

# THE LÖWE-PROGRAMME

25 YEARS OF LONG-TERM ECOLOGICAL  
FOREST DEVELOPMENT



Niedersächsische  
Landesforsten

# Preface

Dear Readers;

A quarter century has passed since the introduction of the LÖWE-Programme in the State Forest of Lower Saxony. The government of Lower Saxony under State Prime Minister Gerhard Schröder introduced the 13 Principles of Ecological Forest Development as a forest development programme for the Lower Saxony State Forestry Administration in 1991. This move followed a devastating and massive storm, catastrophic forest fires, the discussion of forest die-back and economically unsatisfactory business revenues. The main concern was to de-fuse the conflict between economics and ecology. Since 1991, all State governments in Germany have continued the programme and this is a good thing, since new developments and major projects in the forest require staying power and patience.

This brochure from the State Forest of Lower Saxony (NLF) treats the development of our forests in the last 25 years and will convince you: The goal back then was »to cultivate and care for a near-natural, mixed, productive and beautiful forest that was rich in species«. It has been achieved over large areas and the face of the state forest has changed for the better, from the very ground up. The increase in deciduous and mixed forest, the richness of forest structure and the near natural condition are not coincidences. To achieve these results,

multiple generations of foresters have worked hand-in-hand with these objectives in mind. I invite you to see the beauty, diversity and productivity of our State Forest for yourself. Rest and relaxation, nature conservation and sustainable, profitable forestry are all possible on the same area. With these factors, the NLF also meets its obligation in the interest of the public good, securing the productive capacity

and utility of our State Forest for the long term. The well-respected LÖWE-Programme has gained recognition and acceptance all over Germany and beyond, and has also become a model for other forest owners.

Since 2017 the Programme »LÖWE+« has continued to follow and promote the proven 13 Principles of LÖWE for the multifunctional managed forest in the NLF unchanged in both content

and core ideas and so will continue using it as a guideline for forest structure for the next 25 years. LÖWE+ takes into account new insights into climate change, soil and nature conservation, preservation of biological diversity and integrates our NWE10-Concept for unmanaged forests with which we are opening new open spaces for nature in the State Forest.



BARBARA OTTE-KINAST

*Barbara Otte-Kinast*

Lower Saxony Minister for Nutrition,  
Agriculture and Consumer Protection

# Introduction

## WHY LÖWE?

The programme for »long-term ecological forest development« – in short LÖWE has been leading among state foresters in the forests of Lower Saxony for 25 years: It was established in 1991 as a government programme from the government of Lower Saxony at the time for the State Forest and it has been the binding guideline for sustainable and close-to-nature management of the nearly 330,000 hectares of state forest. Nationally, Lower Saxon was a forerunner with the LÖWE-programme and was followed by many German states with similar approaches for ecologically sound silviculture for its national and state forest areas.

With the establishment of the Lower Saxony State Forest as an institution of public law, LÖWE was taken over unchanged by charter as of June 6th, 2005 as »a corporate philosophy«.

LÖWE was and is needed to develop stable forests and preserve them in future. This is the only way to combine the high societal demands on the cultivation, protection and recuperation functions in the State Forest with each other. LÖWE is the foundation of the State Forest and building on it protects the State Forest for the benefit of the general public.

## DIFFICULT STARTING SITUATION

The majority of forests in Lower Saxon would be, left to nature, populated with deciduous trees, predominantly beech trees. At the introduction of the LÖWE-programme, though, just about two-thirds of the area of the State Forest was occupied by conifers, such as spruce and pine. There are various reasons they occupied such a large share of the area:

- In the 19th century, treeless meadows and over-used forests dominated the landscape in Lower Saxony. Exhaustive cultivation through salt mining, mining of metals and agricultural practices had leached into the soil so that only the undemanding pine could be used in the flatlands and the frost-resistant spruce in the mountains when reforestation was initiated.
- During and subsequent to the 2nd World War, vast areas of Lower Saxony were clear-cut. The vast amount of wood was used to supply the war, in reconstruction afterward, as timber for mining construction and as fire wood and for repairs. In the post-war period the reforestation was largely accomplished using spruce and pine, which were in demand as wood for construction.
- The devastating storm disaster »Quimburga« in 1972 and the huge forest fires of 1975 and 1976 resulted in new deforested areas which in turn were reforested with fast-growing conifers.





WHERE EXHAUSTIVE CULTIVATION PRODUCED  
DESERT WASTES IN THE PAST; EXPANSIVE PINE  
FORESTS GROW TODAY:

LÖWE BRINGS CHANGE

The scientific insights from research into forest ecology in the 1980’s have met the changing social demands on the forest and the financial limiting conditions of forestry determined the environment in which the then Forestry Officer for Lower Saxony, Dr. Hans-Jürgen Otto, developed the 13 principles for long-term ecological forest development for Lower Saxony. The LÖWE-programme became binding for the State Forest under Prime Minister Gerhard Schröder in 1991.

LÖWE brings change to a more extensive variety of tree species based on natural forestry. Forests shall become more stable, economical, aesthetic and closer to nature. The model comes from the varied and richly structured forests of trees typical for the region that naturally rejuvenate. LÖWE stands for sustainable silviculture based on sound ecology.

LONG-TERM MANAGEMENT  
WITH 13 PRINCIPLES

In the following, the 13 principles are stated and explained. The changes after 25 years are presented for each principle. You can experience the visible results yourself every day in our magnificent State Forests.

SUCCESS AFTER 25 YEARS OF  
LÖWE-FORESTRY

	1991	2016	Long-term goal
Mixed forests	45 %	59 %	90 %
Mixed forests With some deciduous trees	31 %	58 %	65 %
Share of deciduous trees in young class	52 %	73 %	65 %
Rejuvenation preserving old stock (without clear-cutting)	60 %	95 %	95 %
Share from natural rejuvenation young class (instead of planting, seed)	32 %	68 %	75 %
Sustainable allowed cutting harvestable cubic meters per ha	4,6	5,8	7,5
Growth in harvestable cubic meters per ha	6,3	7,4	8,0

(Source: FE-database)



## PRINCIPLE 1:

# SOIL CONSERVATION AND SELECTING TREE SPECIES SUITABLE TO THE LOCATION

*The forest soils provide a basis for healthy, diverse and top-performing forests.*

A primary objective of near-natural forestry following LÖWE lies in keeping the soil fertile. Its natural economic potential must be cultivated and preserved.

Soil is a complex mixture and it is never static, but a dynamic factor at any location. Forest soils change as the forest stock changes, with input from the air, changes in climate and the way in which they are treated.

For us, the Lower Saxony State Forest, soil conservation is very important. This has various consequences for decisions in the State Forest. Today we insist on using only tree species suitable to the location which should develop into forest ecosystems as close to nature as possible. At the same time, we largely refrain from using plant protection products. The necessary use of modern forestry techniques occurs in a permanent forest development.

## FORESTS FITTING THEIR LOCATION ARE MORE STABLE

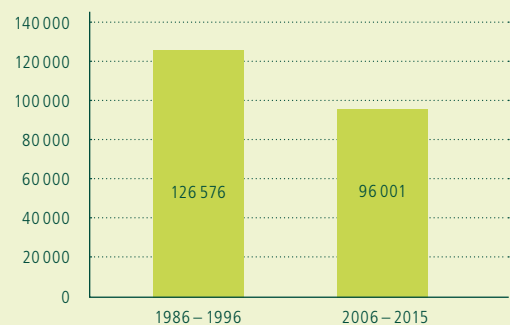
A precondition for the selection of tree species appropriate to the location and the development of near-natural forest ecosystems is knowledge of the forest location. For this reason, location mapping is an important key discipline for soil conservation. The State

Forests today have been comprehensively mapped. The knowledge of soil, climate and vegetation thus establishes the preconditions for the development of the forest of the future.

Forests, which are not suitable for their location, have been successively transformed into stable mixed forests since LÖWE was introduced. Their areas have decreased in the past 25 years by 30,000 hectares to around 96,000 hectares today.

## AREA OF FOREST WITH MISMATCHED TREES FOR LOCATION

[ HEKTARE ]



Total area which, according to current guidelines for tree species selection (ML 2004) do not have a good match between tree stock and forestry objectives (Source: FE Database).



OAKS AND PINES ARE TREE SPECIES SUITABLE TO MEADOW LOCATIONS

IN MOUNTAINOUS TERRAIN, THE SYCAMORE IS AN IMPORTANT MIXED TREE SPECIES

CHEMICAL CONTAMINATION IS HIGH

Along with the initial geological substrate, the climate and the forest stock, input from the air has a particularly strong influence on the chemical composition of the soil in our forests. It is mainly the high sulphur and nitrogen concentration that have left traces that can still be detected today. The environmental measures of recent decades and most of all the financial collapse of eastern Europe in the 1990's have considerably reduced the concentrations of sulphur. The nitrogen input from motor vehicle traffic, agriculture and industry however are still high and continue to acidify the forest soils, with negative consequences for the nutrition of the trees.

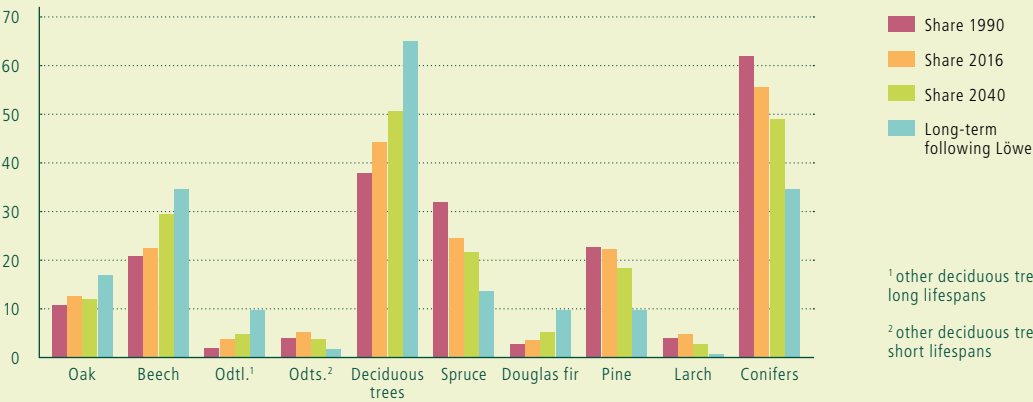
In the last two decades, areas that are especially acidified were limed in order to halt the advance of soil acidification and in order to buffer the new acid accumulation. This secures the yield potential of forest soils. In total, more than 180,000 hectares of forest area have been differentially limed since 1991.

CAUTION WHEN DRIVING

To avoid causing soil damage during timber harvesting, driving on forest soil outside of clearly marked, permanent access alleys and pathways is strictly prohibited. This assures that 80 % of forest soils are not compromised by driving on them.

TREE SPECIES BY PERCENTAGE IN STATE FORESTS

[ % OF WOODLANDS ]



<sup>1</sup> other deciduous trees with long lifespans

<sup>2</sup> other deciduous trees with short lifespans



## PRINCIPLE 2:

# DECIDUOUS AND MIXED FOREST GROWTH

*Pure stocks are to be naturally restricted to rare, extreme locations.*

Mixed forests are comprised of different tree species in different proportions. They evince greater biodiversity through the mixture, often offer a greater structural diversity and are on the whole more stable and resistant to external influences such as storms. At the start of the LÖWE-programme 25 years ago, the Lower Saxony State Forest was still characterised by pure conifer forests of younger spruce and pine trees, which in many places proved susceptible to extreme weather events. »Mixed forests are to be grown to the greatest possible extent in the State Forest in order to increase and protect the variety of species. To adjust to the specific ecological conditions, the increase of deciduous mixed forest has precedence. Pure stocks are to be naturally restricted to rare

extreme locations«, said Dr. Otto when he formulated the LÖWE-objective years ago.

## CONSIDERABLE INVESTMENTS IN FOREST RESTRUCTURING

In 25 years LÖWE has been able to continuously increase the percentage of deciduous tree species from about 40 % to currently a bit above 44 % of the tree species contributing to stock.

Especially in regions with large-area coniferous forest, such as in the Harz and Heide, it was only possible to increase the stock of deciduous trees through extensive planting. So, between 1991 and 2016 in Lower Saxony State Forest, around 120 million young trees





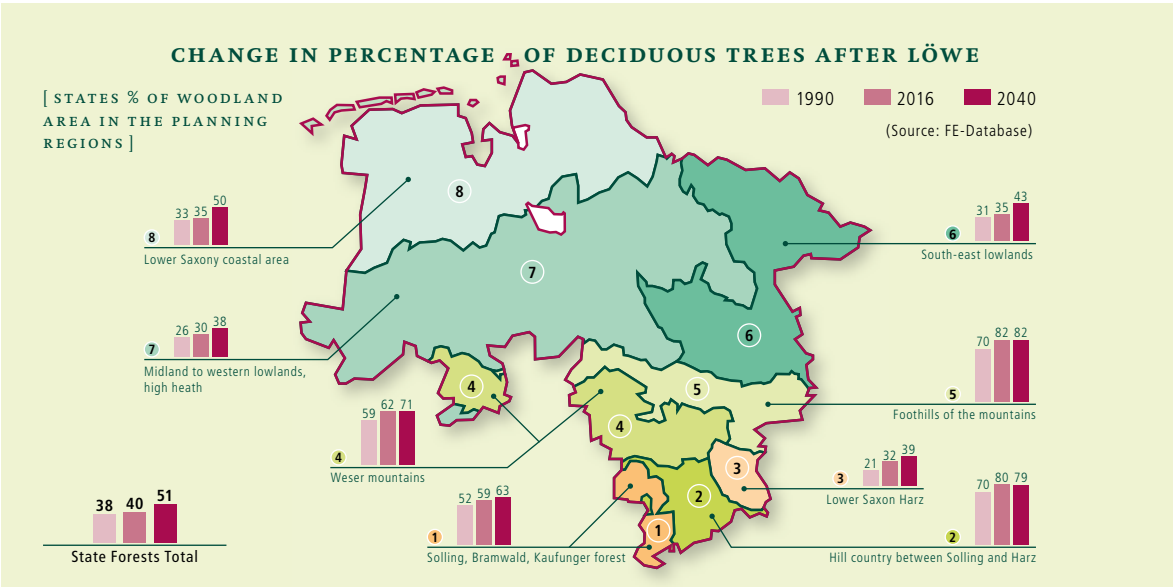
VALUABLE BEECH SEEDS ARE HARVESTED AND PROVIDE FOR A STABLE MIXED FOREST IN THE FUTURE

were planted; this corresponds on average to 4.8 million trees per year. Deciduous trees predominated, with a share of 86 %, among them the beech alone accounted for 58 %. This investment in a LÖWE-compliant forest accumulated in the last 25 years to about 100 million Euros.

MIXTURE IS BEST

With the increase of the share of deciduous trees, the target share of mixed forests also increases. The results of the first nation-wide forest survey from 1987 and the third nation-wide forest survey from

2012 clearly show these changes. The share of mixed forest thus increased from 42 % to 53 %. If one looks at the results of stock-taking from the Forest Management Service, then the share is 68 %. It was possible to make great strides in the direction of increasing deciduous and mixed forest in the last 25 years. Nevertheless, continued efforts are necessary to reach the long-term mixed forest objective. The development toward more mixed forest is a long-term process. Many forests first need to grow to an age when restructuring and mixing is possible. The share of deciduous trees in the forest of the State Forest





YOUNG BEECHES GROW UNDER THE PROTECTION OF OLD PINES

will continue to increase. The long-term goal is 65 %. Additionally, mixed forests need constant silvicultural care so that the less competitive tree species such as the oak are preserved over the long term.

### KEY TREE SPECIES BEECH

The beech tree species is very important: It can endure shade very well and therefore can grow under the conifers making up the old tree stock. As they are gradually harvested, the beech will gradually take over the dominant role in the shape of the forest. To make the forests that are arising as rich in variety as possible, the task of foresters is to intentionally plant additional mixed-tree species such as the Douglas fir, sycamore, cherry, oak, fir or Larch or if possible to preserve them in proportion through natural rejuvenation.

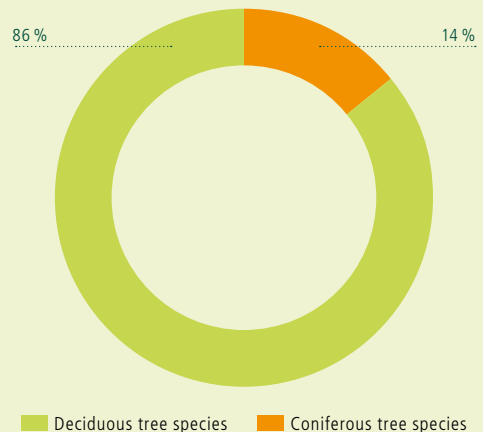
### MEETING THE CLIMATE CHANGE CHALLENGE THROUGH FOREST STRUCTURE

The challenges of climate change with longer dry phases in the summer and increased storms in the winter are being met by the State Forests with their

LÖWE-programme. There is no better strategy than insisting on the biodiversity of structured mixed forests. A broad range of tree species at the right location is the best preparation for both ecologically as well as economically diversified risk reduction. Today, State Forests are making decisions about forest structure that will determine the future of the forests for the next 100 to 200 years.

### SHARES OF PLANTING

Of the deciduous and coniferous tree species planted between 1991 and 2016 (verification provided by state foresters)





### PRINIPLE 3:

## ECOLOGICAL COMPATIBILITY

*Forest ecosystems should not be compromised in terms of productivity, stability and elasticity.*

The tree species spectrum for potential natural vegetation is promoted over large areas with the LÖWE-programme. LÖWE thus places its emphasis on mixed tree species. However, careful enrichment with other species is possible, if they are ecologically compatible. The State Forests use only foreign tree species that have proven through years of growing test that their performance, stability and elasticity are not compromised by the mixed forest ecosystem. The conscientious handling of State Forests has led to an increase in area totalling 3,500 hectares in the 25 LÖWE-years.

Douglas fir, Japanese larch, giant firs and red oak have proven their ecological compatibility. They thus enrich the spectrum of mixed tree species in the State Forest and are used constantly in mixtures, mainly with beech, spruce and pine. They supplement the mixed tree species precisely at locations which will be subject to longer dry periods in the future due to climate change.

### STRICT CRITERION FOR INTEGRATION

Here, the LÖWE-programme is clear and strict:

According to it, tree species that are introduced must be suitable to the location and must improve the soil long-term. They may not spread any diseases and may not themselves be endangered beyond any normal degree. Additionally, they must be capable of natural rejuvenation and must be compatible with other tree species; they may not drive them out and should also have a certain tolerance for shade in order to allow for vertically mixed structures.

In the Lower Saxony State Forest, foreign tree species on 23,500 ha constitute the main stock. The most important of these tree species is the Douglas fir, followed Japanese larch, giant fir and red oak.

### GOOD TO KNOW

Profile of foreign tree species in the Lower Saxon State Forests:

- a) The species must be suitable for the location;
- b) The species must improve the soil over the long term in the sense of optimal cycles of nutrients. This means both the spread of the root system in the mineral soil as well as formation of humus and humus conversion with intact chains of decomposition and mineralisation;
- c) The species may not spread any diseases or in contribute in other ways to instabilities in the ecosystem;
- d) The species itself may not be endangered by abiotic and biotic risks beyond a certain normative degree;
- e) The species must be capable of living in the mixed forest;
- f) The species must be capable of rejuvenating itself through natural rejuvenation;
- g) The species should be as suitable as possible for use in optimal, vertically arranged forest structures.



THE DOUGLAS FIR IS ADAPTED TO THE SOIL AND CLIMATE AND CAN BE SUCCESSFULLY INTEGRATED INTO INDIGENOUS BEECH AND SPRUCE FORESTS

**NEGATIVE EXAMPLE:  
PRUNUS SEROTINA**

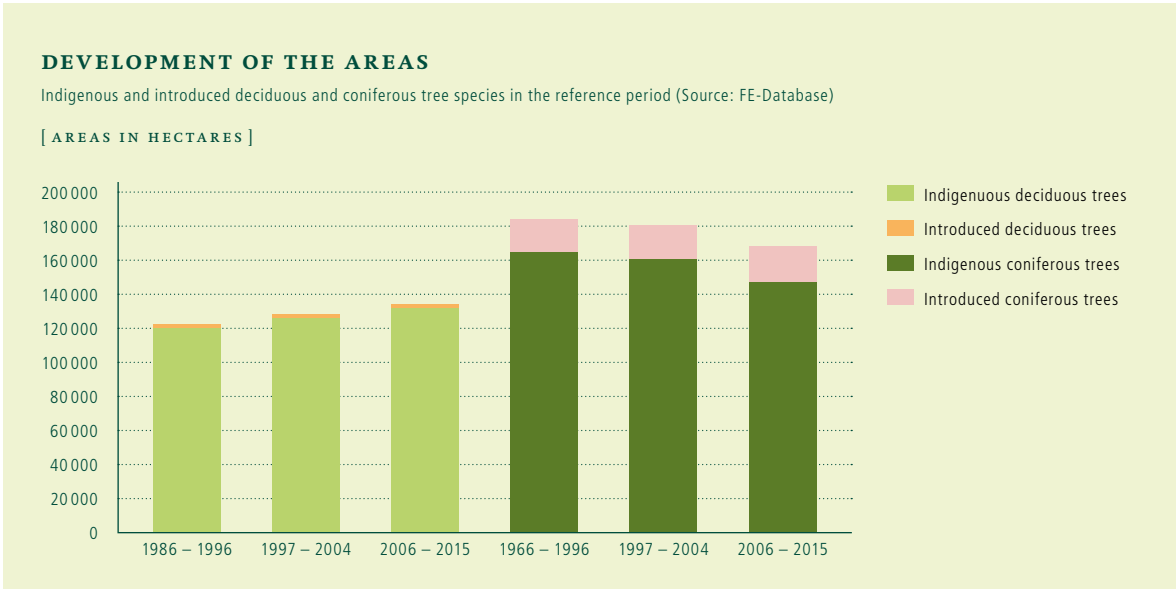
Admittedly, there are also negative examples: The late-blooming bird cherry was introduced in part at poor locations under stocks of coniferous trees as forest-fire protection, and in part it colonised forests from gardens and agricultural planting. It proved to be an invasive species and overwhelmed a part of the indigenous trees and bushes. The State Forests are working on driving the species back.

**VERY WELL-SUITED FOR  
MIXED FORESTS**

The four-species named, Douglas fir, Japanese larch, giant fir and red oak, can be successfully integrated

into the ecosystem and do not push out indigenous species. Their ecological compatibility is shown in a high percentage of 75 % mixtures with indigenous tree species.

The Douglas fir was introduced most frequently as a mixture in older pine stocks in the lowlands. Their share of area has increased from 1987 (National Forest Inventory 1) to 2012 (National Forest Inventory 3) from 2.6 % to 4 % of the area of the State Forests. The most frequent types of mixed tree species with the Douglas fir are beech, spruce and pine. In the last 25 years, 94 % of areas under conifer stocks (spruce and pine forests) were rejuvenated with introduced tree species.





PRINCIPLE 4:

PREFERENCE FOR NATURAL FOREST REJUVENATION

*Forests shall be preferably rejuvenated from natural seeding.*

Natural forest rejuvenation from seeding of old trees is the first choice everywhere where the State Forests already have near-natural, stable and structured mixed forests suitable to their locations that conform to the LÖWE-guiding principles.

The preference for natural forest rejuvenation under the cover of existing old trees has many advantages such as the higher adaptive potential of the young plants, avoiding loss of nutrients on the surface as well as a lower danger of damage from late frost or rodent attack. Additionally, young stands of trees from natural rejuvenation are often qualitatively better and more vital. Furthermore, longer rejuvenation phases in the old forests promote structural diversity.

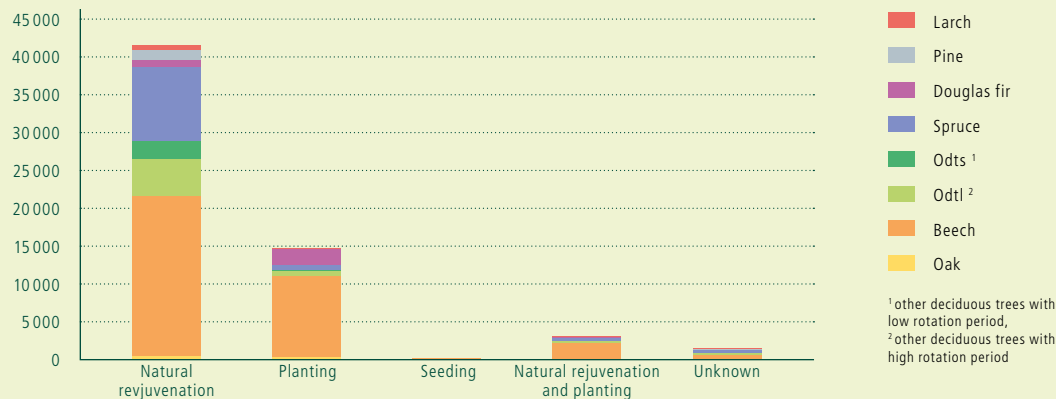
Along with these positive aspects from an ecological point of view, the use of natural forest rejuvenation is also an economic advantage, since fewer plants have to be purchased and the preparatory work, planting, and several years' worth of continuous cultivation are all avoided.

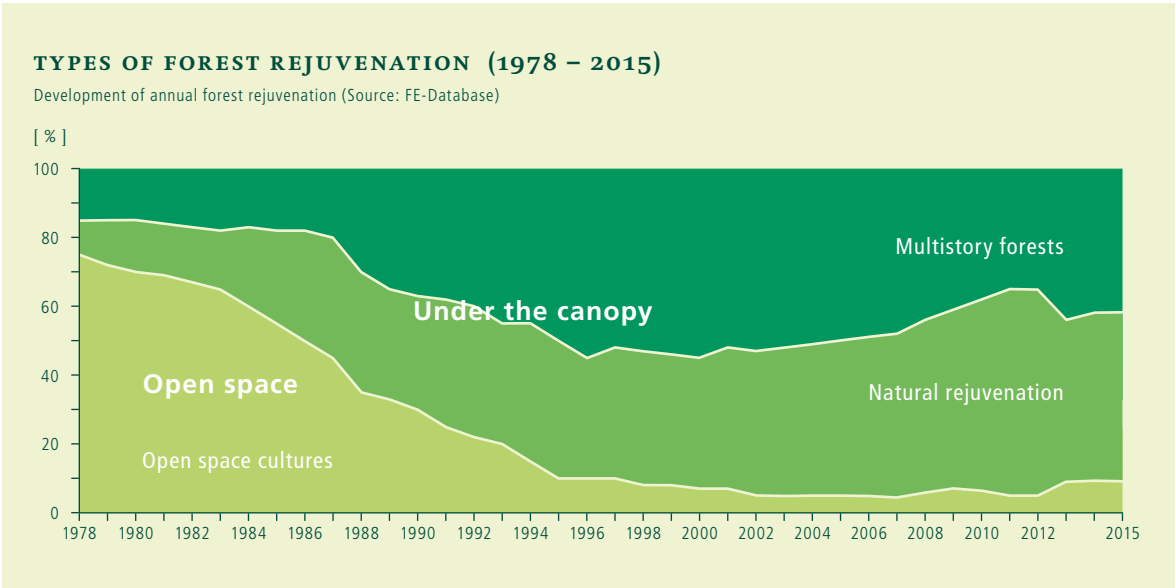
Natural rejuvenation however assumes that the old stocks, from which the seeds come, are suitable for the location. Additionally, there must also already be a sufficient number of mixed tree species present. Where this is not the case, plants or seeds with origin-certified reproductive material are needed. The Lower Saxony State Forests place a great value on origin certification for the seed and invest considerable

DIFFERENT KINDS OF REJUVENATION

(Source: FE-Database)

AREA [ HECTARES ]





means in providing sufficiently selected and tested seed.

**ONLY SUITABLE SEED AND PLANT MATERIAL WILL BE USED**

Since 2002, the Forest Seeding Consulting Office (fsb) in the Lower Saxony Forestry Office in Oerrel is called on to conduct strict controls on plants in contract growing at private orchards. The harvesting and procurement of origin-certified seed and plant material for forest rejuvenation is coordinated and secured by the Central Office of the fsb. Consequently, the number of forest plants in the State Forests that come

from controlled contract growing has increased constantly since 2003. The objective of procuring approximately 80 % of the trees planted in the State Forest from controlled contract growing has been nearly achieved in the years since 2014. This assures that only high-quality seeds and plant materials are used for each forest location for forest rejuvenation.

**TURNABOUT IN FOREST REJUVENATION**

Since 1978, the share of rejuvenating measures taking place under the cover of old trees (natural rejuvenation and planting) has increased dramatically. This





BEECH AND SPRUCE SIGNIFICANTLY CONTRIBUTE TO THE NATURAL REJUVENATION OF FORESTS

documents the turn away from the practice that had dominated until then, of timber harvesting through clear-cutting followed by reforestation in Lower Saxony State Forests. Where in 1978 three-quarters of the planned rejuvenation measures were still planned as open space cultivation, after the introduction of the LÖWE-programme in 1991 it dropped to only about a quarter. Since then this share has dropped further and considerably to less than 10 %.

Admittedly, it has repeatedly proven necessary to reforest on the large scale after natural disasters covering large areas, such as the storm »Kyrill« in 2007, but the introduction of LÖWE clearly marked a turn away from clear-cut harvesting to an approach closer to nature. Thus around 60 % of the new growth since the introduction of the LÖWE-programme has come from natural rejuvenation and coppicing.

### **BEECH IS THE TREE SPECIES FOR FOREST REJUVENATION**

The beech has had a share of 50 % of the total rejuvenation area in the State Forests in the last 25 years. As a shade tolerant tree species, they are ideal for the understory and advanced planting in the large spruce and pine forests, in order to reach the objective of a mixed forest.

### **SHADE INTOLERANT TREE SPECIES ARE THE LOSERS**

Oak, larch and other shade-intolerant tree species demand a lot of light especially in the rejuvenation phase. Light is scarce in a near-natural and structured mixed forest, due to cover from old trees. For this reason, shade-intolerant tree species in near-natural forests are counted among the losers. In order to assure that these valuable tree species still maintain an appropriate presence in the State Forest, special harvestable forms such as patchy gaps and clearings are set in the forests to foster them. Additionally, larger disrupted spaces caused by storms or insects are used for rejuvenating the tree species that need a lot of light, in this case mainly oak.

### **CONTINUING NEED FOR REJUVENATION**

In the future, the introduction of origin-certified deciduous and coniferous trees will continue to be very important. The conifer forests that were planted over large areas after the Second World War will grow to exploitable size in the coming years and with that into the phase of rejuvenation and building up the desired mixed forest. An additional reason for actively planting and seeding younger forest trees is adapting the State Forest to advancing climate change.



## PRINCIPLE 5:

# IMPROVING THE FOREST STRUCTURE

*The stability of the forest shall be increased through vertically arranged forest structures.*

The forest structure will be defined by the distribution of trees, their spacing, their different ages, heights, dimensions, species and mixture.

### STABLE FOREST THROUGH GENTLE CARE

The forest structure will be decisively shaped by the species used in forest rejuvenation, the selection of tree species as well as forest management. The LÖWE-objective is to improve the forest structure through nurture and harvesting. This results in stable mixed forests suitable to their locations which develop into vertically and horizontally structured forests through differentiated care.

### INTERACTION OF HARVESTING, REJUVENATION AND MAINTANANCE

The improvement of the forest structure through the interaction of harvesting, rejuvenation and nurture can be seen in the State Forest in the constant increase of area in the different layers of tree stock (vertical forest structure). With LÖWE, multiple layers of stock were developed in many forests. Thus, the area occupied by the understorey increased from 74,573 hectares to 110,200 hectares.

This successful development is also attested by the Federal Forest Inventory. Where in 2002, 31 % of the State Forests were single-layered, in 2012 it was

SUSTAINABLE AND WELL-STRUCTURED MIXED FORESTS WILL REPLACE PURE STOCKS





HEALTHY FOREST STRUCTURE WITH TREES OF DIFFERENT SPECIES AND AGE CLASSES

only 22 %. The forest structure policy pursued in the State Forests lead to multi-layered forest structure and thereby to an improvement of the vertical forest structure.

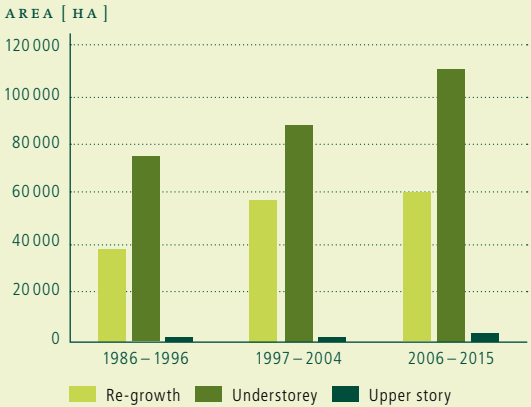
The old stocks that were taken over from the past were overwhelmingly single-layered and not very mixed but it was possible to gradually replace them with age-differentiated and spatially separated use in richly structured forests. This process is continuing and will continue for decades into the future. It is one of the core responsibilities according to LÖWE.

**SHADE-INTOLERANT TREE SPECIES  
NEED CARE**

Consistent care by responsible foresters is required to assure that shade-intolerant tree species such as the oak or the larch stay permanently integrated into the forest structures, because they need a lot of light, these trees are poor competitors against shade-tolerant mixed tree species, and without human intervention they would just perish from lack of light as the stock developed.

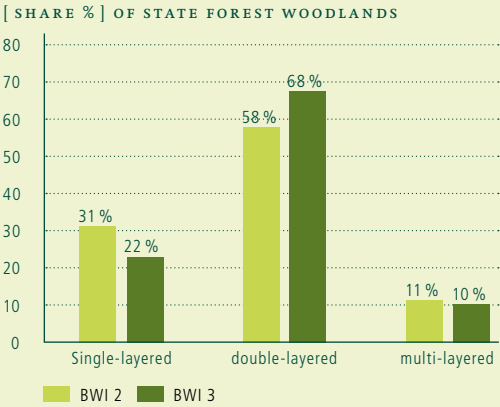
**DEVELOPMENT OF NEW GROWTH UNDER-  
STORY AND UPPER STABLE AREAS**

in the Lower Saxony State Forest in three reference periods  
(Source: FE-Database)



**DEVELOPMENT OF STOCKS**

Development of single, double and multi-layered stocks in Lower Saxony State Forest (Source: BWI 2 and 3)





PRINCIPLE 6:

HARVESTING AT EXPLOITABLE SIZE

*Trees should be harvested singly or in groups when they reach exploitable size.*

With LÖWE, the timber harvest does not follow defined production periods but instead according to when individual trees reach exploitable size (target diameter). Exploitable size is the heart of LÖWE, since taking the individual tree or tree group into account results in long harvesting and rejuvenation periods – the forests get older and richer in structure. Dr. Otto stated it so 25 years ago: »The Lower Saxon forest should grow old and trees should be, as far as possible, harvested as singly or in groups when they reach exploitable size«.

EXPLOITABLE SIZE PARAMETERS

Baumart	Durchmesser
Oak	60 – 70 cm
Beech	60 – 65 cm
Sycamore, ash, cherry	50 – 65 cm
Douglas fir	45 cm
Douglasie	50 – 70 cm
Pine	45 cm
Larch	50 – 70 cm
Red elder	45 cm
Birch	40 cm





THE TARGET DIAMETER IS MEASURED WITH A SLIDE CALLIPER

### TURNING AWAY FROM CLEAR-CUTTING

The introduction of harvesting based on exploitable size also means the end of »clear-cutting«, the practice of harvesting whole areas and then artificially rejuvenating them. A result of harvesting by exploitable size, the inventories increase, forest structures improve and natural rejuvenation is fostered. This creates structures like those in permanent forests.

### HARVESTING AT EXPLOITABLE SIZE IS DEMANDING

Exploitable size varies by tree species, quality, location, risk and depends significantly on the handling of the tree inventory in terms of forest structure during its life to that point. The foresters in the State Forests must understand the structure and the local situation of each forest, because care must be based on the individual tree or group. This applies all the more for the harvest phase (harvesting at exploitable size) with rejuvenation beginning parallel to it. Harvesting selected trees is considerably more difficult in a complex forest structure and yet as little damage on the remaining trees and rejuvenation may happen.

Harvesting based on exploitable size leads to long harvest phases that in part can encompass multiple decades between their beginning and end. The rejuvenation of the forest lasts just as long. This yields a mosaic-like alternation between light and shadow, between main and mixed tree species, between thick and thin, between old and young as well as large and small. The LÖWE-forest is a sustainable but very dynamic ecosystem. The consequence is a multi-levelled and more stable forest stock which allows for timber harvesting without losing its essential character.

### TIMBER INVENTORIES AND AGE ARE INCREASING

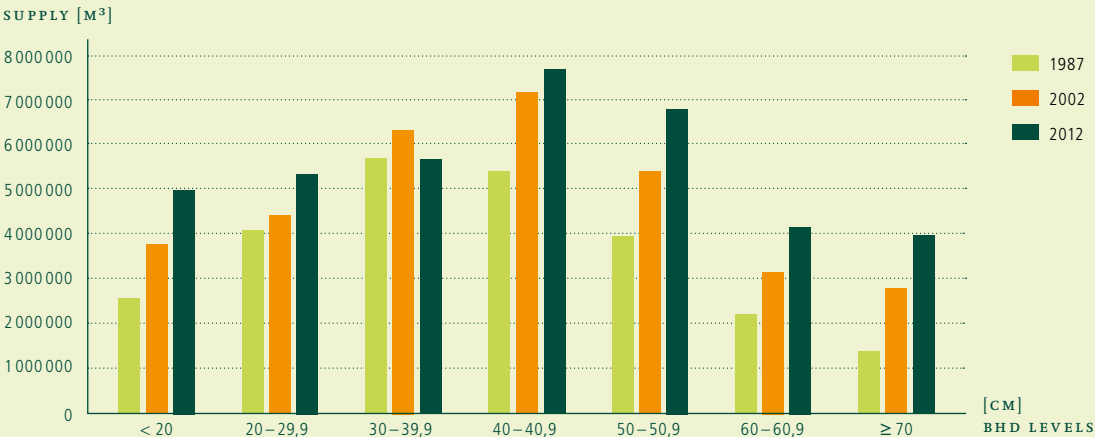
Cautious interventions in the forests, largely leaving behind wide-area harvesting, together with increases of areas where nothing is harvested have led to a significant increase in timber inventories. The timber yield per hectare in the State Forests has increased since the first National Forest Inventory in 1987 from 213 cubic metres to 300 cubic metres in the third National Forest Inventory in 2012. Considerably less timber was used than had grown up.

The increasing inventories are closely connected to the age of the forest because older trees are thicker and taller. The LÖWE-objective, allowing the Lower Saxony State Forest to age, could be advanced considerably in 25 years. The areas with forest over 160 years old increased from 7,500 hectares to 18,400 hectares. The development can be shown analogous to the diameter thicknesses of the tree species. Especially noticeable is increase in deciduous tree inventory over 70 cm in the height of the diameter at breast height. Here the value tripled to more than 4 million cubic metres.



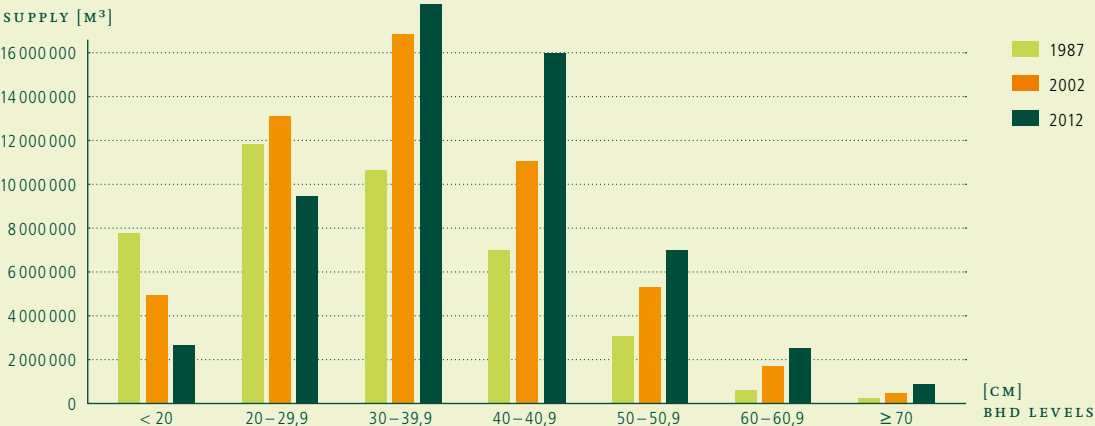
HARDWOOD, DECIDUOUS TREE SPECIES

Supply (m3) of hardwood in Lower Saxon State Forest by BHD-classes on reporting days for BWI 1, 2 and 3 (total amount of stocked woodlands BWI 1-3)



SOFTWOOD, CONIFEROUS TREE SPECIES

Supply (in m3) of softwood in Lower Saxon State Forest by BHD-classes on reporting days for BWI 1, 2 and 3 (total amount of stocked woodlands BWI 1-3)



THERE ARE ALSO RISKS

The high inventories in the Lower Saxon State Forest promise a sustainable good supply of timber in the future. But they also conceal risks: The great inventory of old coniferous and deciduous trees of exploitable size conceals the risk of increase of diminishing wood value through fungal infection, rotting, discolouration and wind breakage, especially for the spruce. For that reason, harvesting

at exploitable age is always linked with a weighing of risks and opportunities. The LÖWE-forest must combine various social requirements with each other in order to equally fulfil the utilitarian, protective and recreation functions of the forest. This understanding of LÖWE has, for example, lead in the beech and oak forests to the potential for harvesting at exploitable size not being exhausted to the benefit of the ecological objectives.





PRINCIPLE 7:

# PRESERVATION OF OLD TREES, PROTECTION OF RARE SPECIES AND THREATENED PLANT AND ANIMAL SPECIES

*Old and thick trees should be preserved individually, in groups or over small areas.*

Biological diversity is the basis of the forest’s stability and adaptability. It is also a precondition for their performance and their sustainable productivity. It encompasses the diversity of habitats, diversity of species and genetic diversity.

Many rare or threatened species of plant and animal can be found in the total area of the forest. Protecting them and preserving older trees have gained massively in importance with LÖWE in the past 25 years. These are integral components of near-natural forest management. Additionally, rare indigenous tree species are intentionally drawn in and their genetic potential is secured.

RARE ORCHID: WILD ORCHID



**OLD TREES ARE HABITATS**

Old trees are also important for preserving and promoting biodiversity in the forest. Our indigenous tree species can of course live several hundred years. When they reach a very advanced age, though, processes begin that degrade the wood quality such as discolouration and rotting. For this reason, trees in the managed forest are harvested considerably before their natural age limit. But it is precisely this phase of aging and decay that is especially valuable from an ecological point of view. The aged trees have a multitude of inhabitants, large and small. Once decay sets in, countless species specialised in dead wood colonize it. In order to protect this habitat and its structures, which are important to biological diversity, a tree habitat concept is implemented in the State Forest.



Along with the area-wide coverage, individual specific habitat trees in old forests that are starting to reach exploitable age should be preserved for the long term. Habitat trees will be selected and permanently marked in groups and small areas if possible.



OLD TREES ARE PRESERVED

»HOTSPOTS« OF BIODIVERSITY

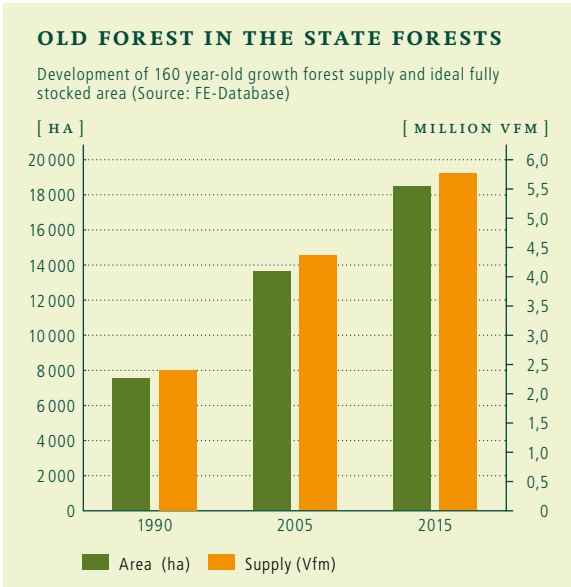
After 25 years of LÖWE, there are around 14,000 hectares of habitat trees in the State Forest. Of these, 9,600 hectares are even classified under the characteristic of biodiversity as especially valuable »Hotspots«. With their structures and properties, they offer preconditions for an especially high inventory of species typical for the habitat. These habitat tree areas are mainly no longer managed and can develop

naturally without any human direction. Around 2,000 hectares of habitat tree areas continue to be cared for to protect them or their shade-intolerant tree species in them, and this most of all for old oaks.

ADVANCED AGE MEANS MORE WOOD—EVEN DEAD WOOD

Since the introduction of LÖWE, the area of old forests older than 120 years has considerably increased. In 1990 it was 42,300 hectares, today it is more than 62,000 hectares, at least around 20 % of the forest area in the State Forests. The wood inventory of the forests that are at least 120-years old has increased from around 14.4 million cubic metres to around 20 million cubic metres currently. The wood supply of forests over 160-years has more than doubled.

Along with the aging forests, the quantities of dead wood are also increasing and with them the potential for biological diversity on the forest areas of the State Forests. The results of the National Forest Inventories from the years 2002 and 2012 for the State Forest show that the quantity of dead wood over 20 cm in diameter has increased from 12 to 20 cubic metres per hectare. Over 10 cm diameter the amount is



around 30 cubic metres per hectare. The current designations of nature conservation areas in the FFH-areas (European Nature Conservation Areas) of the State Forests and the natural forest development (NWE 10) to 10 % of the area of State Forest will allow the quantities of dead wood to continue increasing in the future.

**RARE FOREST BIRDS FEEL RIGHT AT HOME**

The development of rare forest birds has been taken as an indicator of diverse and ecological valuable forest for some years. The species which need old forests with corresponding tree structures and relevant shares of dead wood, such as the stock dove and middle spotted woodpecker evince a growing population dynamic in Lower Saxony. Even the severely threatened black stork is improving. A disproportionate number of rare and shy large birds breed in these state forests. In the framework of species protection projects are actively nurtured in the State Forest.



YOUNG BLACK STORK

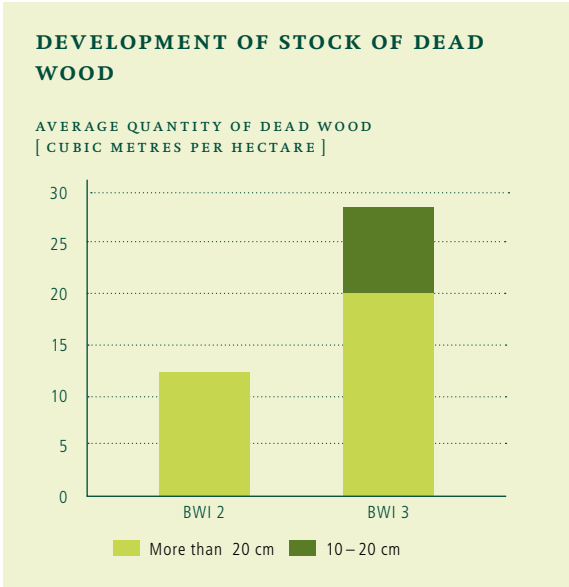
**FORESTERS MANAGE CONSERVATION**

In the framework of biotope conservation, the regular care of open land has a preeminent place: Heath areas, calcareous low-nutrient meadows, dry grasslands and well as mountain meadows and extensive grasslands are regularly cared fore on an area of around 2,400 hectares. The State Forests have actively re-naturalized around 2,000 hectares of moors in recent years, including the Mecklenbruch in Solling or the Giebelmoor near Wolfsburg – both moor areas of national significance. With the re-naturalisation





DEAD WOOD CREATES HABITAT



of moors, not only are the stocks of a multitude of endangered animal and plant species secured, but an active contribution to climate conservation is made. With LÖWE, forest conservation in the State Forests is a fixed component of near-natural forest management and so the responsibility of all foresters on-site in the

forest districts. They are supported by foresters especially trained in forest ecology.

**UNIQUE CHARACTERISTIC:  
CONSERVATION PLANNING**

Measures to preserve nature and endangered species are never taken without a plan. Management planning for conservation areas and Natura 2000-areas drafted based on forest biotope maps that are renewed every 10 years in the Lower Saxony Forest Planning Office and coordinated in mutual agreement with the natural conservation authorities.

**ACTIVE GENE PRESERVATION**

Moreover, the State Forests, together with the North-west German Forest Research Institute protect and preserve State Forests in the framework of a gene preservation programme aimed at preserving the genetic diversity of rare species of trees and shrubs. Before the LÖWE-programme began, these so-called gene preservation forests only constituted about 150 hectares. Today around 4,900 hectares conserve the genetic diversity of the indigenous species of trees and shrubs.



PRINCIPLE 8:

BUILDING A NETWORK OF FOREST CONSERVATION AREAS

*Forest areas for typical and rare forest communities should be preserved.*

The many natural treasures which the State Forests of Lower Saxony have to offer, and they should not be lost. For this reason, LÖWE depends on a representative selection of forest areas that present typical and rare forest communities. They are to be preserved in an appropriate scope which should not be managed at all or only with particular specifications. A network of forest conservation areas with 6 different categories has been set up since 1991 in the State Forest in a self-management commitment among the State Forests.

Additionally, there are legally mandated conservation areas under the National and State Conservation Laws.

81 PERCENT WITH CONSERVATION FUNCTION

Since 1991, the total surface of conservation areas in the State Forest established on a legal basis or conservation areas declared on internal commitment has increased continuously: With an area of 272,000 hectares, today around 81 % of the State Forests are subject to at least one protected area status. The largest shares of area are taken up by Landscape Conservation areas and NATURA 2000-areas. According to national law about 260,000 hectares are protected, according to EU-laws about 82,000 hectares. A special protected area of the State Forests is the National Park Harz with 15,652 hectares of state forest area. In their own responsibility the State Forests have 80,000 hectares declared as LÖWE-forest conservation areas. Many forest areas are associated with multiple conservation functions.

ALDER SWAMP FORESTS ARE HABITATS FOR RARE PLANTS AND ANIMALS

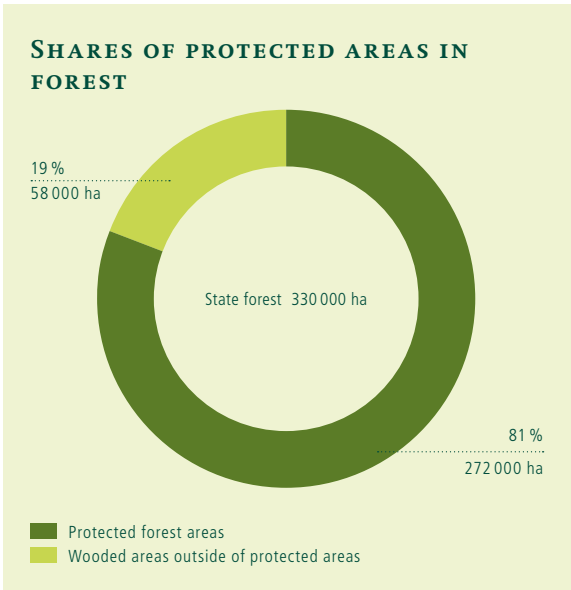


These numbers give impressive testimony that the State Forest takes on essential state duties in habitat and species conservation and fulfils its exemplary functions in Lower Saxony. The conservation areas are, depending on the conservation purpose and status are subject to different objectives and restrictions.

**FOREST CONSERVATION AREAS UNDER OWN MANAGEMENT**

The forest conservation area concept is an integral component of LÖWE. The declared forest conservation areas represent the natural composition of the forests at the suitable typical locations for these forest types. The forest conservation area concept encompasses six different conservation categories:

- 1. **Natural forests** are conservation areas without any harvesting and care measures. They can develop over the whole area according to their own regularities and are scientifically managed by the Northwest German Forest Research Institute in Göttingen, in the State Forest they occupy 4,576 hectares.
- 2. **Natural management forests** constitute, with 60,500 hectares the largest conservation area. Here the State Forests are managed, over the middle and long term, only using tree species from the natural forest communities, that is tree species, which would occur here at the specific location naturally.
- 3. **Shade-intolerant management forests** serve, with their 8,500 hectares, to conserve forest inventories of shade-intolerant tree species such as oak, birch and pine.
- 4. **Cultural-historical management forests** are relics of historical forms of forest exploitation such as mid-forest, lower-forest and wood pasture management. Their area encompasses 450 hectares and extends from differentiated and small-area forest management to preserving heritage varieties of domestic animals.



- 5. **Gene conservation forests** are managed on 4,900 hectares with the objective of preserving the genetic variety of tree and shrub species.
- 6. **Special biotopes and habitats for endangered species** encompass 5,500 hectares in the State Forests. These areas are especially important for conservation of species and biotopes.

**FORESTS SHOULD DEVELOP NATURALLY**

In 2007, the Federal Government committed itself in the framework of the National Biodiversity Strategy to leave 5 % of forest areas in Germany to natural development. The State Government of Lower Saxony intends to implement the national strategy of taking 10 % of the State Forest out of silvicultural management. The State Forests have already achieved 8.6 % as result of successful LÖWE-implementation. Currently the political process is moving toward closing the gap.

**SOVEREIGN CONSERVATION AREAS**

The responsibility of the State Forests for conservation of nature and species has increased considerably since the introduction of LÖWE. Where in 1991 the area devoted to natural conservation in the State Forest was only 17,700 hectares, today that number is 30,400 hectares. The area devoted to nature conservation will increase significantly again with the legal



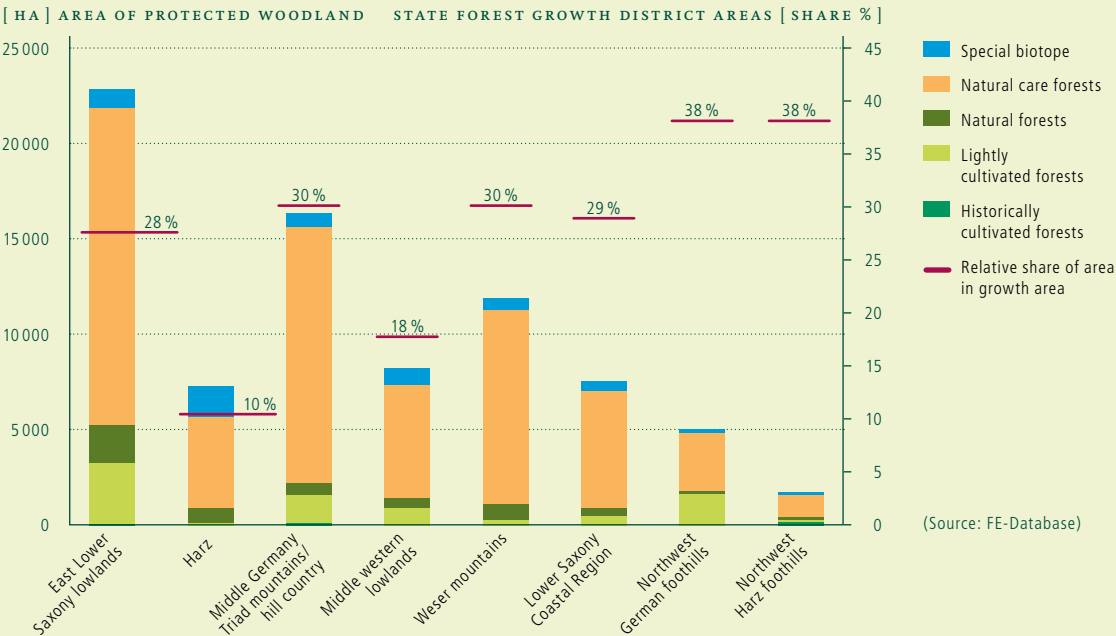
FORESTS FOLLOWING THE COURSE OF STREAMS ARE IMPORTANT BIOTOPES FOR SPECIES DIVERSITY

establishment of the European Flora-Fauna-Habitat-Areas in the coming years. With the Biosphere Reservation of Lower Saxony in Elbtalaue and the National Park Harz, another 21,000 hectares have been placed under protection in the past 25 years. Including the 208,000 hectares of Landscape Conservation areas, 260,000 hectares of the State Forest are under sovereign conservation.

The development of conservation areas underscores the key importance of natural conservation and species preservation in the State Forest for Lower Saxony. When LÖWE was introduced in 1991, the objective was to combine the different social functions of the forest with each other integrally and in balance. Today there is a noticeable movement in the direction of nature conservation and species preservation.

DISTRIBUTION OF PROTECTED FOREST CATEGORIES

Over the different growth districts in the Lower Saxony State Forest:  
Incl. the presentation of the shares of area of the protected forest are as area of the total growth districts





PRINCIPLE 9:

PRESERVATION OF SPECIFIC FOREST FUNCTIONS

*The conservation functions may not be endangered by the recreation function.*

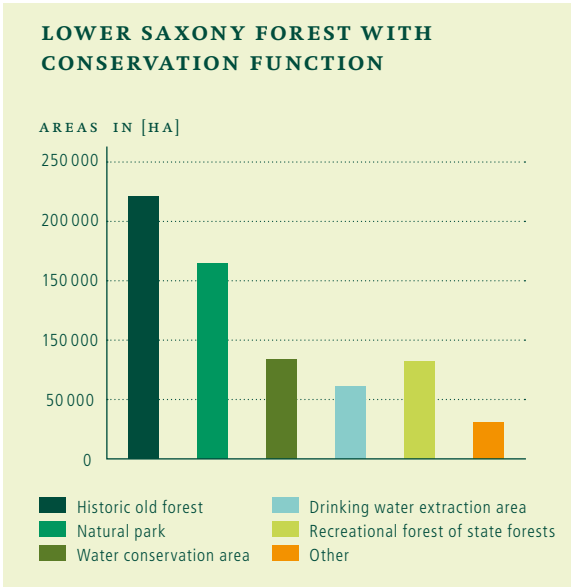
The Forests of Lower Saxony and especially the Lower Saxony State Forest fulfil different functions. Classically speaking the Forests Act summarizes them under the three points of the productive, conservation and recreation function. This covers a broad spectrum of performance for our forests. The LÖWE-programme fosters these functions in a special degree: »To the extent that individual functions of the forest such as water and soil conservation, climate protection, visual aesthetics, emissions mitigation, noise control and biotope conservation as well as the recreation function of the forest with the development of an ecological forest structure cannot be achieved in sufficient degree, the specific function locally emphasized is to be developed specifically.«

CONSERVATION FUNCTIONS HAVE PRECEDENCE

All forest functions are in principle conserved equally through ecological forest management following LÖWE. Should this however not be the case due to location-specific conditions or special social requirements imposed on a specific forest function, this forest will be correspondingly developed and managed. The precondition for the precedence of individual conservation functions are coordinated planning of spatial arrangement, urban development planning, agricultural planning, biotope mapping as well as mapping of forest functions and forest biotopes. The conservation functions have significant influence on the productive and recreation functions.

CLIMATE PROTECTION THROUGH LONG-TERM CARBON SEQUESTRATION

The unpredictable consequences of global warming can only be limited by effective climate protection. This means on the one hand reducing the emission of greenhouse gasses that are harmful to the climate and on the other drawing these gases out of the atmosphere over the long term and sequestering them. The Lower Saxon State Forest fulfils here a sub-task in the overall structure of sustainably managed forests. The forests are the second-most effective terrestrial carbon sinks following moors. In the course of photosynthesis they sequester carbon in living tree biomass (wood, leaves, buds, fruits) and in dead



biomass (needles, leaves, deadwood) as well as in the humus component of the soil. If the wood inventories continue to increase as in the Lower Saxony State Forest, this will produce a carbon sink.

Sustainable forestry can still considerably increase the efficacy of the carbon sink by providing wood for long-term, for example as wood for construction. Carbon is bound up in the wood products and at the same time new wood is re-growing in the forests that also binds carbon. The sink function of wood products is mathematically still multiple times greater in its efficacy for climate protection, if the wood from sustainable forestry replaces materials that would be produced using fossil fuels, such as steel or concrete. This applies to lesser effect to sustainably produced firewood as well, if it replaces heating oil or natural gas. Avoiding carbon dioxide which is harmful to the environment by using sustainable wood products is called the substitution effect.

100 MILLION TONS OF CARBON SEQUESTERED

In 1987, the total supply of sequestered carbon in the living tree biomass in the Lower Saxony State Forest was around 29 million tons of carbon. By 2012, the sequestered amount had increased to around 41 million tons of carbon. If one includes the carbon



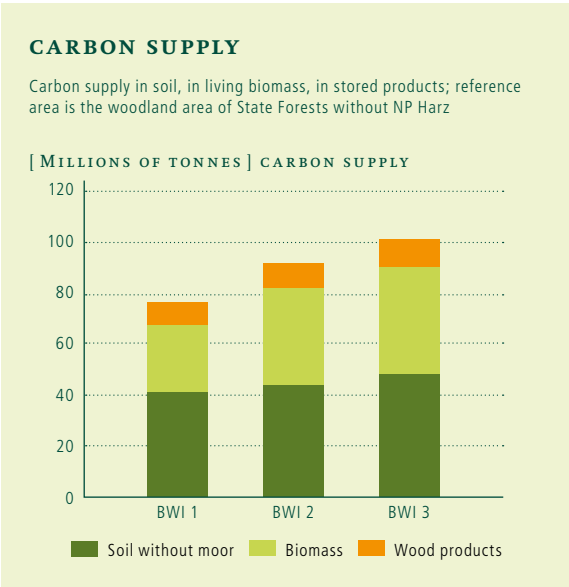
CARBON IS SEQUESTERED IN WOOD PRODUCTS AND DOES NOT GET INTO THE ATMOSPHERE IN THE FORM OF CARBON DIOXIDE

sequestered in the forest soils and in the wood products, the calculated amount of carbon sequestered in the State Forest and in the products produced with its wood increased between the National Forest Inventory 1 and National Forest Inventory 3 from around 76 million tons to around 101 million tons carbon. At the same time around 17 million tons of carbon were avoided in the last 25 years through substitution effects.

FORESTS AS RECREATION AREAS

The State Forest fulfils an important social function as recreation area for the people of Lower Saxony. Here you will find space for everything from classic walking to event sports such as climbing and mountain biking which makes it possible for you to experience nature in different ways. Estimates put the annual number of visits to the state forest at around 250 million.

People need the forest for rest and recreation. In close proximity to cities especially, the forest is an important place where people can regain their inner balance and relax. Quiet relaxation is the main emphasis. The State Forests have 48,000 hectares of recreational forest in two levels of intensity. In Recreation Level I, forest management of the State Forest is mainly governed



by rest and relaxation; in Recreation Level II, it is only influenced by these aims. Overall, there are currently 25,600 hectares, meaning about 8 % of the area of the state forest, assigned to Recreation Level I.

**RESPONSIBILITY FOR OLD FOREST**

The term historical old forests refers to forests with a habitat tradition going back more than 200-years. They are of great ecological significance especially in the history of forests in the lowlands of Lower Saxony. The State Forests assume special responsibility for these old forests with a total area of 221,000 hectares.

**NATURAL PARKS AS DEVELOPMENTAL ELEMENTS IN RURAL SPACES**

The State Forests are involved in many natural parks with a total of around 160,000 hectares area. Natural parks are very expansive areas that are to be developed and managed uniformly and predominantly on the territory of landscape conservation or nature conservation areas. To this degree there are some overlaps with other conservation areas (see Principle 8). The main element is environmentally sound land use with focus on sustainable tourism. Prominent examples are the Solling-Vogler Natural Park, the Elm-LappForest, Münden, Terravita or the Wildeshauser Geest. To sustain the natural parks, the State Forests use their own personnel or financial support.

**GUARANTOR OF CLEAN DRINKING WATER**

Additionally, there are various water conservation areas of different categories on more than 150,000 hectares of the Lower Saxony State Forests. More than half of the Lower Saxony drinking water extraction areas are in the State Forest. When one considers that the share the State Forest makes up of the total area of Lower Saxony is only about 10 %, it become clear, considering the increasing nitrate pollution in ground water below land areas used for agriculture, that the State Forest bears an enormous responsibility for providing high-grade drinking water. For example, the nitrate content in the water from the forested Harz is around 4.4 milligrams per litre, while it is softer above the legal limit of 50 milligrams per litre in the regions of the state under intense agricultural use.

**278 EUROS PER HECTARE AND YEAR**

The »special functions of the forest« described in the LÖWE-programme are all so-called ecosystem functions of the forest. The forest fulfils these multifarious social functions free of charge until now, although a current study by the Thünen-Institute of Hamburg indicates that the social benefits of the forest are paid for in expenses and costs of reduced yields in the amount of 278 Euros per year per hectare.



NUMEROUS RIDING AND HIKING PATHS SECURE THE RECREATIONAL FUNCTION OF THE FOREST



PRINCIPLE 10:

# STRUCTURING AND MANAGING THE EDGES OF THE FOREST

*The forest edges require special care.*

The edges of the forests are transitional zones between the forest and the open landscape or other forest-free biotopes, making them particularly important. With their special micro-climates, they offer an important habitat for many plant and animal species. Their often-linear formation has an important function for the biotope network. At the same time, they act as a seam in the transition to forest conservation. Intact forest edges offer exceptional wind protection to the forest areas behind them.

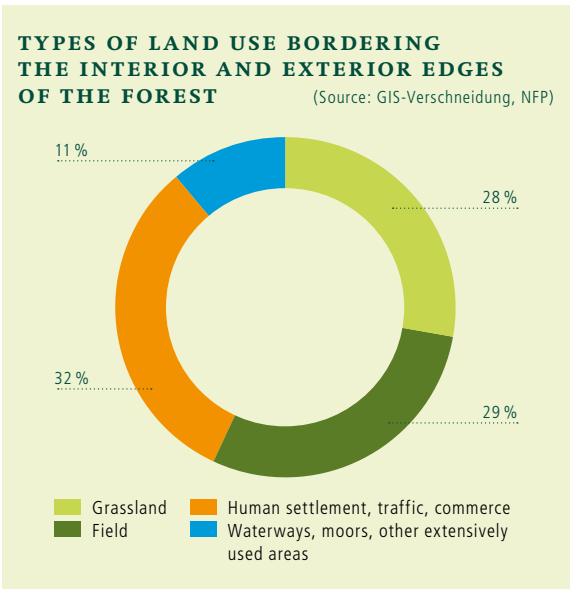
The Lower Saxony State Forests border on areas with other forms of land use over a length of approxi-

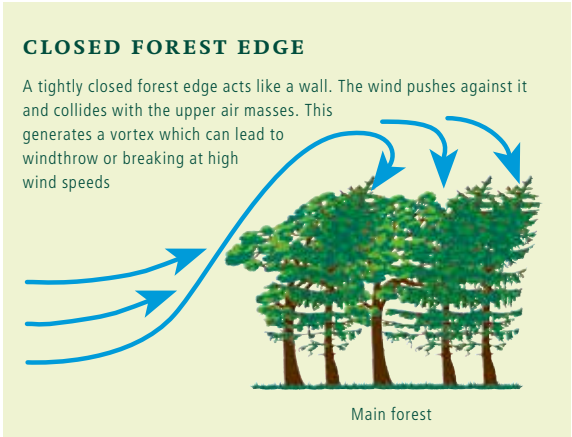
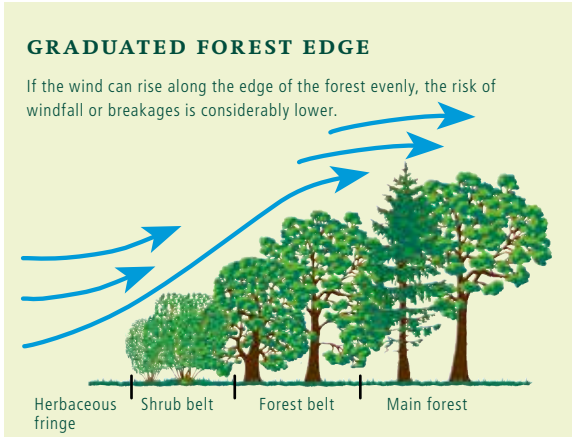
mately 7,700 km. Around 6,200 km of this are forest edges. The approximately 1,400 km of interior edges of forest are mostly found where forests border on grasslands (e.g. wild meadows) or along water courses, moors and other extensively used areas. If one adds all of the lorry-driveable forest paths to the forest edges, the total length of interior forest edges comes to over 15,000 km.

## SPECIAL CARE FOR SENSITIVE FOREST EDGES

In total the Lower Saxony State Forest borders in equal parts on grassland, fields and residential, road traffic or commercial areas. The LÖWE-programme does justice to the special significance of forest edges: »In the course of a consistent development, forest edges require special care.« The care and development of forest edges interacts with the other LÖWE-principles and supports them, for example Principle 5 for improving the forest structure and principle 7 to protect endangered species.

To optimally fulfil the multifarious functions of the forest edges, they must be given sufficient area in which indigenous species of herbs, shrubs and trees grow in the greatest possible variety and with a staged structured as sit approaches the closed forest. If the typical tree and shrub species do not arise through natural rejuvenation, they will be actively introduced along the forest edges.





**TYPICAL TREES AND SHRUBS**

The care of forest edges gives special consideration to characteristic species of herbaceous plants, shrubs and trees that are often less competitive. The areas adjacent to open land or to roads should be reserved for rare tree and shrub species. If the necessary seed trees are absent, they will be actively planted along these forest edges. In the past 25 years, the State Forests have on average planted around 50,000 trees and shrubs per year to share the interior and exterior forest edges.

Around ten percent of the forest edges extend along standing water bodies and flowing water courses. They are very important for the proximity of the water courses to nature. For that reason, tree species foreign to the location will be removed along streams and brooks. This allows adequate light to fall on the

zones along their banks so that a variety of different species of vegetation can grow. The alders growing along the brooks have sufficient room for vital growth again.

**CONFLICTING GOALS THROUGH PROXIMITY**

The edges of the forest are also sensitive areas, as far as cooperation with the various landowners is concerned: Proximity to areas subject to intensive agricultural use often detracts from the function of the forest edges and the forest stands behind them. The negative consequences of direct ammonia emissions are especially strong. Conflicting goals often arises along the edges of forests that border on residential, industrial or infrastructure facilities, conflicts arising from meeting traffic safety and ecological objectives.





PRINCIPLE 11:

ECOLOGICAL  
FOREST  
CONSERVATION

*Use of chemical protection products has been reduced to a minimum.*

Biological forest conservation has precedence over technical measures in the LÖWE-Forest. The use of plant protection products is only possible under very strict criteria. These include situations where they are necessary to avert existential dangers. Application is always preceded by a careful review of the alternatives and risk assessment.

**USE OF CHEMICAL PROTECTION PRODUCTS IS BEING MINIMISED**

The use of plant protection products has decreased significantly in the last 25 years. This is primarily a success achieved by LÖWE itself. Near-natural forest structure with harvesting at exploitable age and rejuvenation under cover has made it possible to

avoid great upheavals in the woods of the State Forests. Likewise, the structured deciduous and mixed coniferous forests are now much more stable and less susceptible to harmful organisms.

Moreover, forest conservation has been technically improved: Numerous new biological procedures and methods were developed. Additionally, a modern web portal for forest conservation has been established with the Northwest German Forest Research Institute. Reliable prognoses for forest management are generated from the great wealth of information and data so that foresters can detect dangers as early as possible and fight them with appropriate measures.

TOTALLY DESTROYED PLANTS BY OPEROPHTERA BRUMATA





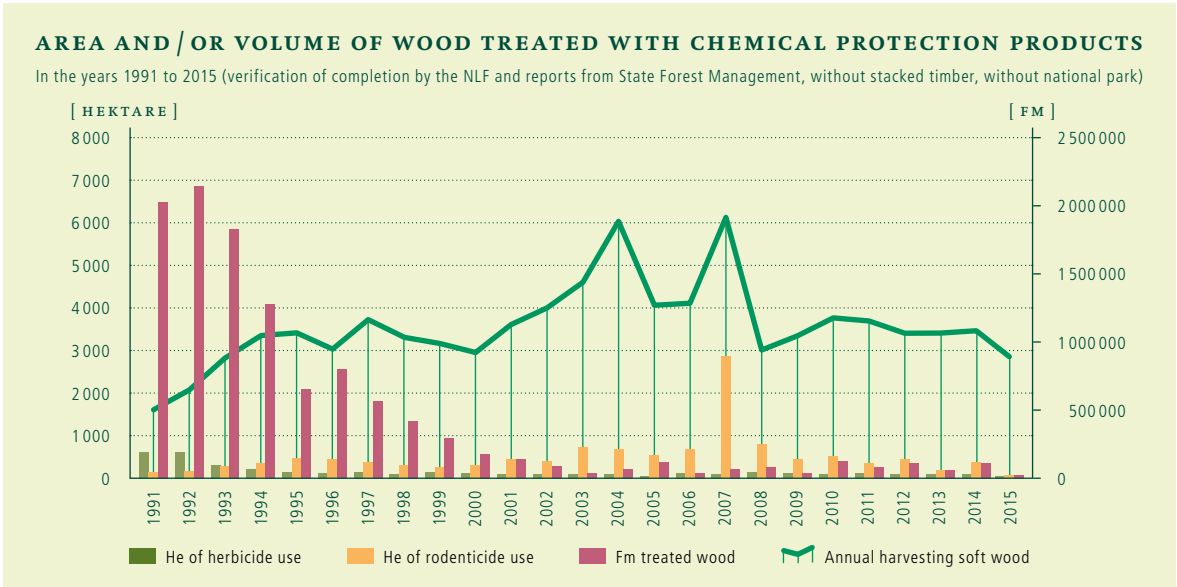
BARK BEETLES ARE CAPABLE OF DESTROYING LARGE SECTIONS OF FOREST

CLIMATE CHANGE GENERATES NEW PROBLEMS

The progressive, long-term ecological development of the forest will further reduce potential hazards from abiotic (storm and fire) and biotic (insects and fungi) in the State Forest. Nevertheless, existential threats remain possible in the future. This is true especially in light of advancing climate change, which on the one hand exposes the forests to increasing stress from storms and drought and on the other from massive growth and spread of biological pests such as fungi and insects that benefit from it. A part of the growing risks associated with climate change can be counter-

acted by correct selection of tree species and through stabilising forest stocks in the framework of ecological forest conservation.

With changes in the climate we also find ourselves confronted with the migration of new, in some cases very threatening species into the State Forest. Currently ash dieback, caused by a miniscule fungus, is spreading and will likely kill a majority of our ash trees. A near-natural forest is not indestructible and requires efficient ecological forest conservation, which does not exclude the use of chemical protection products in especially threatening situations.







THE POPULATION OF HOOFED GAME MUST BE REDUCED TO A SIZE COMPATABLE WITH THE ECOSYSTEM THROUGH INCREASED HUNTING.

hoofed game can become a limiting factor to forest stability. Wildlife populations that are compatible with a stable ecosystem are thus a necessary precondition for the successful implementation of all other principles for forest management in the LÖWE-programme. Only in this way can structured and species-rich deciduous and coniferous mixed forests develop and be maintained. Targeted hunting is the key for adapted wildlife populations in the woods of the State Forests. Wildlife is undoubtedly part of the symbiotic community in the State Forest, but wildlife may not hinder the achievement of the LÖWE-objectives.

### ECONOMIC LOSSES

Excessive stocks of wildlife do not just constitute an ecological risk because they suppress the development of a species-rich and stable mixed forests but also because they constantly cause economic losses: The available variety of wood types is reduced through grazing and browsing of selected tree species by wildlife. If the natural mixture disappears or rejuvenation does not occur, artificial intervention in the ecosystem becomes necessary in the form of planting, and that rapidly becomes expensive.



HIGH POPULATIONS OF FALLOW DEER AND RED DEER ENDANGER THE LÖWE-FOREST

At present, the high populations of red and fallow deer are endangering the deciduous trees planted by LÖWE in the massive spruce and pine forests of the Harz, Solling, Elbe-Weser and Heide through their bark stripping and browsing. This negative development of recent years can also be seen in the results of inventories of the State Forests. The current assessment of damage from bark stripping for the Harz and Solling has identified major new bark stripping in many places, reaching as much as 20 % in some areas (every 5th tree).

Damage from browsing has also increased markedly. The browsing assessment completed in 2015 confirmed that only about one half of the State Forest evinces a wildlife-forest-relationship that conforms to the LÖWE-programme. In the other half, forest rejuvenation is in a stressed or in some cases extreme situation.

### **DAMAGE FROM WILD ANIMALS IS EXPENSIVE**

In the State Forests, measures taken to protect against wild animals generate considerable costs. The annual expenditures for building fences extending up to 100 kilometres are in the range of 1.5 million Euros and for protective measures for individual trees up to 330,000 Euros. Damage from bark stripping in Harz and Solling lies based on a reference area of 30,000 hectares at an annual 4.3 million Euros. When wild animal population density is not controlled, long-term major asset losses and negative ecological developments are the results.

### **HUNTING MUST BE CONSTANTLY ADAPTED**

The hoofed game populations must be thinned back to a size compatible with the ecosystem through increased hunting. This is the key to successful implementation of long-term ecological forest development in the State Forest.



### PRINCIPLE 13:

# ECOLOGICALLY COMPATIBLE USE OF FORESTRY TECHNOLOGY

*Forestry technology must be aligned with ecological requirements.*

Forestry technology is also indispensable in near-natural forest management. The requirements for its use are clearly defined in the LÖWE-programme: Forestry technology must be aligned with the ecological requirements. Procedures are to be used that conserve the forest soils, forest stocks and preserve their structure and diversity of species.

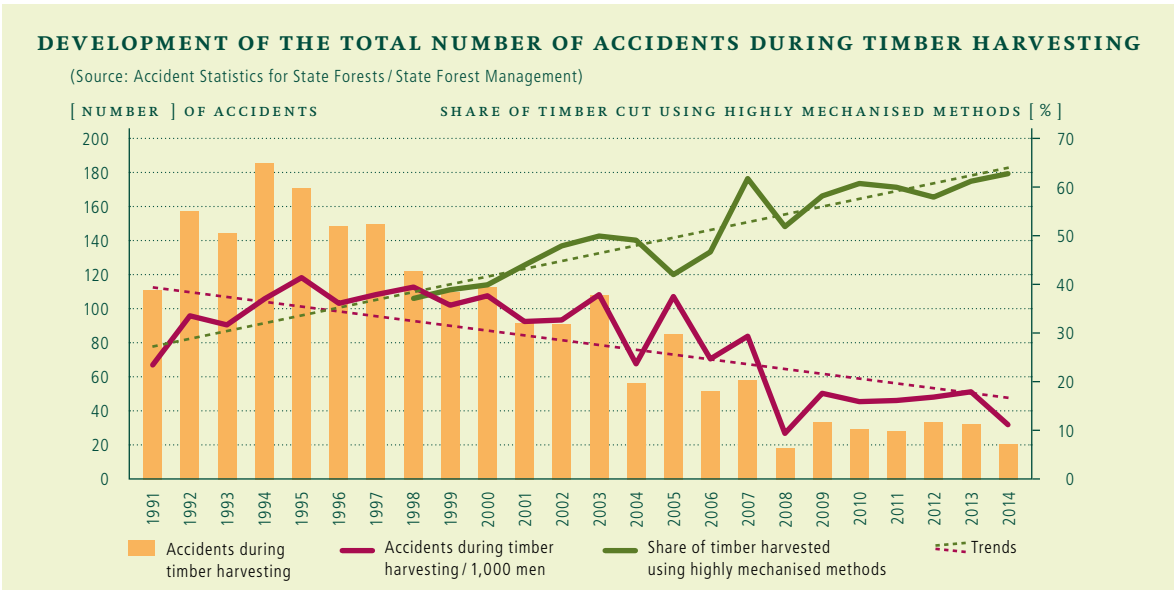
### TECHNOLOGICAL PROGRESS

In the last two decades, forestry technology has developed rapidly. The resulting changes and opportunities have been strategically and gradually used

by the State Forests, in order to reach the structural objectives in forestry anchored in LÖWE taking economic aspects into account as well while at the same time conserving soils and forest stocks and increasing occupational safety.

Modern forestry technology, managed by our qualified employees and contractors, provides, with planting, management and timber harvesting, makes sure that the State Forest develops in the direction prescribed by the LÖWE-Programme. Moreover, forestry technology made a significant contribution





to improving occupational health and safety for our employees. Severe workplace accidents during timber harvesting have declined considerably in the last 20 years with the increasing use of forestry technology.

**SOIL CONSERVATION IS STRONGLY EMPHASIZED**

Since the introduction of LÖWE, timber harvesting machines have travelled exclusively on the skid trails which are built with a distance of at least 20 metres from each other. Strict compliance with this is an important component of assuring soil conservation. Vehicle access is therefore restricted to less than 20 % of the forest area. Here there will undoubtedly be soil compaction, but the areas in the deeper soil zones are still penetrable by tree roots. In particularly sensitive areas, the space between the skid trails is increased and, as required by LÖWE, other technologies such as sky cranes and logging horses are used. Based on the location maps, sensitive locations in the State Forest are classified and the soil conservation bulletin then defines the operational stipulations for driving on them.

**CONSTANT OPTIMISATION IN THE NETWORK**

The use of forestry technology requires specialised knowledge that is preserved in the machine and equipment bases for timber harvesting and for forest development. There is tight cooperation between our experts and partners from research, industry and corporations, to the end of constantly refining timber harvesting machines and trying out even more conservation-friendly harvest procedures.

**ROUTE-INFORMATION SYSTEM FOR GREATER SAFETY**

The State Forests have reacted to increasing challenges in timber logistics and environmental conservation along with the increasing demands in the areas of accident prevention and emergency rescue with the introduction of new route information system. On this basis the existing route network is optimised and expanded as needed. This also benefits forest visitors in their recreational activities and is very important in identifying rescue points when emergencies occur.

# For all these reasons: LÖWE!

The programme for long-term ecological forest development (LÖWE) initiated in 1991 for the State Forest has, in the last 25 years, proven to be a trail-blazing and socially accepted strategy. With LÖWE it was possible to resolve the tensions between the economy and ecology. LÖWE has been supported by all of the political parties of the State Parliament of Lower Saxony for 25 years.

## 13 PRINCIPLES FOR SUCCESS

The results of LÖWE are readily apparent in the State Forest and have noticeably changed its appearance in the last two decades. But the journey we have begun toward a structurally rich and nearly natural forest is far from over – there are still many decades and great challenges ahead of us.

The State Forests annually produce approximately two million cubic meters of raw timber sustainably and while remaining nearly natural. We have been able to considerably reduce the production risks, significantly increase the conservation impact and clearly improve its recreational value. In the past 25 years we

have been able to build on existing forest structures and experiences in forest management, refine them and integrate new social demands, research results and new technologies in managing the State Forest. This was only possible through the terrific dedication and hard work of our employees who identified the LÖWE-programme from the very start.

## CAUTIOUS ADAPTATION FOR ECOLOGICAL AND MULTIFUNCTIONAL FOREST MANAGEMENT

Changed ecological, economically mixed and socio-economically mixed limiting conditions have been taken up in the past through well-adjusted updates to and adaptations of the LÖWE-programme and have assured its acceptance inside and outside of the State Forest. This cautious adaptation will continue in the future and advance successful ecological forest development. »LÖWE-Forestry« in the Lower Saxony State Forest is and remains an ecologically sound and sustainable form of land use, which does justice to the demand for multifunctional forest management in a particular way.





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