

2020

# GREEN BONDS

POST-ISSUANCE REPORT

# Preface

**IN 2017, SVEASKOG DECIDED** on a new green framework. Underlying this framework are the “Green Bond Principles” the aim of which is to promote investment in projects that deliver environmental sustainability. Sveaskog’s framework has been reviewed by Det Norske Veritas – GL.

In 2017, SEK 1 billion was issued under the framework, in 2018 no new green bond was issued by Sveaskog but In April 2019 a total of SEK 1.1 billion was issued. This year, 2020, Sveaskog has Issued green bonds on two occasions in April and May totalling SEK 1.7 billion. There was considerable Interest and the bonds were placed with investors primarily in Sweden and Finland.

Limiting global warming is one of the greatest challenges of our time. In this context the growing forest and the use of wood play a significant role in combating climate change.

As Sweden’s largest forest owner, with 14% of the country’s productive forest land, Sveaskog conducts sustainable forest management in order to increase forest growth which creates more wood raw material that can replace fossil-based material as well as increasing the uptake of carbon dioxide from the atmosphere. With its natural raw material, forest management and wood raw material play a key role in development towards a sustainable, bio-based society.





# Climate benefits of the growing forest

The significance of climate change and how we should manage it are issues that are growing in importance both in Sweden and internationally and are affecting attitudes to forest management and the forest as a raw material. The global climate agreement COP21 agreed by countries in Paris in December 2015 describes forest management as a success factor for preventing the Earth's temperature rising by more than two degrees and preferably remaining below 1.5 degrees. IPCC also stresses the importance of sustainable forest management in efforts to prevent climate change (IPCC, 2019). Activities that are highlighted as important for the forestry sector are replanting, reforestation of deforested areas and increased use of sustainably produced bioenergy which is completely in line with the Swedish forest management model.

Sveaskog's forests make an annual contribution with a net uptake of approximately 8 million tonnes of carbon dioxide and the harvested raw material from our own forests contributes a substitution effect, see below. This can be compared with Sweden's total domestic emissions which in 2018 amounted to 52 million tonnes carbon dioxide equivalent. The company's forests are therefore already buffering over 10% of Sweden's domestic climate emissions at the same time as our wood raw material is used in products that are phasing out our fossil dependence. In this way Sveaskog is making a significant contribution to Sweden's goal of zero net emissions by 2045 and the ambition to be the world's first fossil-free welfare nation.

The climate benefit of the forest has three components:

- 1) the annual change in carbon storage in tree biomass and soil,
- 2) the substitution effect that arises when forest products replace fossil-based material, and
- 3) storage changes in forest products, i.e. the annual change in carbon storage in society

when wood raw material is used for various products such as sawn material, board and paper.

With continued initiatives for increased growth, Sveaskog assesses that growth in our forests will increase resulting in higher timber volumes. At the same time we expect to increase timber removals. This means that the aggregate climate impact of our business will increase further and with it Sveaskog's contribution to society's climate goals.

## **Annual changes in carbon storage on forest land**

Sweden's forests are growing and take up more carbon dioxide than they release. The forest is therefore a carbon sink. Since the beginning of the twentieth century the volume of timber in the Swedish forests has doubled at the same time as removals of wood raw material have also doubled. This is partly due to Sweden legislating early on mandatory reforestation and partly through continued improvements in silviculture resulting in increased growth. Today Sveaskog's regeneration felling is about 60–65% of annual growth which means that carbon storage in Sveaskog's forests increases all the time. By focusing on long-term sustainable forest management, the carbon storage in Sveaskog's forests can continue to increase for many years to come at the same time as the company delivers climate-smart products and energy.

## **Substitution effect**

By looking at the entire chain from forest to industry and consumption, it is possible to calculate the emissions avoided with a harvested cubic metre of wood raw material. This gives a measure of how effectively a harvested cubic metre contributes to mitigating climate change. There is no standardised method for calculating substitution effect and Sveaskog has therefore asked re-

searchers at the Swedish University of Agricultural Sciences to perform a calculation <sup>1</sup>. The calculation is based on the assumption that all forest products create a substitution effect, i.e. if the product does not exist it is replaced by another product with emission of carbon dioxide that was not previously part of the atmospheric circulation. Further it is assumed that increased availability of forest products does not mean increased consumption but that the forest products replace or contribute to the replacement of coal, oil, natural gas and cement. Based on how wood raw material is used in Sweden shared across sawn timber, board, paper, cartonboard and biofuel, the result is a substitution effect of 470–880 kg carbon dioxide equivalent per harvested forest cubic metre. Taken together this means that Sveaskog's harvest of wood raw material from own forests during 2020 contributed to avoiding 3–7 million tonnes of carbon dioxide emissions.

### Storage changes in forest products in the community

When wood raw material is used in different products, the carbon store in the forest moves out into the community. Approximately one half of the volume of biomass harvested in the forest goes to the pulp industry and half to sawmills. Half the sawlogs become something other than solid wood products. Chips go to the pulp industry and sawdust and bark become biofuel. In a similar way about one half of the raw material that goes to the pulp industry becomes something other than paper pulp, for example bioenergy for the production of electricity and heat and also vehicle biofuel, chemicals and textiles, see Figure 1. This means that about 50% of the total biomass harvested in the forest is used for sawn material, board, paper and pulp, while the remainder becomes bioenergy.

<sup>1</sup> The calculations have been performed by Tomas Lundmark, Professor of Forest Management at the Swedish University of Agricultural Sciences.

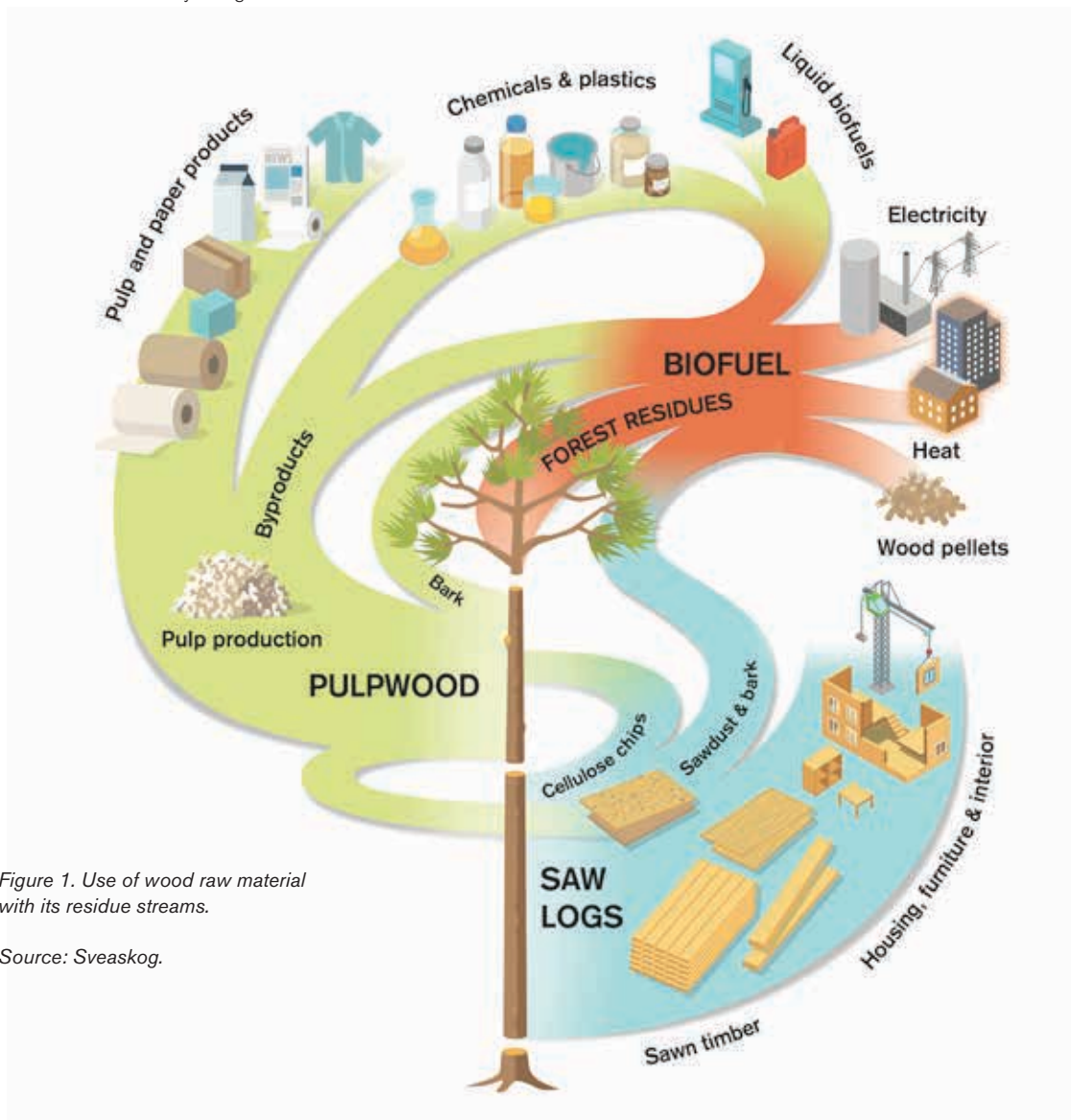


Figure 1. Use of wood raw material with its residue streams.

Source: Sveaskog.

Sveaskog's green bonds of SEK 1.7 billion issued in April and May 2020 have been used to finance sustainable forest management and development projects which aim to increase the climate benefit of the forest and wood raw material, reduce energy consumption or the use of fossil resources. There has also been financing of forest land.



Sustainable forest management



Research & development



Acquisitions of forest land

Projects to which the bonds were allocated are reported on the following pages.

# Sustainable forest management

Sustainable forest management increases growth and therefore also carbon dioxide sequestration. Sveaskog's current investments in sustainable forest management according to the Swedish forest management model are split across the following projects:

## Silviculture

### Planting

For each tree felled on Sveaskog's land, three new ones are planted to ensure regeneration. Well-executed regeneration is the first important step to ensure the quality and value of the new forest. With the new seedlings in the ground, the build-up of carbon dioxide in the forest starts again. Sveaskog plants approximately 40 million new seedlings annually.

### Cleaning

Cleaning manages the development of the stand so that the best trees with the highest quality are given space for optimum development. The aim of cleaning is to optimise growth of the trees that remain by removing competitive trees. Cleaning also opens up the forest and makes it more attractive for outdoor activities after some years. Cleaning is normally carried out once or twice before the stand reaches 30 years.

### Thinning

Thinning further improves the quality of the remaining trees. The aim of thinning is to optimise the timber component, i.e. that part of the tree which will be used later for long-lived products such as sawn timber. Trees harvested at thinning

are used mainly as pulpwood, but also for sawlogs and bioenergy.

Sveaskog's total investment in silviculture in the period April 2019 to March 2020 amounted to SEK 699,744 thousand of which SEK 612,356 thousand was financed through Green Bonds.

**Main environmental benefit:** Increased carbon dioxide sequestration.

## Fertilisation

Fertilisation is an efficient way of increasing growth and therefore also carbon dioxide sequestration. Normally a stand is fertilised 10–15 years before felling and the increased growth is estimated at 10–20 m<sup>3</sup> per hectare, which corresponds to increased carbon dioxide sequestration of between 10 and 20 tonnes CO<sub>2</sub> per hectare. During 2019 Sveaskog fertilised a total of 4,390 hectares which will result in further sequestration of between 40,000 and 80,000 tonnes of carbon dioxide.

Sveaskog's total investment in fertilisation during the period April 2019 to March 2020 amounted to SEK 13,824 thousand of which SEK 12,098 thousand was financed through Green Bonds.

**Main environmental benefit:** Increased carbon dioxide sequestration.





Nature conservation workers. Meadows and grazing are among our most biodiverse land. Here Sveaskog has thinned out old overgrown grazing land in the Raslängen Ecopark where grazing sheep will promote biodiversity.

## Regeneration felling

All forests bind carbon dioxide but a tree's growth slows with age and thus its ability to bind additional carbon dioxide. The managed forest therefore contributes the most climate benefit over time since the high growth persists. If the substitution benefit which arises from all the products from wood raw material that replace fossil energy and energy-demanding building materials is taken into account, then the climate benefit of the managed forest is enormous.

Each year Sveaskog carries out thinning and regeneration felling on about 40,000 hectares or approximately 1% of our land.

Sveaskog works actively to avoid negative environmental impact when felling and has an environmental target that 99% of all felling shall take place without any serious impact on natural or cultural values. Prior to felling a conservation value assessment is made and environmental consideration is planned in detail. All silvicultural activities are carried out with consideration for the environment in the form of edge zones by watercourses, leaving valuable trees and tree groups and sensitive habitats. On average 12–14% set aside due to environmental consideration when felling.

Sveaskog's total investment in regeneration felling during the period April 2019 to March 2020 amounted to SEK 703,840 thousand of which SEK 615,941 thousand was financed through Green Bonds.

**Main environmental benefit:** Substitution benefit.

## Nature conservation

An important part of sustainable forest management is nature conservation. Sveaskog has

developed its own strategy for how it carries out nature conservation work. We work with several tools at different scales – from consideration for nature when felling to setting aside nature conservation forests and large contiguous landscapes that we call ecoparks. Sveaskog works both with retaining high conservation values and strengthening and recreating natural values. The latter is achieved using silvicultural methods that actively promote nature conservation.

Sveaskog has already made its largest investment in nature conservation by setting aside 10% of productive forest land below the montane forest region as nature conservation forests and in addition has established 37 ecoparks. A total of 28% of Sveaskog's forest land is not used for timber production. In 2019 we carried out, among other things, deciduous forest and grazing land restoration, recreation of wetlands and removal of fish run obstacles in waterways with the aim of strengthening and recreating conservation values. One of the most common nature conservation activities is to pick out young deciduous forest from previously planted spruce stands. In the Raslängen Ecopark, which is Sveaskog's most southerly ecopark, a comprehensive restoration programme is under way where many of the spruce forests will be transformed into deciduous or pine forest or grazing.

Sveaskog's total investment in nature conservation during the period April 2019 to March 2020 amounted to SEK 10,975 thousand of which SEK 9,604 thousand was financed through Green Bonds.

**Main environmental benefit:** Strengthened conservation values.

# Research and development



In its development projects, Sveaskog collaborates with other players including universities, forestry and the transport sector. Projects are usually multi-year and Sveaskog's investments in the projects during the reporting period are summarised below. In total Sveaskog's investments in these projects amounted to SEK 10,000 thousand of which SEK 10,000 thousand was financed through Green Bonds.

## Somatic embryogenesis

Somatic embryogenesis (SE) is a method for vegetative propagation of the best plant material that results from breeding. This means being at the leading edge of plant breeding and thus providing the market with the absolutely best forest cultivating material far sooner than through traditional mass propagation. It also means that an unlimited number of new embryos can be created from a single seed. Sveaskog has participated in the development of SE plants for a number of years and the aim now is to automate the propagation process.

Raising these microplants is considerably more environmentally efficient compared with traditional plant breeding since a greenhouse can hold up to six times as many plants, which saves energy.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 3,500,000.

**Main environmental benefit:** Reduced energy consumption.

## Effekt 20

Effekt 20 is a comprehensive inventory programme in six of Sveaskog's 37 ecoparks. In collaboration with researchers from Lund University and the Swedish University of Agricultural Sciences the project evaluates how completed nature conservation efforts have affected the occurrence of wood-living beetles and woodland birds in the ecoparks. By comparing the ecoparks with reference areas over time, the programme aims to evaluate the effects of nature conservation efforts on the landscape.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 932,000.

**Main environmental benefit:** Increased knowledge of effective nature conservation efforts.

## Sector-leading consideration inventory

Sveaskog's target is that 99% of silvicultural activities when felling shall be carried out without any major environmental impact. The target is assessed by the Swedish Forest Agency using annual inventories. What is checked is how well environmental consideration is applied when felling, such as edge zones by lakes and waterways, that areas with ecological qualities are not felled, and consideration for cultural environments. The evaluation then becomes the basis for continued development of good environmental consideration. Over the past two years, Sveaskog has succeeded in carrying out 98% of all silvicultural activities without major environmental impact.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 1,949,000.

**Main environmental benefit:** Increased knowledge of effective environmental consideration in forest management.

\* Applies to the period April 2019 to March 2020.



## Auto2

The working environment for machine operators who drive harvesters, scarifiers and forwarders is physically challenging, both regarding noise and uneven terrain. Driverless and remote-controlled forwarders would mean an improved working environment for many machine operators. Auto2 is a technology development project financed by Vinnova and the forest industry with collaboration from several universities, forest and machine companies, including Sveaskog. The project

covers both partial and full automation of the machines. If the driver's cab can be eliminated, then machines will become lighter which in turn reduces soil impact.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 1,026,000.

**Main environmental benefit:** Improved working environment and reduced soil impact.

## Bio-based granulate for 3D printing

Today's packaging is often fossil based (plastic) or made from cartonboard, corrugated board and wood. In step with increased international trade and on-line shopping, the global packaging market has risen by 5.5% between 2009 and 2021 and is expected to increase even further in the future. Therefore there is a need to develop bio-based alternatives which work for 3D printing since this results in lower climate impact. The aim of the project is to develop a granulate for 3D printing with as high a content of bio-based raw material as possible and to optimise and test prototypes for

customised one-time packaging and returnable packaging. Sveaskog participates in the project together with a broad consortium of research institutions and companies from the cleantech, packaging manufacturing and 3D printing sectors.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 627,000.

**Main environmental benefit:** Reduced use of fossil resources.

## BioPitch

By using the forest's raw material in the manufacture of infill for artificial grass pitches we can move away from today's fossil-based material. Artificial grass football pitches have been identified by the Swedish Environmental Protection Agency as the next to largest source for the spread of microplastics in nature and waterways. The BioPitch project is developing an environmentally friendly, wood raw material-based infill which is fossil-free and can decompose in nature outside the football pitch. In a first phase, the infill's function has been verified in the laboratory. In this phase production

is scaled up and the properties of the material evaluated in an appropriate environment. Sveaskog participates in this project together with Stockholms Fotbollförbund, RenCom, Sportslab, research institute RISE and a number of municipalities.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 191,000.

**Main environmental benefit:** Reduced use of fossil resources and lower environmental impact.

\* Applies to the period April 2019 to March 2020.



The BioPitch project is developing an environmentally friendly, fossil-free and wood raw material-based infill for football pitches.



Sveaskog participates in a project that will enable larger and longer transports to reduce transport costs and fuel consumption.

### Vehicle biofuel from lignin in black liquor

In collaboration with a consortium of researchers, entrepreneurs and a vehicle fuel producer, Sveaskog is conducting a project which aims to develop a technology to extract lignin from pulp mills' black liquor and convert this to raw material for vehicle biofuel. The project has been running since 2014 and has moved from laboratory experiment to a pilot plant where the

technology and product are verified as meeting the demands of a commercial operation.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 260,000.

**Main environmental benefit:** Reduced use of fossil vehicle fuels.

### Multi-damaged forest

In the Swedish provinces of Norrbotten and Västerbotten large areas of multi-damaged forest have been observed. These are young forests which have suffered several different sorts of damage, primarily game grazing and fungal disease. In some cases the damage is so extensive that requirements for reforestation have not been met. Forest damage causes lost growth and lower timber quality which results in lower resource usage. It is therefore a priority for Sveaskog to get to grips with the multi-damaged forests. In a first phase a broad inventory of young forests has been carried out where

Sveaskog participates together with, among others, Skogforsk, the Swedish University of Agricultural Sciences and the Swedish Forest Agency in a research project to address this problem. The next phase is to develop an action plan to deal with the damaged forests.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 421,000.

**Main environmental benefit:** Increased growth and therefore increased carbon dioxide sequestration.

### Bigger and longer vehicles

Forestry is transport intensive and Sveaskog is therefore participating in projects to enable larger and longer transports, partly to reduce transport costs and partly to reduce fuel consumption and the consequent carbon dioxide emissions. One such project is the ST project for lorries with a greater load capacity so that the gross weight can go up to 74 tonnes compared with the traditional 60–64-tonnes lorries. An ETT vehicle can increase capacity further to 90 tonnes. Studies show that fuel consumption and thus carbon dioxide

emissions are reduced by 8–14% compared with regular lorries. Reduced fuel consumption of that order corresponds to an annual reduction for Sveaskog in carbon dioxide emissions of 6,000 to 10,000 tonnes.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 471,000.

**Main environmental benefit:** Reduced use of fossil vehicle fuels.

\* Applies to the period April 2019 to March 2020.



In the Cognitive Forestry project Sveaskog is collaborating with IT company Sogeti who are using artificial intelligence, satellite imagery and advanced algorithms to produce detailed maps.

## Flowcut

In collaboration with researchers, forest companies and entrepreneurs Sveaskog is conducting the Flowcut project which aims to develop a technology that will make it profitable to use the biomass from felling thin trees. The goal is to achieve profitable thinning in dense, overlooked stands and a successful project will mean that we can use some of the biomass that is often cut down and left in the forest. This will increase the

availability of biofuel which can be used to replace fossil resources.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 198,000.

**Main environmental benefit:** Reduced use of fossil resources.

## Cognitive forestry

Sveaskog encourages the development of digital technology in forest management. In the Cognitive Forestry project the company has started a collaboration with the IT company Sogeti which uses artificial intelligence, satellite imagery and advanced algorithms to produce detailed maps of the forest holdings which simplify both planning and silvicultural activities. The technology can be used, among other things, for early identification of spruce bark beetle infestation which

mitigates forest damage attacks and improves the use of raw material when insect attacks are discovered earlier which means that smaller volumes are classified as firewood.

Sveaskog's total costs incurred during the reporting period\* amounted to SEK 425,000.

**Main environmental benefit:** Lower environmental impact and improved raw material utilisation.

\* Applies to the period April 2019 to March 2020.

# Financing and refinancing of acquisitions of forest land



Sveaskog is Sweden's largest forest owner with some 4 million hectares of forest land. All our forest land is certified according to the forest certification systems FSC® and PEFC™. In this way we contribute to promoting sustainable forest management worldwide.

FSC is a voluntary international system and is the only forest certification that has broad global support from the environmental movement. FSC-certified forest management provides an economic return but also takes into account environmental values and social conditions. Biodiversity, ecologically valuable environments and cultural heritage are protected. Employees are offered contracted and safe employment terms. The Sami and the general public are given the opportunity for insight and influence. When carrying out silvicultural activities, special consideration is given to Sami cultural sites, reindeer-herding areas or important recreational areas. PEFC is similar to the certification rules developed by FSC but is more suitable for family forestry.

Sveaskog continuously acquires new forest land which is always FSC and PEFC certified. In this way sustainable management of the forest and forest land is ensured. The acquired forest land is

also covered by Sveaskog's environmental targets which means that our voluntary set-asides are increased by an amount corresponding to 20% of the acquired productive forest land. With green bonds we can both finance new forest land acquisitions and also refinance the loans for previous acquisitions. During the period April 2019 to March 2020 Sveaskog acquired a total of 2,535 hectares of forest land at a cost of SEK 240 million. Certified forest land accounts for the absolutely largest item on Sveaskog's balance sheet and during the period SEK 200 million of the amount Sveaskog raised through issuing green bonds was applied to refinancing Sveaskog's FSC and PEFC certified forest land.

Sveaskog's total investment for acquisitions of forest land during the period April 2019 to March 2020 amounted to SEK 240 million of which SEK 240 million was financed through Green Bonds. During the period, bonds amounting SEK 600 million matured, of which SEK 200 million was refinanced using Green Bonds.

**Main environmental benefit:** FSC and PEFC certification of forest land.

# Summary of Sveaskog's green projects

## Sustainable forest management

### Market Area North

Project name	Project category according to framework	Total investment (SEK)	Total costs incurred (SEK) allocated to the green bond at 31 March 2020	Share of the project financed by the green bond (%) at 31 March 2020	Most significant measurable environmental impact as a result of financing
Silviculture	Environmentally sustainable forestry	315,179,760	275,818,684	87.5	Net sequestration equivalent to 3,730,000 tonnes carbon dioxide
Fertilising	Environmentally sustainable forestry	2,353,740	2,059,794	87.5	
Regeneration felling	Environmentally sustainable forestry	298,421,545	261,153,310	87.5	
Nature conservation	Environmentally sustainable forestry	4,088,441	3,577,858	87.5	

### Market Area South

Project name	Project category according to framework	Total investment (SEK)	Total costs incurred (SEK) allocated to the green bond at 31 March 2020	Share of the project financed by the green bond (%) at 31 March 2020	Most significant measurable environmental impact as a result of financing
Silviculture	Environmentally sustainable forestry	384,564,250	336,538,125	87.5	Net sequestration equivalent to 1,848,000 tonnes carbon dioxide
Fertilising	Environmentally sustainable forestry	11,470,431	10,037,952	87.5	
Regeneration felling	Environmentally sustainable forestry	405,418,602	354,788,090	87.5	
Nature conservation	Environmentally sustainable forestry	6,886,161	6,026,186	87.5	

### Whole of Sveaskog

Project name	Project category according to framework	Total investment (SEK)	Total costs incurred (SEK) allocated to the green bond at 31 March 2020	Share of the project financed by the green bond (%) at 31 March 2020	Most significant measurable environmental impact as a result of financing
Silviculture	Environmentally sustainable forestry	699,744,010	612,356,809	87.5	Net sequestration equivalent to 5,578,000 tonnes carbon dioxide
Fertilising	Environmentally sustainable forestry	13,824,171	12,097,746	87.5	
Regeneration felling	Environmentally sustainable forestry	703,840,147	615,941,401	87.5	
Nature conservation	Environmentally sustainable forestry	10,974,602	9,604,044	87.5	

## Research and development

Project name	Project category according to framework	Total costs incurred (SEK) allocated to the green bond at 31 March 2020	Most significant measurable environmental impact as a result of financing
Somatic embryogenesis	Research and development	3,500,000	Reduced energy consumption
Effekt 20	Research and development	932,000	Increased knowledge of effective nature conservation efforts
Sector-leading consideration inventory	Research and development	1,949,000	Increased knowledge of effective environmental consideration in forestry
Vehicle biofuel from lignin in black liquor	Research and development	260,000	Reduced use of fossil vehicle fuels
Auto2	Research and development	1,026,000	Improved working environment and reduced soil impact
Bio-based granulate for 3D printing	Research and development	627,000	Reduced use of fossil resources
BioPitch	Research and development	191,000	Reduced use of fossil resources and lower environmental impact
Bigger and longer vehicles	Research and development	471,000	Reduced use of fossil vehicle fuels
Flowcut	Research and development	198,000	Increased availability of biofuels that can replace fossil raw materials
Cognitive forestry	Research and development	425,000	Reduced environmental impact in forestry and improved raw material utilisation
Multi-damaged forest	Research and development	421,000	Increased growth and therefore increased carbon dioxide sequestration

## Financing and refinancing of property acquisitions

Project name	Project category according to framework	Total investment (SEK)	Total costs incurred (SEK) allocated to the green bond at 31 March 2020	Share of the project financed by the green bond (%) at 31 March 2020	Most significant measurable environmental impact as a result of financing
MA South	Acquisitions of forest land	219,500,000	219,500,000	100	FSC® and PEFC certification of 1,989 hectares of forest land
MA North	Acquisitions of forest land	20,500,000	20,500,000	100	FSC® and PEFC certification of 546 hectares of forest land
Whole of Sveaskog	Refinancing of property acquisitions	600,000	200,000	33	FSC® and PEFC certification of 546 hectares of forest land

## Summary, SEK

Green bonds issued in 2020	1,700,000,000
Investment in sustainable forest management	-1,250,000,000
Investment in research and development	-10,000,000
Financing of property acquisitions and refinancing	-440,000,000
Balance not reinvested	-

# **This report was approved at a meeting of Sveaskog's Green Bond Committee**

Stockholm, 3 February 2021

Kristina Ferenius  
*Chairman*

Anders Jakobsson

Lena Sammeli-Johansson

Olof Johansson

## Appendix 1 – Calculation of climate benefits

The carbon balance in the forest is determined by several different processes.

In green plants photosynthesis takes up carbon dioxide from the atmosphere and converts it into carbohydrates. Some of the absorbed carbon dioxide is released again by the respiration needed for metabolic activity in trees and other plants. While the trees are growing, some carbon is allocated to the ground via the roots and when needles and cones fall. Dead organic material is gradually broken down by different organisms which leads to carbon dioxide being emitted back to the atmosphere.

In the managed forest there is a further factor that is significant for the carbon balance, harvesting the trees.

This means that some of the growth is extracted in the form of wood raw material which is then used for consumption by society. Assuming that forest products are replaced by others that have fossil origins or are based on cement, a substitution benefit achieved by the harvested biomass can be calculated.

In reporting climate benefits contributed by Sveaskog's forests and forest management, only climate benefits as net growth are taken into account. Since Sveaskog only felled 62% of annual growth, the carbon stored in the standing timber increased. Carbon storage in the ground or the substitution benefit have not been included in the calculation below.

The following formula has been used to calculate the amount of carbon sequestered in Sveaskog's forests during the year:

$$\text{Total carbon sequestration (tonnes)} = \text{Net growth (m}^3\text{fo)} \times \text{BEF} \times \text{CF}$$

where,

Net growth = Change in standing timber stocks (m<sup>3</sup>fo)

BEF = Biomass Expansion Factor, conversion factor to determine the total oven-dry biomass

CF = Carbon Fraction, the amount of carbon in oven-dry wood

**Table 1.** Parameters used to calculate carbon content

Tree species	CF (tonnes C tonnes oven-dry mass <sup>-1</sup> )	BEF
Pine	0.51	0.7
Spruce	0.51	0.8
Source	(IPCC 2006)	(Lehtonen, et al. 2004)

The following formula has been used to convert the amount of carbon sequestered to the amount of carbon dioxide sequestered:

$$\text{Total carbon dioxide sequestered (tonnes)} = \frac{\text{Carbon sequestered (tonnes)} \times \text{CO}_2 \text{ molecular weight}}{\text{C molecular weight}}$$

In 2019 net growth on Sveaskog's entire land holdings was 5.2 million m<sup>3</sup>fo which corresponds to carbon dioxide sequestration of 7,2 million tonnes. Bonds have financed 87.5% of the growth-improving activities reported as

green projects within the framework of environmentally sustainable forestry. Therefore 87.5% of the total climate benefit of net growth is reported as a result of the financing.



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