for an answer to this question, we encounter the basic problem that the wording of the 12 Malawi Principles and its 5 guidelines is held so general that it permits a host of different interpretations. “Management, though, should be based on tangible parameters that are quantifiable, representative, and indicative of the impacts of human activities on the ecosystem” (UBA, 2000, p. 40f., our translation). Thus, the ecosystem approach in its current form may well be a useful tool for establishing the framework of a concept for the sustainable management of ecosystems. However, its wording is not tangible enough to be able to promote or assess concrete activities for securing biological diversity in forestry. The “operational guidelines” themselves, initially intended for the application and implementation of the ecosystem approach, do little more than summarize the principles once more, again on a similarly abstract level. Therefore, to ensure the progress of this approach, it is concrete, *a priori* rules for action, or for restraint from action, in the various areas of sustainable use and for specific ecosystems, rather than *ex ante post* research, that need to be elaborated, and consequently implemented.

Nonetheless, the objectives expressed in the 12 Malawi Principles and its five guidelines may serve as a superordinate ideal for further ecological optimisation of sustainable forest management in Germany. While forest management in Germany is well on the way to fully consider the ecosystem approach in its

ecosystem management decisions, there is still a need for optimisation in certain areas, as can be seen in some of the examples given above (e.g. Principle 5: “Conservation of ecosystem functioning”; Principle 7: “Appropriate temporal scale” and Principle 11: “Consideration of all scientific knowledge”). In a very narrow view of things (see also Principle 5; BUND, 1995) we might even put the question whether it is really possible to integrate all ecological, economic, and social objectives into one management system in one and the same area. The example of the necessity for total reservations indicates that it is not possible, and that therefore a certain co-existence of those objectives will be required also in terms of area (see also Principle 10).

Despite the need for further development of comprehensive sustainable forest management, a great deal of the experience gained in German forest management can be applied also to other sectors along the lines of the Malawi Principles. This applies for instance to the National Forest Programme (NFP) (see also Chapter 3.4 and Principle 1(1)), to certification (see also Chapter 3.3 and Principles 1(2) and 4(4)), or to the decentralized organizational structure (see also Chapter 3. 1.4 and Principle 2). To our knowledge there are currently only two studies in the German-speaking countries, which in their examination of the concept of ecosystem management on the basis of the ecosystem approach of the CBD with respect to other ecosystems or delimited regions explicitly refer to the Malawi Principles and their guidelines (UBA, 2000; FOECKLER et al., 2001). According to these studies, individual components and the general “philosophy” of the ecosystem approach are in every way being considered in sectoral and integrative approaches to the management of ecosystems. However, these authors too arrive at the conclusion that the wording of the approach is much too general in parts to be able to serve as directives for action on an operational level.

To sum up, the ecosystem approach should be understood as a basic guideline for the integrated management of ecosystems but not as a *modus operandi*. While it is certainly possible to successfully employ the approach for introducing the concerns of the CBD into relevant areas of politics, it is not adequate as guidance for tangible protects, due to its highly theoretical organization. PRESCOTT et al. (2000) follow a similar line of argumentation. On the one hand, they stress the usefulness of the ecosystem approach for the analysis of the state of biodiversity in a given country, while on the other they point out that the stipulation of joint intersectoral action in the management of ecosystems usually does not suit the in-situ realities, because planning and management of the conservation and use of biological resources is still carried on a sectoral basis (i.e. based on resources and not on ecosystems). The authors draw the conclusion that a sectoral approach is more likely to promote the awareness of ecosystem managers for the effects of management decisions, potentially making them more responsive to future intersectoral co-operation.

Consequently, the strong points of the ecosystem approach are to be seen primarily in the promotion of communication and discussion between the various stakeholders and actors. This approach may therefore, similar to the international approach for a National Forest Programme, serve to win the support of as many stakeholders as possible for the implementation of a broad range of sustainability objectives.

5 Literature

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6 Appendix

6.1 List of Abbreviations

AID	Auswertungs- und Informationsdienst für Ernährung, Landwirtschaft und Forsten e.V. (Evaluation and Information Service for Food, Agriculture, and Forestry)
ANW	Arbeitsgemeinschaft Naturgemäße Waldwirtschaft e.V. (Study Group for Nature-Conforming Forest Management)
BFANL	Bundesforschungsanstalt für Naturschutz und Landschaftsökologie (Federal Research Institute for Nature Conservation and Landscape Ecology, now BfN)
BFH	Bundesforschungsanstalt für Forst- und Holzwirtschaft (Federal Research Centre for Forestry and Forest Products)
BfN	Bundesamt für Naturschutz (Federal Agency for Nature Conservation)
BMBF	Bundesministerium für Bildung und Forschung (German Federal Ministry of Education and Research)
BMELF	Bundesministerium für Ernährung, Landwirtschaft und Forsten (German Federal Ministry for Food, Agriculture, and Forestry, now BMVEL)
BMVEL	Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft (German Federal Ministry of Consumer Protection, Food, and Agriculture)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BNatSchG	Bundesnaturschutzgesetz (National Act on Nature Conservation)
BUND	Bund für Umwelt und Naturschutz Deutschland e.V. (German Association for Environmental and Nature Conservation)
BWaldG	Bundeswaldgesetz (National Forest Act)
CBD	Convention on Biological Diversity
CSD	Commission on Sustainable Development
DFWR	Deutscher Forstwirtschaftsrat (German Forestry Council)
DGFH	Deutsche Gesellschaft für Holzforschung e.V. (German Society for Wood Research)
EU	European Union
EUROSTAT	Statistical Office of the European Communities
e.V.	eingetragener Verein (registered association)
EVCV	Erster Vorarlberger Coleopterologischer Verein (First Coleopterologic Society of Vorarlberg)
FFH	EU Directive on the conservation of natural habitats and of wild fauna and flora
FSC	Forest Stewardship Council

FVA	Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg (Forest Research Institute of Baden-Wuerttemberg)
GAK	Gemeinschaftsaufgabe zur Verbesserung der Agrarstruktur und des Küstenschutzes (Common Task of Improvement of the Agricultural Structure and Coastal Protection)
GmbH	Gesellschaft mit beschränkter Haftung (Limited Liability Company)
GP	Greenpeace e. V.
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (German Society on Development Cooperation)
HAF	Holzabsatzfonds (Wood Marketing Fund)
ICP	International Cooperation Programme
IBN	Institut für Biodiversität Netzwerk e.V. (Institute for Biodiversity Network)
IFF	Intergovernmental Forum on Forests
IPF	Intergovernmental Panel on Forests
LfoG	Landesforstgesetz (State Forest Act)
LFV	Landesforstverwaltung (State Forest Administration)
LÖBF	Landesanstalt für Ökologie, Bodenordnung und Forsten Nordrhein-Westfalen (State Institute for Ecology, Land Planning, and Forestry Nordrhein-Westfalen)
LÖWE	Programm zur langfristigen ökologischen Wald-Entwicklung (Programme for Long-Term Ecological Forest Development)
LWaldG	Landeswaldgesetz (State Forest Act)
LWF	Bayerische Landesanstalt für Wald und Forstwirtschaft (Bavarian State Institute of Forestry)
MLR	Ministerium Ländlicher Raum Baden-Württemberg (Ministry for Rural Affairs Baden-Württemberg)
MUF	Ministerium für Umwelt und Forsten Rheinland-Pfalz (Ministry for Environment and Forestry Rheinland-Pfalz)
MURL	Ministerium für Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen (Ministry for Environment, Regional Planning, and Agriculture Nordrhein-Westfalen)
NFP	National Forest Programme
NSG	Naturschutzgebiet (Nature Reserve)
PEFC	Pan European Forest Certification
SBSTTA	Subsidiary Body on Scientific, Technical and Technologic Advice
SRU	Der Rat von Sachverständigen für Umweltfragen (The German Council of Environmental Advisors)

STEMELF	Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (Bavarian State Ministry for Food, Agriculture, and Forestry)
UBA	Umweltbundesamt (Federal Environmental Agency)
UNCED	United Nation Conference on Environment and Development
UN/ECE	United Nations Economic Commission for Europe
VFm	Vorratsfestmeter (stacked cubic meter)
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderung (German Advisory Council on Global Change)
WRI	World Resources Institute
WWF	World Wide Fund for Nature