



focus **paper**

Lenzing Group
Biodiversity and ecosystems
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Table of Contents:

.....	1
Introduction	3
Lenzing's impacts and dependencies on biodiversity	5
Lenzing's actions	7
Ecosystems: Forests are more than raw materials for production	10
Biodiversity management in Lenzing's supply chain	11
Plantation forestry	11
Management in LD Celulose's plantation.....	11
Biodiversity in European semi-natural forests.....	15
Supporting forest and biodiversity conservation beyond Lenzing's supply chain.....	20
Forestry and climate change.....	24
„Transform“: Stakeholder activities.....	24
CDP Forests.....	24
Austrian State Forest (Österreichische Bundesforste, ÖBf)	24
Textile Exchange (TE) Biodiversity Benchmark.....	25
Wood K plus.....	25
Index of Figures:	26
Index of Tables:	26
References and Endnotes:	26

In the 2021 double materiality analysis of the Lenzing Group, the topic of biodiversity increased in importance and became a material topic. Therefore, from 2021 onwards, the Sustainability Reports of the Lenzing Group contain the dedicated chapter “Biodiversity and ecosystems”. Please refer for yearly updates there.

Introduction

Biodiversity was defined in a recent report by IPCC (Intergovernmental Panel on Climate Change) and IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services)¹ as “the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part”. Biodiversity is visible on all levels of life, as genetic diversity within and between species, as the abundance of individuals of one species and as the abundance of species in ecosystems. The higher the diversity, the higher is the resilience of a system to outside pressures, for example, diseases² or disturbances associated with climate change³. We are in the middle of an immense biodiversity crisis, the sixth mass extinction, which could cause that up to three-quarters of the today’s living species would go extinct in the next 300 years. The last mass extinction, which occurred 65.5 million years ago, wiped out the dinosaurs^{4,5}. Although mass extinctions occur naturally, the one we are experiencing now is fueled and accelerated by human interference, for example, deforestation, conversion of land and water and air pollution. Biodiversity loss and climate change are strongly connected, which is why taking action is of utmost importance for humanity. While healthy ecosystems and a high level of biodiversity can mitigate climate change and lead to a “good quality of life” for humans due to their ecosystem services, they are under threat by human impacts and climate change⁶ (see Fig. 1).

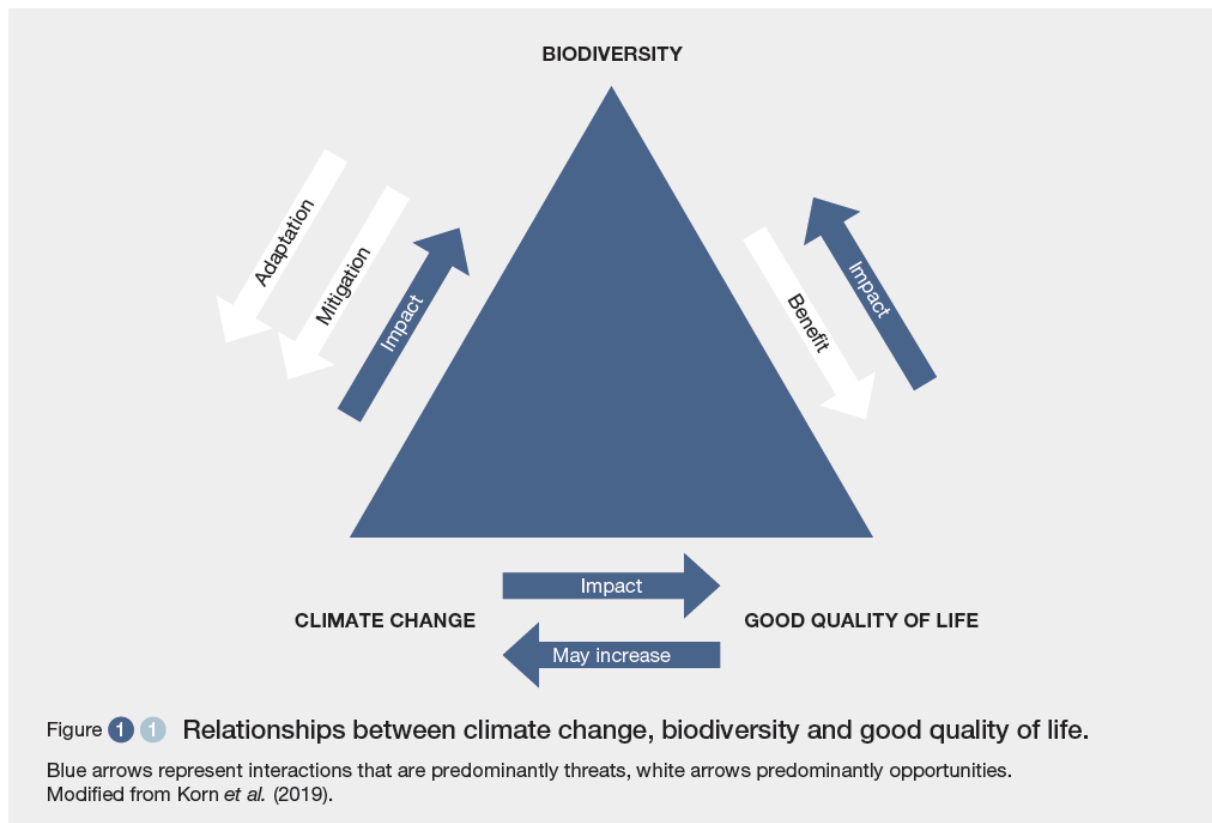


Figure 1: Relationship between Biodiversity, Climate Change and Good Quality of Life. Taken from: IPBES-IPCC 2021: Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change

Global biodiversity loss has recently moved into the focus of the sustainability debate in many industries, including the textile and nonwoven sector. The World Economic Forum identifies nature loss as one of the top three systemic risks to the economy, people, and planet. Numerous initiatives have been established to address this issue, while others have adopted work streams dedicated to biodiversity.

According to the IPBES, pressures on nature leading to loss of biodiversity and ecosystem functions are categorized into five groups (IPBES 2019⁷ cited after Science Based Targets for Nature (SBTN) 2020⁸):

1. Land / water / sea use change
2. Resource exploitation
3. Climate change
4. Pollution
5. Invasive species

Economists have been trying to express ecosystem services in monetary values, the benefits that are provided range from food to resources and tourism. It has been estimated that these benefits amounted to USD 125 – 140 trillion in 2011 (Costanza et al. 2014⁹). Damaging or losing just one ecosystem service could therefore lead to an immense economical loss to local and global economies.

Between 1997 and 2011, the world lost an estimated USD 4-20 trillion per year in ecosystem services due to land-cover change and USD 6-11 trillion per year due to land degradation. Specifically, biodiversity loss can result in reduced crop yields and fish catches, increased economic losses from flooding and other disasters, and the loss of potential new sources of medicine (as the majority of drugs used for healthcare and disease prevention are derived from biodiversity) (OECD 2019¹⁰).

Restoring already damaged ecosystems can also be a lucrative investment, apart from the social values leading to monetary benefits far outweighing the initial costs¹⁰. Some estimated values of selected biodiversity and ecosystem services can be found in table 1:

Table 1: Examples for estimated values of selected biodiversity and ecosystem services (Taken from¹¹: Swiss Re Institute Biodiversity and Ecosystem Services – A business case for re/insurance, 2020)

Scale	Good or service	Estimated annual values
Global	Seagrass nutrient cycling	USD 1.9 trillion
Global	Value of animal pollinated crops	USD 235 – 577 billion
Global	First sale of fisheries and aquaculture	USD 362 billion
Global	Coral reef tourism	USD 36 billion
Europe	Services from the European protected areas network (Natura 2000)	EUR 223-314 billion
Canada	Value of commercial landings from marine and freshwater fisheries	CAD 3.4 billion
France	Recreational benefits of forest ecosystems	EUR 8.5 billion
Germany	Direct and indirect income from recreational fishing	EUR 6.4 billion
Italy	Habitat provision	EUR 13.5 billion
Japan	Water purification from tidal flats and marshes	JPY 674 billion
UK	Physical and mental health benefits of nature	GBP 2 billion

US	Air purification from trees and forests (avoided morbidity and mortality)	USD 6.8 billion
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In the context of global biodiversity loss, the textile and apparel industry has recently become more aware of its contribution to this problem^{12,13}. The focus is on the agricultural production of natural fibers and pollution issues related to fiber production and textile processing, although wood sourcing from forests is also seen as a potential cause of biodiversity loss. Products have potential impacts at the end of their life due to waste pollution in land and water ecosystems, especially via non-biodegradable materials that are leaked into the environment.

Lenzing's impacts and dependencies on biodiversity

To address its impacts and dependencies on biodiversity, Lenzing is utilizing the framework proposed by the Science Based Targets for Nature initiative (SBTNi). In its Initial Guidance for Business (2020)⁸ it describes a five –step process: Assess, Interpret & prioritize, Measure, set [targets] disclose, Act, Track.



Figure 2: Framework by SBTNi for setting targets related to biodiversity

Steps 1 and 2: Assessment and prioritization

Lenzing as a leading cellulose fiber manufacturer is focusing on three areas: its wood and pulp sourcing, production processes, and products' end of use, in order to address biodiversity loss.

Wood is the most important raw material for Lenzing. The main source of potential impact from the Lenzing Group's operations and supply chain is therefore connected to land use by forestry. Lenzing also mainly depends on biodiversity and the proper functioning of forest ecosystems that provide the raw material of wood. Negative effects on biodiversity can arise from the intensified utilization of forests. On the other hand, the positive effects of sustainable forest management on biodiversity and ecosystems are well known and can be further explored and implemented (see feasibility study "Biodiversity initiative Lenzing AG", p.20 in this focus paper).

Additional potential impacts on water, soil, and air can arise from production facility emissions. At the end of the value chain of textile and nonwoven products, biodiversity impacts can arise from non-degradable plastics entering the environment.

Lenzing is highly depended on healthy forests and plantations as these are the source for its most important raw material wood. At the same time for wood-based cellulose fibers, the main potential negative impact on biodiversity can arise from the intensified use of wood resources, which at the moment are mostly forest or plantations.

The Lenzing Group uses two different types of forestry for its wood sourcing, depending on the global region: sustainable and multi-functional forest management is applied in the Northern hemisphere by Lenzing's wood and pulp suppliers in Europe and North America. Plantation forestry with high sustainability standards is conducted mainly in the Southern hemisphere by Lenzing's pulp supplier in South Africa and by the new pulp plant in Brazil.

Biodiversity and ecosystem status monitoring in the Lenzing Group are performed in the global regions via two different approaches.

In Europe, biodiversity is monitored at a national level according to the Forest Europe Criteria. Results are published regularly in the European overview^{14,15}. Recent reports paint a mixed picture of success and issues still to be resolved. The measures to be taken are better understood thanks to intensive research activities.

For the Brazil operations, a long-standing monitoring program on plantation level is conducted by Lenzing's joint venture partner Dexco (formerly Duratex), which began in the 1970s with the establishment of its first plantations. LD Celulose, the joint venture and Lenzing's Brazilian legal entity, continues this program at its managed plantations. Data is gathered every six months to cover seasonal variations, and is reported annually.

Pulp suppliers apply their own biodiversity monitoring schemes.

Steps 3 and 4: Measurement, target setting, disclosure and Actions

Attempts to quantify impacts from land use on biodiversity usually consist of two components: the quantity of land (forest) area used, and the intensity of use. The estimation of land area used for Lenzing's wood sourcing is part of the initiated "Biodiversity concept" project and of the pilot case studies for testing the new Greenhouse Gas Protocol draft guidance on Land Sector and Removals. Variations in data availability and data quality can arise depending on the forest type, the land ownership, the sourcing area and the supply chain position (wood or pulp sourcing to Lenzing).

Quantity of forest area used for Lenzing's wood sourcing: data availability and quality

Table 2

Lenzing sources	Forest type	Land use intensity	Data/estimates	(Expected) data quality
Wood	Plantation	High	Known (see "Quantitative description of area managed and influenced by LD Celulose", Table 4)	High
Wood	Semi-natural	Low to medium	Estimates needed based on regional statistical data	Medium
Pulp (pulp supplier sources wood)	Plantation	High	Estimates possible	Medium
Pulp (pulp supplier sources wood)	Semi-natural	Low to medium	Rough estimates	Low

To respond to the pressures on nature by taking positive action, the Science Based Targets for Nature initiative introduced the Action Framework with five key types of actions: "Avoid – Reduce – Restore and

Regenerate – Transform”. This scheme was also adopted by the Textile Exchange Biodiversity Benchmark. The main steps for taking action (step 4) of this framework are:



Framework of actions for nature, from SBTN (2020)^a

Table 2

Avoid
Prevent impact from happening in the first place: prevent the impact entirely
Reduce
Minimize impacts, but without necessarily eliminating them
Restore
Initiate or accelerate the recovery of an ecosystem with respect to its health, integrity, and sustainability, with a focus on permanent changes in its state
Regenerate
Take measures designed to increase the biophysical function and/or ecological productivity of an ecosystem or its components within existing land uses, often with a focus on a few of nature's specific contributions to people (e.g. regenerative agriculture often focuses on carbon sequestration, food production, and nitrogen and phosphorus retention)
Transform
Take measures contributing to system-wide change, notably to alter the drivers of nature loss, e.g. through technological, economic, institutional, and social factors and changes in underlying values and behaviors

a) Science-based targets for nature. Initial guidance for businesses. 2020

Lenzing's actions

For Lenzing, several targets have been derived from the Sustainability strategy and the Better Growth corporate strategy, containing elements that positively influence biodiversity and ecosystem services or nature's contributions to people. For more information on these targets and the progress made in 2022, please see the latest Sustainability Report.

SBTN's framework for action and Lenzing's approach

Table 3

Category of action	Reference	Lenzing's approach
Avoid	Wood and Pulp Policy	Lenzing explicitly commits to avoiding deforestation in the procurement criteria of the Wood and Pulp Policy
Reduce	Sustainability Target 2	To offer viscose, modal and lyocell staple fibers with up to 50 percent post-consumer recycled content on a commercial scale by 2025
Restore	Sustainability Target 6	To implement a conservation solution of 20 ha in Albania in combination with a social impact project by 2024
	Sustainability Target 7	To implement conservation solutions on 15,000 ha at the new pulp site in Indianópolis (Brazil) by 2030
Regenerate & Transform	Sustainability Target 8	To engage in further conservation, biodiversity protection, and restoration activities in regions where forests are at risk or should be improved by 2025

Avoid: Biodiversity due diligence via sustainable sourcing

The Lenzing Group takes responsibility by focusing on sustainable sourcing. Lenzing only sources wood and dissolving wood pulp from semi-natural forests and plantations (as defined by the Food and Agriculture Organization of the United Nations). Moreover, it does not source materials from natural or ancient and endangered forests.

In order to protect the earth's remaining ancient and endangered forests as well as the biodiversity and ecosystems' integrity within these forests, Lenzing is committed to avoiding the use of wood and pulp containing wood sourced from regions such as the Canadian and Russian Boreal Forests, Coastal Temperate Rainforests, tropical forests and peatlands of Indonesia, the Amazon and West Africa.

Lenzing's wood procurement management system ensures that all wood is sourced from legal and sustainably managed sources. The forest certificates held by the Lenzing Group cover general criteria for biodiversity and forest ecosystem protection according to international standards. Additional criteria can be found in the national standards which vary between countries. For example, the percentage of area set aside for conservation varies between countries and even regions within countries.

Regular risk assessments, audits, on-site visits, and independent third-party certification of sustainable forest management programs ensure compliance with the policy and Lenzing's commitment to no-deforestation.

For more information on Lenzing's wood sourcing practices and policies, please see the "[Raw material security](#)" chapter of the latest Sustainability Report or the "[Wood and Pulp](#)" Focus paper.

Reduce: Lowering emissions to air and water, and biogenic resource use

Thanks to its climate strategy and science-based targets in line with the Paris Agreement and UN SDG 13, Lenzing is on the road to reducing CO₂ emissions. For more details, see the "[Climate & energy](#)" chapter. In accordance with the strategic focus area "Greening the value chain", the Lenzing Group has targets and programs in place to reduce emissions affecting water and air. For example, closed loop water and chemical cycles are implemented. Lenzing follows the Changing Markets roadmap for the manmade fibers industry. All sites have been assessed through the ZDHC¹⁶ scheme. For more information on emissions to air and water, please see the chapter "[Sustainable innovations](#)" in the latest Sustainability Report or the "[Responsible Production](#)" focus paper.

Furthermore, Lenzing has set the target to produce fibers with 50 % recycled cotton content until 2025, which would reduce the need for virgin materials from agricultural or forest resources. For more information on recycling, please see the "[Circularity and resources](#)" chapter in the latest Sustainability Report.

Restore: Enhance ecosystem quality in managed forests

Sustainably managed semi-natural forests in Europe and other parts of the Northern hemisphere are multifunctional in the way that they provide not just timber but also many ecosystem services such as water regulation or protection against natural disasters, while maintaining biodiversity at the same time. The Lenzing site (Austria) mainly uses beech wood and small amounts of other hardwoods and spruce, whereas the Paskov plant (Czech Republic) mainly utilizes spruce. The percentage of broadleaf forest, especially beech, is increasing in wood-sourcing countries as forests are being returned to a more natural mix of tree species, contributing to climate change resilience. The area devoted to spruce cultivation is decreasing, although stocks are still increasing in most sourcing countries due to low felling rates. The utilization of beech wood to manufacture fibers provides relatively high value creation versus wood use for energy generation, making it an important economic factor for the regeneration of forests with more deciduous (= leaf-loosing) species. Adapting forest ecosystems in Central Europe to climate change through greater species diversity is a crucial transition and is in line with the EU Biodiversity Strategy.

Regenerate:

Lenzing is contributing to conservation and afforestation projects in endangered areas outside of its value chain. These include an afforestation project in Albania, recently expanded to several countries in the Western Balkans, and a conservation project in Congo. For more information on these and other commitments, please see the below part “Supporting forest and biodiversity conservation beyond Lenzing’s supply chain”.

Transform: Partnering for systemic change

Lenzing is part of several initiatives dedicated to fight biodiversity loss and negative impacts of the fashion industry. For more information on stakeholders, please see the [“Stakeholder”](#) focus paper and/or the chapter “Transform: Stakeholder activities” below.

Ecosystems: Forests are more than raw materials for production

Forests provide much more than just raw materials for production. Apart from their beauty and recreational value, they fulfill a multitude of environmental functions and are essential for climate regulation. People benefit from ecosystem (goods and) services. Not all benefits of ecosystems to people can be measured in monetary terms. It is therefore important to include other values as well, such as health, social or conservation values. The sustainable management of forests ensures that the different ecosystem services provided are maintained and protected while a steady supply of material for the wood-based industry is ensured. This is the core element of foresters' job description and an important part of their training.

Figure 3 provides an overview of the functions of forest ecosystems associated with the provisioning of wood. Depending on the location and environment, some systems might be more important than others in one forest.

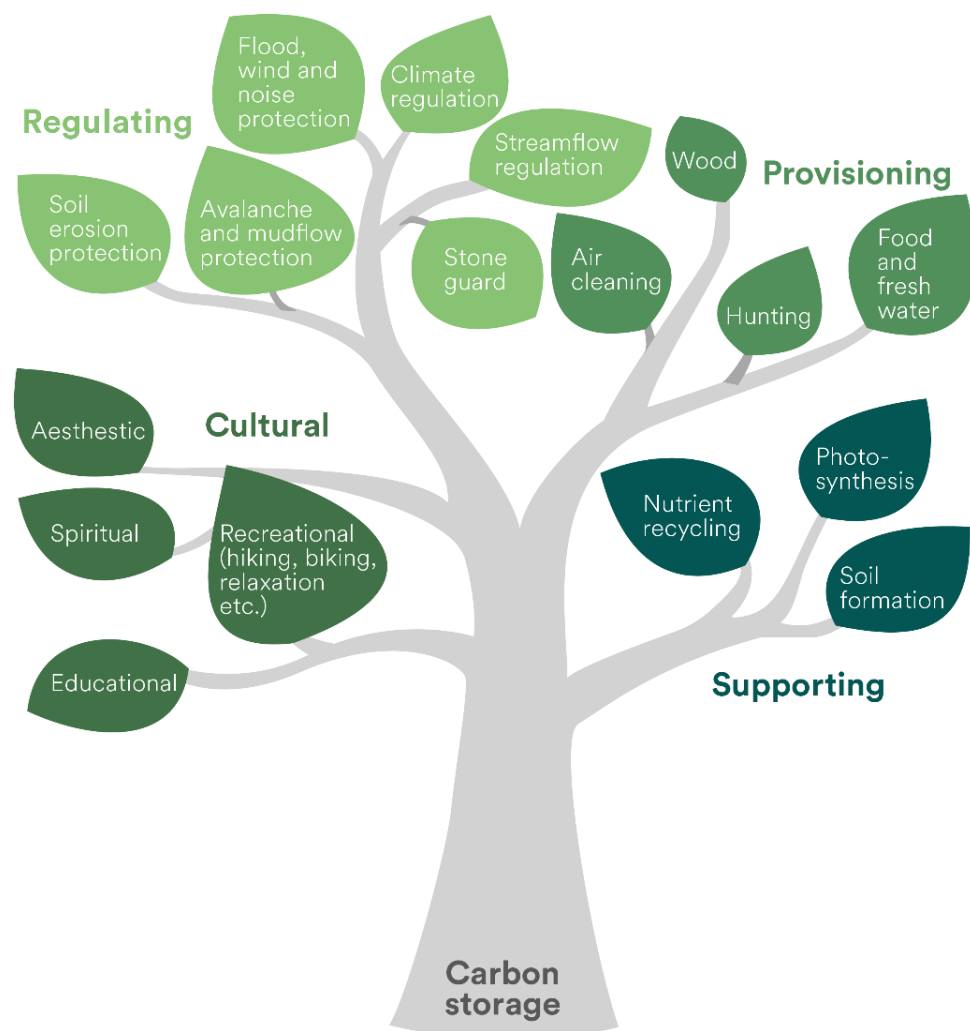


Figure 3: Functions of forest ecosystems, adapted from Lambini et al. 2019¹⁷ and WRI 2005.¹⁸

The concept of ecosystem services is increasingly used to describe the links between the natural environment, e.g. forests, economic activities, and society. Natural forests offer a big potential for

biodiversity among many areas of life, such as insects, mammals, plants and bacteria. By protecting natural forests (especially primeval forests), all these species can be conserved.

Planting trees is one of the most appropriate and proven measures for limiting global warming, as trees are highly efficient in capturing carbon from the atmosphere and storing it for a long time. At the same time, forests can have a cooling effect, which can be measured on a global scale¹⁹. The utilization of forest products to replace fossil-based products with higher greenhouse gas emissions can be used as a further measure to limit global warming. Wood will be a core resource for the developing bioeconomy. On the other hand, greater utilization of wood resources can lead to unwanted negative effects on biodiversity.

Biodiversity management in Lenzing's supply chain

The Lenzing Group addresses its impacts and dependencies on biodiversity through regionally adapted approaches of sustainable forest management. In the Northern hemisphere, Lenzing's wood and pulp suppliers manage semi-natural, multifunctional forests in Europe and North America. Plantation forestry is conducted mainly in the Southern hemisphere by Lenzing's pulp suppliers e.g. Sappi in South Africa and by the new in-house operations in Brazil (LD Celulose).

Plantation forestry

In total, some 80 percent of the land used for plantation forestry in South Africa, is certified to FSC® standards. The focus is on two natural ecosystems: grasslands and wetlands. Both are included in conservation and regeneration programs run by plantation operators on their own and/or managed land²⁰. Approximately 25 percent of this land is not planted with trees but conserved for biodiversity²¹. Plantation forestry can reduce deforestation pressure on natural (primary) forest areas by providing wood at very high yields per unit area as an alternative to sourcing it from natural forests. FSC® certification entails management criteria to protect biodiversity²², as determined in detail in the national standards. For this certification, among other requirements, management practices include a proportion of 20 % of reserved conservation areas.

Management in LD Celulose's plantation

Lenzing constructed a new pulp mill in Brazil in a joint venture with Dexco (formerly Duratex), which started operation in 2022. The pulp mill is supplied by wood from plantations, which are owned and managed under this joint venture (LD Celulose). The whole area of the plantation is currently 78,640 hectares, which include 17,065 hectares of protected area (Table 4). Eucalyptus is grown in these plantations since it is a fast growing and high-yielding species with a high cellulose content, making the trees very suitable for conversion to fibers. Every 7 years the trees are harvested, and a new generation of eucalyptus can grow. For each harvested tree, a new one is planted. In areas, where the tree yield was very good, it is possible to regrow the trees from stumps (so called second rotation). LD Celulose does not use genetically modified organisms (GMOs).

Quantitative description of areas managed and influenced by LD Celulose

Table 4

	2020		2021		2022	
	ha	%	ha	%	ha	%
Total area	66,101	100	71,631	100	78,640	100
Forest/plantation area	50,325	76	54,081	75	58,194	74
Owned	–		–		–	
Leased/managed	50,325	76	54,081	75	58,194	74
Protected	13,153	20	14,623	20	17,065	22
FSC® area	43,835	66	43,835	61	47,608	60
Infrastructure	2,623		2,927		3,380	4



Fig. 4 A: Eucalyptus plantation (Source: LD Celulose) (B) Replanting of Eucalyptus trees (Source: LD Celulose)

LD Celulose's plantations are in areas that were converted to agriculture many decades ago. There are generally large areas nearby for planting soy and coffee or grazing livestock. Some areas under LD Celulose's management are determined for the Legal Reserve and Permanent Preservation Areas, as the law requires. The conservation unit closest to the LD Celulose planting area is Páú Furado State Park, which is about 30 kilometers from the plantation. That means this particular conservation unit is not impacted by LD Celulose's activities. The managed land contains a proportion of conservation area dedicated to biodiversity protection that goes beyond the legal requirements and FSC® standards. The managed area belongs to the Cerrado biome (vast ecoregion of tropical savanna in eastern Brazil) and is located around 800 kilometers away from the Amazon region (see Fig. 5).

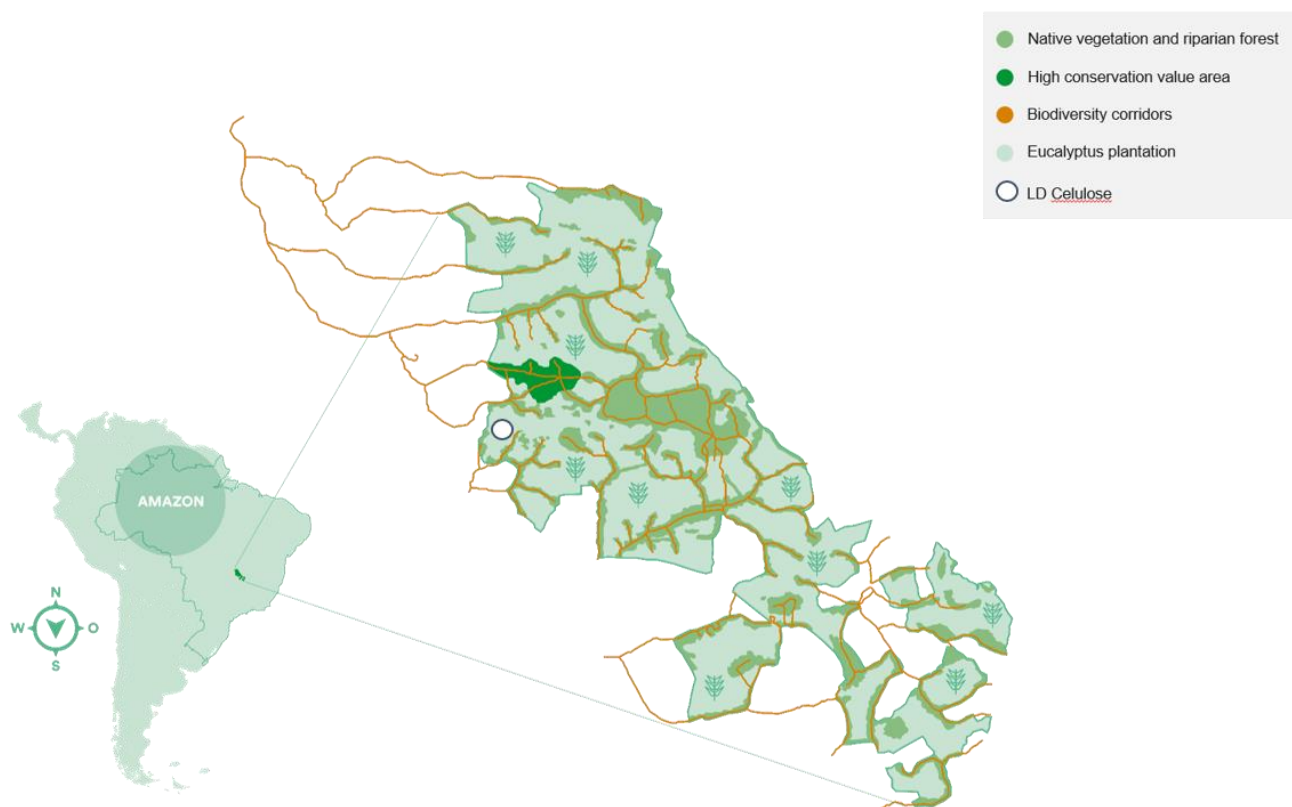


Figure 5: Map of plantations own and managed by LD Celulose in Brazil

Brazilian environmental law determines the maintenance of Permanent Preservation Areas (APPs) and Legal Reserve areas. APPs are specific areas of vegetation such as ciliary forests, areas of vegetation adjacent to watercourses, and areas of vegetation on slopes. Legal Reserve areas correspond to the obligation to preserve at least 20 % of a property in a rural area (Table 7). The APPs are very useful in avoiding, for example, the silting of rivers and the collapse of slopes, while the Legal Reserve guarantees the preservation of the native vegetation of Brazilian biomes (biome = large ecological zone). More information on the main aspects of the Brazilian Forestry Code (Law No. 12.651 of 2012), including the challenges Brazil faces in applying this important law, is available in a report from 2016 by Observatório do Código Florestal (OCF)²³.

LD Celulose is aware of the diversity of flora and fauna found in its forest areas, since the 1970s when Dexco (formerly: Duratex) started its biodiversity research projects. Biodiversity research projects are undertaken in these areas through partnerships with universities²⁴ in addition to internal programs. LD Celulose monitors fauna and flora in the forest areas and areas directly influenced by the pulp mill site. These programs are carried out annually in the dry and rainy seasons and aim to monitor possible impacts on local biodiversity. The programs are also required by the Brazilian environmental agency. There have been no significant impacts on biodiversity to date.



Figure 6: *Pseudopaludicola facureae* (Source: LD Celulose)

LD Celulose's forestry unit is supervised by ecology and environmental specialists who were also responsible for identifying a High Conservation Value Area (HCVA) in the plantation area in 2021. These contain *Pseudopaludicola facureae*, a species of frog found only in this region of Minas Gerais (Fig. 6). However, this frog was not observed in the annual fauna monitoring in 2022. Nonetheless, the area is still considered an HCVA as the monitoring process spans over 2 years. The forestry unit constantly works to identify any area that needs to be classified as HCVA to ensure the protection of animal and plant species. One method of monitoring is the use of cameras. With the help of these cameras, LD Celulose was able to identify the presence of endangered species, such as the maned wolf and giant anteater (Fig. 7). Approximately 450 different species of fauna and 204 species of flora were identified on the plantations.



Figure 7 A+B: Maned Wolf (A) and Giant Anteater (B) captured on camera within LD Celulose's plantations. (Source: LD Celulose)

In the responsible management practiced by LD Celulose, techniques are employed that aim to protect biodiversity as well as soil and water quality. Examples of these measures are:

- **Minimum cultivation:** for soil conservation, LD Celulose uses the minimum cultivation technique, which consists of keeping the remaining plant material at the harvest site to form layers of soil protection and ensure the cycling of nutrients.
- **Nutritional recommendation:** LD Celulose performs soil analyses to determine the requisite fertilizer recommendation for maintaining soil fertility.
- **Preservation and monitoring of riparian forests:** LD Celulose also monitors and protects the riparian forest within the plantation area. The trees and other vegetation along the river act as a guard that protects the river water by keeping the soil in place. This is extremely important for the animals living here and the people in surrounding areas who need clean water.
- **Connectivity:** To improve the connectivity of the Permanent Preservation Areas and legal reserves, LD Celulose carries out mosaic planting, establishing ecological corridors that aim to connect fragments of native forest. These corridors are strips of natural vegetation without planting or harvesting of trees (Fig. 8). Biodiversity corridors can ensure that individuals of a different population within one species can mate, in order to maintain or increase genetic diversity. This measure is a voluntary activity beyond the legal or certification-related requirements.



Figure 8: Biodiversity corridor and plantation area. In the picture, on the left: forest plantation; on the right: legal reserve with native vegetation

Biodiversity in European semi-natural forests

The Lenzing Group's pulp mills in Europe source more than 90% of their wood in four countries, in Austria, the Czech Republic, Slovakia, and Germany.

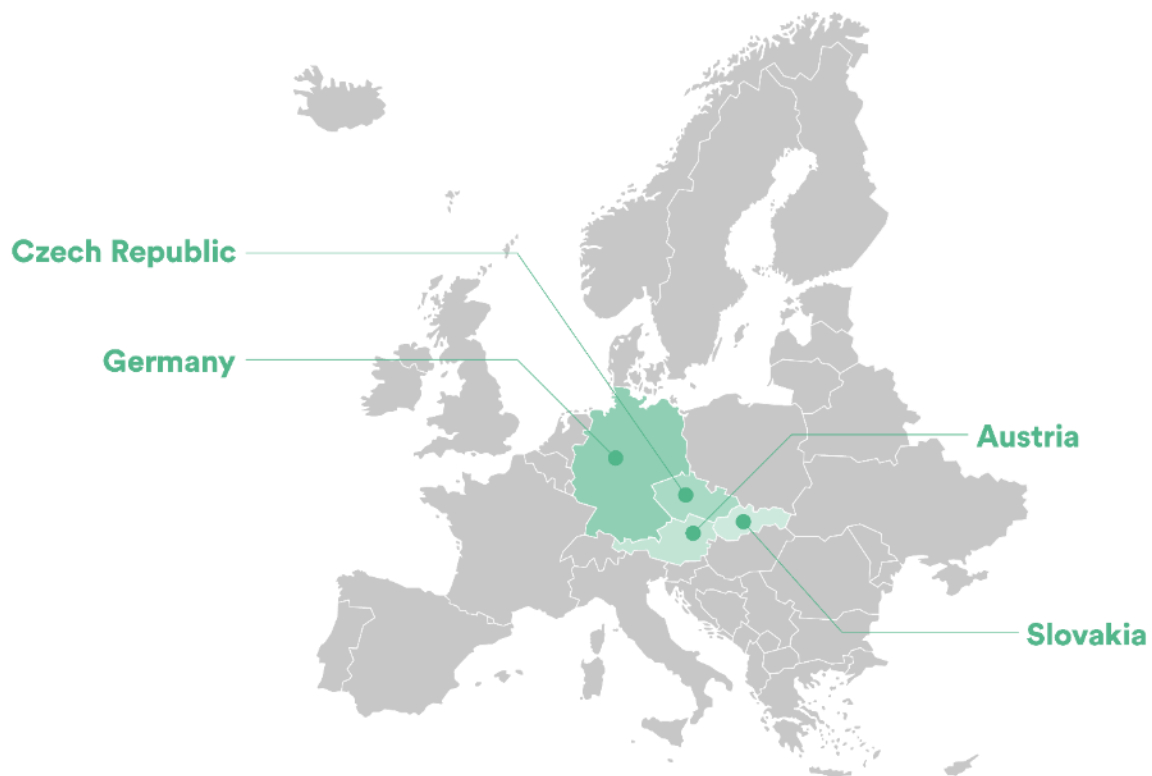


Fig 9: Main wood sourcing countries in Europe (for complete list see the [Sustainability Report 2022](#))

For semi-natural forests in Central Europe, forestry laws have been implemented since the 19th century in order to balance the demand for wood sourcing with nature conservation and the ecosystem services provided by forests. This approach has been at the core of a forester's job description and an important part of the corresponding training for a long time.

As an overarching political process for the European Union and beyond, the Forest Europe political process was initiated in 1990 by the Ministerial Conference on the Protection of Forests in Europe, which is comprised of 46 states, to promote sustainable forest management in Europe. A set of indicators grouped into six different criteria was developed to measure the sustainability performance of European forests and set targets for improvement. Current efforts focus on climate change adaption, water protection and biodiversity. As a major buyer of wood in Europe, the Lenzing Group supports these targets, which aim to ensure the continued and improved function of forests in their ecosystems while maintaining the long-term availability of wood as a raw material. Requirements for intensified biodiversity measures will likely come out of the European Union Biodiversity Strategy and Forestry Strategy in the process of development. Lenzing contributed to the Open Consultation on the Forest Strategy in 2021.

Publications on biodiversity in managed versus unmanaged forests in Europe, and the effects of some national strategies have been reviewed in the scientific literature of recent years. The level of species richness varied in the comparisons depending on the region and taxonomic group, but differences were rather small.

The study by Paillet et al.²⁵, a comprehensive review of 49 papers (meta-analysis) on species richness comparing the differences between managed and unmanaged forests in Europe is probably the main authority on this issue. The main conclusion is "a small, marginally significant effect of forest management on total species richness. Species richness tended to be higher in unmanaged than in managed forests (+6.8 percent), but the response varied widely among taxonomic groups." (page 108). In the region of Thuringia in Germany, the formal records on species richness date back 250 years²⁶. There, biodiversity has shown to be higher in managed forests than unmanaged forests. For endangered

species with special habitat requirements, protection measures other than non-management are required. The beech forests in Thuringia (Thüringer Wald) are an important sourcing region for Lenzing.

Another study describes the beneficial impacts of sustainable forest management on biodiversity in Northern Germany²⁷. The report documents the high biodiversity in managed forests and shows that biodiversity has already improved as a result of Germany's national strategy (established in 2007) for multi-functional forestry and towards more natural forest ecosystems.

The EU's biodiversity strategy for 2030 published in May 2020¹ is a long-term plan to protect nature and reverse ecosystem degradation, preparing Europe for future threads such as climate change, forest fires, food insecurity and disease outbreaks. Its action strategy contemplates 16 targets and other transformative changes¹, which include, among others:

- Establishing a larger EU-wide network of protected areas on land (30%) and at sea (30%)
- Launching an EU nature restoration plan, which will also impact farmland management, for example, promoting agro-ecological practices as reduction of pesticides and fertilizers.
- Unlocking funding (20 billion EUR/year) for biodiversity and setting in motion a new governance framework, in the form of the LIFE program¹ or Horizon Europe¹
- Putting the EU in a leading position in addressing the global biodiversity crisis

Interreg Europe names in its most recent Policy Brief "*Preserving and Restoring Biodiversity*" a few successful examples, recommendations, and key learnings on this regard happening under the EU Biodiversity Strategy 2030²⁸, mentioning relevant projects related to pollinators, light pollution, afforestation, sustainable forestry, protection and restoration.

For its pulp mills in Europe, Lenzing sources more than 90% of its wood in four countries, Austria, the Czech Republic, Slovakia, and Germany. Table 5 gives an overview of some basic indicators of forest sustainability and nature protection in these countries.

Table 5: Selected forest indicators for the four main sourcing countries of Lenzing's pulp mills in Europe

Country	Austria	Germany	Czech Republic	Slovakia	Source
Share of forest area (%)	47 %	32 %	34 %	39 %	FAO-FRA 2020: according to national statistics, Austria has 48%
Forest area in 2020 (1000 ha)	3,899	11,419	2,677	1,926	FAO-FRA 2020
Forest area increase (1990-2020) (%)	3.3 %	1.8 %	1.1 %	1.3 %	FAO- FRA 2020
Certified forest area PEFC+FSC® (% , 2019)	75 %	78 %	69 %	67 %	PEFC Global statistics; Slovakia: FRA 2020

Forest area with some kind of special protection	approx. 25 %	approx. 80 %	approx. 30 %	approx. 40 %	Forest Europe 2020 ²⁹ , Austria: Walddialog 2020 ^{Fehler! Textmarke nicht definiert.}
Growing stock increase (1990-2020) (%)	26%	30%	27%	34%	Forest Europe 2020 ³⁰

In Austria, forest biodiversity is monitored according to a Biodiversity Index (Geburek et al. 2015³¹), which originates from 2004, when the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) initiated a project to develop suitable indicators to describe the condition and trends of biodiversity in Austria. This initiative (MOBI-e – Monitoring, Biodiversity, and Development) was expected to identify important indicators for all land, river and lake habitats, in order to make a long-term contribution - after the establishment of a monitoring system - to reporting obligations amongst other things³².

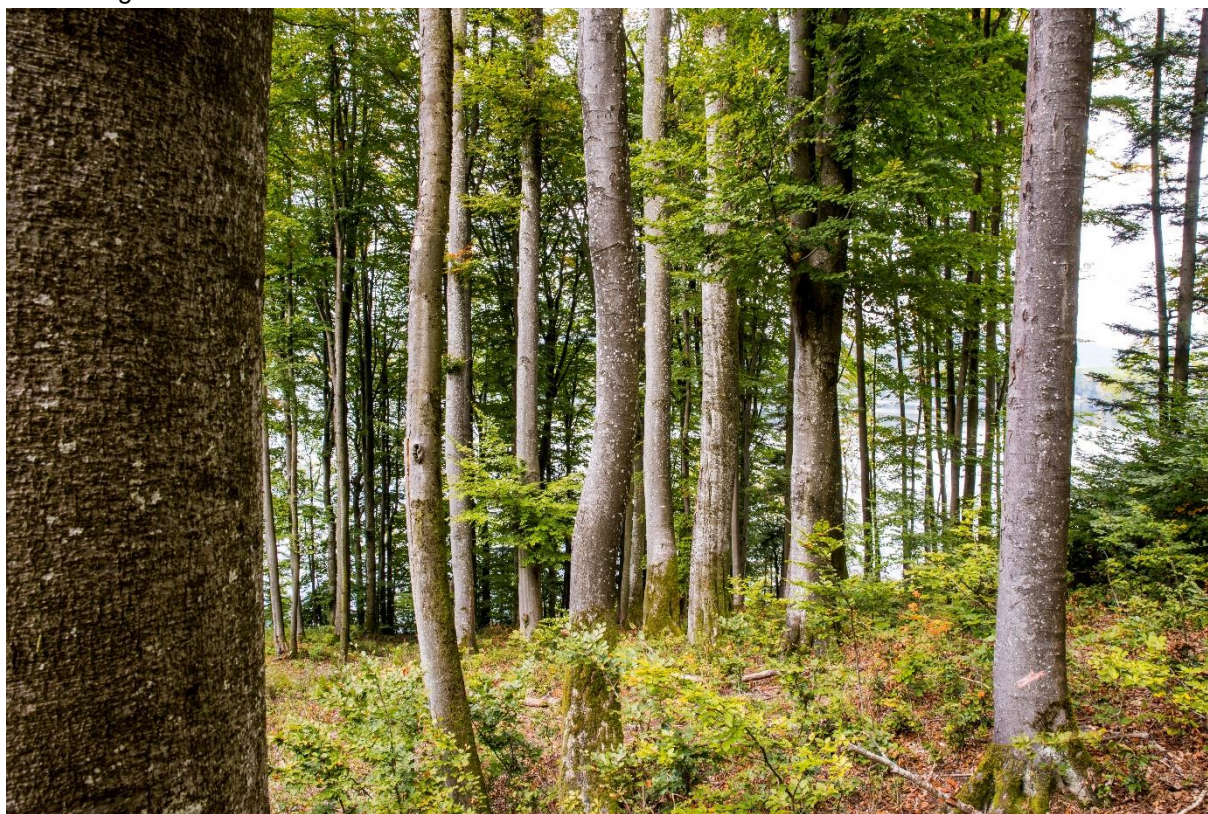


Figure 10: Beech forest in Central Europe

For semi-natural forests in Central Europe, forestry laws have long since prioritized biodiversity protection in forest management. In Austria, forest biodiversity is monitored according to a Biodiversity Index and will be further regulated according to the governmental biodiversity strategy. An increase in the proportion of protected and strictly protected areas is expected.

Lenzing and some of its biggest wood suppliers invest in voluntary biodiversity-related projects, where Lenzing cooperates with competent partners, nature conservation organizations, etc. However, biodiversity projects are complex, and even the protection or restoration of small areas can be very resource-intensive. Lenzing, thus started the intensive search for potential projects a few years ago.

Some of those projects are already in the execution stage or finalized. New initiatives will be consolidated over the medium-term.

Here are some of the activities to improve biodiversity in semi-natural forests from which Lenzing sources its wood:

- A biodiversity island is a small forest area without forest management, i.e. no timber harvest, etc. These islands serve as steppingstones for animal or bird species throughout the commercial forest because they are home to very old and huge trees with cavities for small mammals, such as martens or dormice, birds, such as owls or woodpeckers, and bats. Forest islands are a voluntary activity of forest managers like Österreichische Bundesforste AG. Our wood supplier's main approach, however, is to ensure a high level of species diversity in commercially used forests, as well.
- Standing and lying dead wood is a valuable habitat for fungi and lichens
- Moist biotopes are a hot spot of biodiversity. Amphibians such as salamanders, frogs or toads depend on those habitats for reproduction. When our wood supplier repairs its forest roads and has a digger handy, it often creates artificial moist biotopes for those amphibian species
- Diverse hedges on the fringe of the forest are valuable habitats for birds, insects and small mammals, such as the hazel dormouse, which benefits from the flowers of bushes in spring, from the berries and nuts in autumn, and from branches as a hiding place throughout the year. These structures often occur naturally, but sometimes our wood supplier assist nature and plants bushes and small trees where the forest meets meadows or farmland (the key is to choose the right plant species).



Figure 11: Standing and lying dead wood is a valuable habitat for fungi and lichens (Photo provided by Österreichische Bundesforste AG)

Specifically for the Lenzing supply from Austrian beech forests, Lenzing commissioned a feasibility study with Umweltdachverband, an Austrian umbrella organization of environmental NGOs. Umweltdachverband studied the possibilities to connect Lenzing's wood sourcing with activities for protecting biodiversity, especially endangered species, in managed beech forests in Austria. The case study has concluded that there are numerous species living in managed beech forests in Austria, among them also red-list species, which have adapted themselves to the management practices. Others are species of the open land, which have found habitat in managed forests. Therefore reversing these semi-natural forests to completely natural forests (stopping all management) could potentially harm these species (see box below).

Feasibility study “Biodiversity initiative Lenzing AG”: Key messages by Umweltdachverband in summary (shortened)

Challenges for humanity – protecting biodiversity and the climate

The two greatest global environmental challenges of our time are climate change and the loss of biodiversity. Biodiversity or biological diversity encompasses all species and organisational levels of living organisms, their genetic diversity, the diversity of ecosystems (habitats) and the processes at work in these systems. It not only forms an important basis for human life, but is also the foundation for numerous economic sectors. Companies depend on species and ecosystems in many ways. In order to maintain the ecosystem services provided free of charge by nature in the long term, the sustainable use of natural resources is of utmost importance.

Tropical rainforests – the lungs of the earth

Tropical rainforests are hotspots of biodiversity and are among the most species-rich ecosystems on our planet. However, unlike European forests these fascinating megadiversity centres are low in nutrients. They store high amounts of CO₂, yet, they are increasingly endangered by various human activities, such as deforestation or slash-and-burn practices. Rainforests obtain their nutrients mainly from dying plant remains of the rainforest and not from the soil, as this is washed out of nutrients due to intensive rainfall. If the rainforest is cleared, no nutrients can be replenished from the soil, making reforestation much more difficult. Therefore, a further deforestation in tropical regions must be avoided. As a consequence, forestry in these regions relies on intensely managed plantations, which are planted on agricultural land (segregative approach).

Forests of Central Europe

These forests are by nature comparatively species-poor as a result of the displacement of tree species in the course of the ice ages. Nutrient-rich soils allow sustainable use over centuries. Well over 100 forest biotope types prevail, all of which harbour characteristic fauna and flora. Beech forest types play an important role in this. Intensive use of forests (short rotation periods, pure stands etc.) leads to the endangerment of species. So-called Red Lists include on the one hand relict species of primeval forests, such as wood-dwelling beetles and certain lichen species, and on the other hand species of sparse or economically used forests. Many of these species have adapted to managed cultivated landscapes over many centuries and are often tied to moist or dry specific sites.

What does this mean for European nature conservation?

In the light of European efforts to promote the bioeconomy, it is indispensable to think about and consider biodiversity in forestry management. In order to maintain diversity in the forests in the long term, a combination model of segregation and integration should be aimed for. The EU Biodiversity Strategy and the EU Forest Strategy envisage precisely such a combination model: 30 % of the country's land area is to be placed under effective protection and 10 % under strict protection. The 10 % target includes, for example, virgin forests and near-to virgin forests as well as forests with high

nature conservation value, such as national parks, wilderness areas and natural forest reserves. These are not to be used economically (segregative approach).

What does this mean for the beech forests?

Austria is still home to original primeval beech forests and stands close to primeval forests, most of which are already under strict protection, for example, in the Kalkalpen National Park, in the Dürrenstein-Lassingtal Wilderness Area and in the core zone of the Wienerwald Biosphere Reserve. These beech forests with a high proportion of old trees, standing as well as lying deadwood offer an ideal habitat for many endangered animal and plant species. There are sufficient natural tree cavities in which cavity-nesting birds, bats and many other creatures find breeding space and shelter. The number of animal species in beech forests is estimated at up to 10,000. Only some of the Red List species can be secured in strict protected areas. Therefore, biodiversity measures are also needed in managed forests (integrative approach). For this purpose, PEFC partner organisations in Austria define regionally coordinated biodiversity targets.

How can Lenzing AG contribute to the preservation of biodiversity?

Lenzing has identified biodiversity as a material topic and starts to assess its dependencies and impacts in a learning phase, in order to define targets and implement specific actions. Lenzing can support best practices adopted by suppliers. A best practice example is ÖBf AG's Ecological Landscape Management, an initiative for more biodiversity in the forest in the sense of integrated ecological forestry. A variety of nature conservation measures are implemented: from deadwood management and bird protection measures to wild bee protection and support measures for amphibians.

How can Lenzing AG communicate this biodiversity commitment?

Biodiversity has not yet found its way into the communication of wood products. Yet the topic offers a wealth of emotional stories, messages and images that could be used to communicate the value of forest biodiversity in an extremely promising way. The connection between biodiversity, sustainable forest management and the natural product wood-based fiber for a good life could be shown.

Lenzing AG's commitment to biodiversity means that the company is not only a supplier of sustainable fibers for clothing and nonwovens, but also an active environmental and nature conservationist. Without biodiversity, we as humans lack the natural basis for life – Lenzing contributes to protecting and preserving valuable and healthy natural environments. In addition, Lenzing fulfils a responsible educational mandate to communicate the value of biodiversity and to link it to the value of wood-based, renewable materials.

Supporting forest and biodiversity conservation beyond Lenzing's supply chain

As a consequence of our understanding of greater responsibility and leadership, to bring positive change beyond the own supply chain or sphere of direct influence. In addition to activities related to its own supply chain, Lenzing supports conservation solutions in other regions outside its own sourcing areas.

Lenzing provided **advocacy to support political leaders** in the protection of forests, specifically the ancient and endangered forests in Canada (Broadback Forest Quebec, Vancouver Island) and Indonesia (Leuser Ecosystem). For the UN Conference of Parties on Biodiversity #15 in 2022, Lenzing supported the letter of "World's MMCF Producers Call on the Convention of Biological Diversity to support conserving at least 30% of the world's forests by 2030".

With the NGO **One Tree Planted**, Lenzing supported the "Earth Day Campaign" 2019, including the restoration of the Yosemite National Park in California, USA. With the support of this initiative not only the land was restored, but also the wildlife habitat was positively impacted. In 2020, some 10,000 trees were planted. In 2021, 33,025 trees were planted, mainly in California and Colorado, as well as in Haiti. In 2022, around 1,000 trees were planted. This amounts to a total of around 60,000 trees since 2019 that have been planted with the support of Lenzing.

Albania is one of the countries in Europe with the greatest need for improvement in its forest areas. New forest management approaches were recently implemented by the government to address environmental problems and fulfil the current needs of society with respect to the sustainable use of natural resources. Lenzing together with the Austrian Development Agency (ADA) implemented a project in Albania, in which Lenzing wants to afforest 20 hectares with the help of the local community. The project is scheduled to run for five years until the end of 2024. It aims to support the development of rural areas in Albania in the broader region of Shkoder (Ana e Malit) and Diber (Peshkopi) by using natural resources sustainably and fostering alternative income sources for communities.

Achievements in 2022:

- In the course of the reforestation measures, almost 20,000 trees have now been planted, covering 12 hectares of afforestation area with the cooperation of around 180 members of the local Forest and Pasture Users Association. The survival rate of the seedlings, in the newly established tree nursery at the Eco Social Farm close to the reforestation area, is between 85 percent and 90 percent. This has been a great success in establishing the afforestation activities as an example of good practice to be replicated in the region. In the tree nursery tree seedlings are protected until they are tall enough to be planted in the forest area.
- More than 150 local forest workers were trained on forest management in 2022, fire prevention and safety, reaching more than 400 forest workers during the course of the project. All training sessions were conducted under Covid-19 safety regulations. **By providing these trainings, the management of almost 100,000 hectares of forest area in Albania could be positively influenced.** The workshops have helped not only to improve the forest management, but also reduce the risks of forest fires – which is a constitute challenge in the region – and the risk of injuries for forest workers could be reduced.
- The student number at the Shkodra Forestry School has increased due to improved IT infrastructure and marketing materials / publicity events.

- A round table on “Innovative Partnerships for Sustainable Forest Management” took place in June 2022 in Tirana, involving the Albanian vice minister for Tourism and Environment, the Austrian ambassador and stakeholders and experts in forestry. Scientific studies about sustainable forest management in the area were presented, which were conducted in conjunction with the University of Tirana.

In 2022, the project scope was extended to the whole catchment region of the Drin River in Albania, Montenegro, Kosovo, and North Macedonia, in the project “Integrated Forest Management along the transboundary Drin River Basin. Sustainable forestry as a nature-based solution for water and ecosystem management put into practice in the Western Balkans.” The project is funded by the Austrian Development Agency, but enabled through a donation from Lenzing.

The rainforests in the **Congo** basin are the second largest tropical rainforests area and home to numerous wildlife species including bonobos, chimpanzees and forest elephants. Lenzing supported the Mai Ndombe REDD+ project to contribute to the protection of these globally important forests with a charitable donation in 2022. It takes the approach to improve the livelihood of the local communities through new opportunities for income, which has a positive effect on the protection of forests and ecosystem as well as biodiversity. The project supports the protection of 300,000 hectares at the west side of the Mai Ndombe Lake in DR Congo, which is part of the world’s second largest rainforest and home to numerous wildlife species. The area is threatened by deforestation through legal and illegal logging.



Fig. 12 : Mai Ndombe Lake (Photography by Filip Agoo on behalf of Everland)

The project uses carbon revenues to prevent logging contracts from being renewed in the area and creates alternative livelihoods for the local communities. This enables the forest and wildlife to regenerate, which will promote biodiversity. To further advance the community’s self-determined development, trainings and demonstrations about sustainable (fish) farming are held to improve food

security while also conserving natural resources. Lenzing's contribution was directed towards restoring the fish stocks and the environmental health of Lake Mai Ndombe.

For more information on these projects, see the chapter "[Biodiversity & ecosystems](#)" of the [Sustainability Report 2022](#) or the [Focus Paper "Social Responsibility"](#).

Forestry and climate change

Forests play a vital role in climate change mitigation. Sustainable forest management aims to balance the interest in material production with biodiversity and climate aspects. For the interconnections between Lenzing's forestry matters and climate change, see the Focus Paper "Wood and Pulp".

„Transform“: Stakeholder activities

CDP Forests

The Lenzing Group contributed to the Carbon Disclosure Project (CDP) in the areas of Climate and Forests for the first time in 2020. It received a double "A" score for tackling climate change and acting to protect forests. In 2021, Lenzing added the area Water and received a triple "A" rating, among only 14 companies worldwide. The same rating was achieved in 2022 among 12 companies. Only 16 companies worldwide have an "A" rating for forests in 2020. 24 in 2021, and 25 in 2022. Through its significant demonstrable actions in these areas, Lenzing has taken a leading position in corporate environmental ambition, action, and transparency. In 2021 for the first time, Lenzing reported on its activities in Brazil. The efforts to ensure legal compliance and to ensure that activities (e.g. leasing of new areas for plantations) do not contribute to deforestation in Brazil were examined. Transition risks were included and published in the risk reporting. Data was collected and it was extensively reported on the activities in Brazil, ensuring a share of certified or controlled wood input greater than 99 percent. The CDP forest score confirms that the production of Lenzing's wood-based cellulosic fibers does not contribute to deforestation - through a combination of a stringent wood sourcing policy, forest certification and a dedicated collaboration with the CanopyStyle initiative.

Austrian Federal Forests (Österreichische Bundesforste, ÖBf)

As the Lenzing site pulp mill obtains more than 35 percent of its wood from Austrian forests, the state of Austria's forests is especially important for the sourcing situation. In Austria, forest biodiversity is monitored regularly according to a Biodiversity Index³³. Recent outcomes are reported in the "Indicators of sustainable forest management 2020"³⁴ from the multi-stakeholder organization "Walddialog", as a contribution to the Forest Europe indicators and targets process. Biodiversity in Austrian forests will be the focus of the upcoming governmental biodiversity strategy from 2020 onwards. As a consequence, an increase in the shares of protected and strictly protected areas is expected. For example, every type of forest defined by ecological science is going to be represented in natural forest protected areas ("Naturwaldreservate").

One important wood supplier to the Lenzing site (Austria) is the state-owned company Österreichische Bundesforste (ÖBf AG, Austrian Federal Forests). Managing 10 percent of the national territory and 15 percent of Austria's woodland, ÖBf is the largest ecosystem manager, forest managing company and owner of hunting and fishing licenses. Sustainability forms the guiding principle for all ÖBf activities. The ÖBf team for ecological landscape management is developing individual nature conservation plans for each of the 120 ÖBf-forest units in addition to the existing forest management plans³⁵. These include specific measures to protect endangered species and increase biodiversity under local conditions, which are integrated into daily forest management work. Furthermore, ÖBf is also cooperating with the NGO umbrella organization Umweltdachverband, for example, in the project "Biodiversity and multifunctional management in forests". This pilot project has established practical, regionalized guidance for science-based biodiversity and ecosystem regeneration^{36,37} in an important wood sourcing region for Lenzing, the PEFC region 6 located in Styria and Carinthia, Austria. The outcome³⁸ provides guidance for targeted measures to protect rare ecosystems and red-list species in the course of the management operations in productive forests. It is used in all ÖBf forest management units, and is offered to all forest owners in the region for voluntary use. Lenzing will contribute to this roll-out phase as a member of the advisory group, and by presentations at planned information events, giving a perspective about the stakeholder demand for biodiversity action in managed forests.

Textile Exchange (TE) Biodiversity Benchmark

The Textile Exchange Biodiversity Benchmark was launched on December 2, 2020. The benchmark is part of the TE Corporate Fiber and Materials Benchmark (CFMB) Program and is connected to TE's "Climate+" strategy. The role of the benchmark is to address biodiversity loss and support improvements in the industry's sphere of influence through knowledge-sharing. The methodology for companies to set targets for nature is being developed through the Science-Based Targets Network (SBTN). It has taken an initial big step by surveying companies about integrating biodiversity into their business strategies and operations, making commitments, setting targets, and aligning with the Sustainable Development Goals (SDGs):

In 2021, Lenzing contributed as a member of the advisory group, providing input to the tool development and its own input to the benchmark. The "Biodiversity insights Report 2021"³⁹ provides "a first global baseline for the apparel and textile industry" regarding the awareness of its impacts on biodiversity. It describes approaches to actions in business integration, transparency, materiality, implementation, monitoring and evaluation, as well as corporate reporting. In 2022, the findings of the Insights Report were integrated as a new chapter of questions into the CFMB program. In 2023, Lenzing contributes to the update of the "Biodiversity Insights Report".

Wood K plus

Many Austrian companies, including Lenzing, and scientific bodies have joined forces in the "Kompetenzzentrum Holz". It is a leading research institute in wood and wood-related renewable resources in Europe. One workstream of Wood K plus for Lenzing is sustainability in wood sourcing. In 2021, the focus shifted to biodiversity, including support for the work for the Textile Exchange Biodiversity Benchmark. A master's thesis on the assessment of biodiversity impacts in textile fiber production by Life cycle assessment (LCA) methods was finalized in 2022⁴⁰, with these approach & results:

A Delphi survey approach was used. Expert interviews were conducted on the challenges of biodiversity in LCA, with backgrounds ranging from ecology to LCA-modelling. Three rounds of interviews were conducted. The findings were applied to three fibers/production systems: beech, cotton, and eucalyptus. Holistic and technical approaches to tackle challenges were suggested by experts. Data availability and a common understanding of biodiversity amongst researches are the groundwork to create a replicable study. For now, the focus will lie on species diversity until more data becomes available. For the three compared production systems, (regional) data must be gathered on the history of land use, the type and the intensity of land use that is conducted and the behavior of the ecosystem and species in response. There are high levels of uncertainty concerning the regional resolution. LCA is a promising methodology and should be considered to disclose biodiversity impact, however, the previously mentioned challenges must be taken into account.

Index of Figures

Fig. 1: Relationship between Biodiversity, Climate Change and Good Quality of Life.

Fig. 2: Framework by SBTNi for setting targets related to biodiversity

Fig. 3: Functions of forest ecosystems

Fig. 4 A+B: Eucalyptus plantation (Source: LD Celulose) (B) Replanting of Eucalyptus trees (Source: LD Celulose)

Fig. 5: Map of plantations own and managed by LD Celulose in Brazil

Fig. 6: *Pseudopaludicola facureae* (Source: LD Celulose)

Fig. 7 A+B: Maned Wolf (A) and Giant Anteater (B) captured on camera within LD Celulose's plantations. (Source: LD Celulose)

Fig. 8: Biodiversity corridor and plantation area

Fig. 9: Main wood sourcing countries in Europe

Fig. 10: Beech forest in Central Europe

Fig. 11: Standing and lying dead wood is a valuable habitat for fungi and lichens

Fig. 12: Mai Ndombe Lake (Photography by Filip Agoos on behalf of Everland)

Index of Tables

Table 1: Framework of actions for nature, from SBTN (2020)^a

Table 2: Quantitative description of areas managed and influenced by LD Celulose

Table 3: SBTN's framework for action and Lenzing's approach

Table 4: Quantitative description of areas managed and influenced by LD Celulose

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