

“The reindeer are starving”

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The contribution of burning biomass to the impacts of pulp production in Sweden

SKYDDA SKOGEN



Introduction

Sweden produced [around 12 million tonnes of pulp in 2022](#), accounting for over a quarter of Europe's total pulp production and making it Europe's largest producer. Bioenergy is Sweden's largest energy source and accounts for almost a third of total energy supply. [Almost 60% of final energy use in the industrial sector is bioenergy](#), and the pulp and paper industry accounts for much of this.

The two main consumers of bioenergy are the district heating sector and forest industries, and pulp-producing companies play a substantial role in both. The Swedish Energy Agency (SEA) calculates that in 2021 the pulp and paper industry consumed 73 TWh¹ of energy, 75% of which was from bioenergy.² [Sweden's total energy consumption is around 355 TWh](#), meaning that the pulp and paper industry is responsible for a fifth of the country's total energy use.

Primary woody biomass accounts for around a third of the biomass burned in Swedish power stations, and [includes so-called forestry residues as well as roundwood](#), which also frequently includes centuries old dead trees, as well as deciduous trees, which are vital for biodiversity. Primary woody biomass [was used to generate 13 TWh of energy in 2020](#), not including firewood burned domestically. Figures for fuel production are slightly higher, with [Swedish Energy Agency figures](#) indicating that a total of 17 TWh of primary woody biomass fuels from forestry operations (excluding firewood) were produced in 2022, compared to 31 TWh of woody biomass fuels from industrial byproducts such as bark and sawdust.

As in other parts of Europe, [many of Sweden's pulp mills generate excess heat and electricity to sell to](#)

[external customers](#), such as municipal district heating networks and the public electricity grid. They are also increasingly selling lignin, bioethanol, tall oil, bark, wood chips and wood pellets.

It is often claimed that the forestry industry's most important product is timber and that all other products, such as paper, packaging and bioenergy, are a result of the efficient utilisation of residual biomass. However, [timber only accounts for 20% of the export value of the forestry industry in Sweden](#), whereas other products that are classified as residual, such as biomass used to generate energy, account for the majority of what raw forest materials are turned into. [According to Svenska Cellulosa Aktiebolaget \(SCA\)](#), one of Sweden's largest pulp producers, 30% of everything that is harvested from their forestry areas is converted into energy or products such as wood pellets that are destined to be burned.

This case study aims to assess the Swedish pulp industry's overall contribution to the demand for primary woody biomass for energy generation and place this within the context of the impacts of Sweden's intensive forestry model.

State support and subsidies for burning biomass

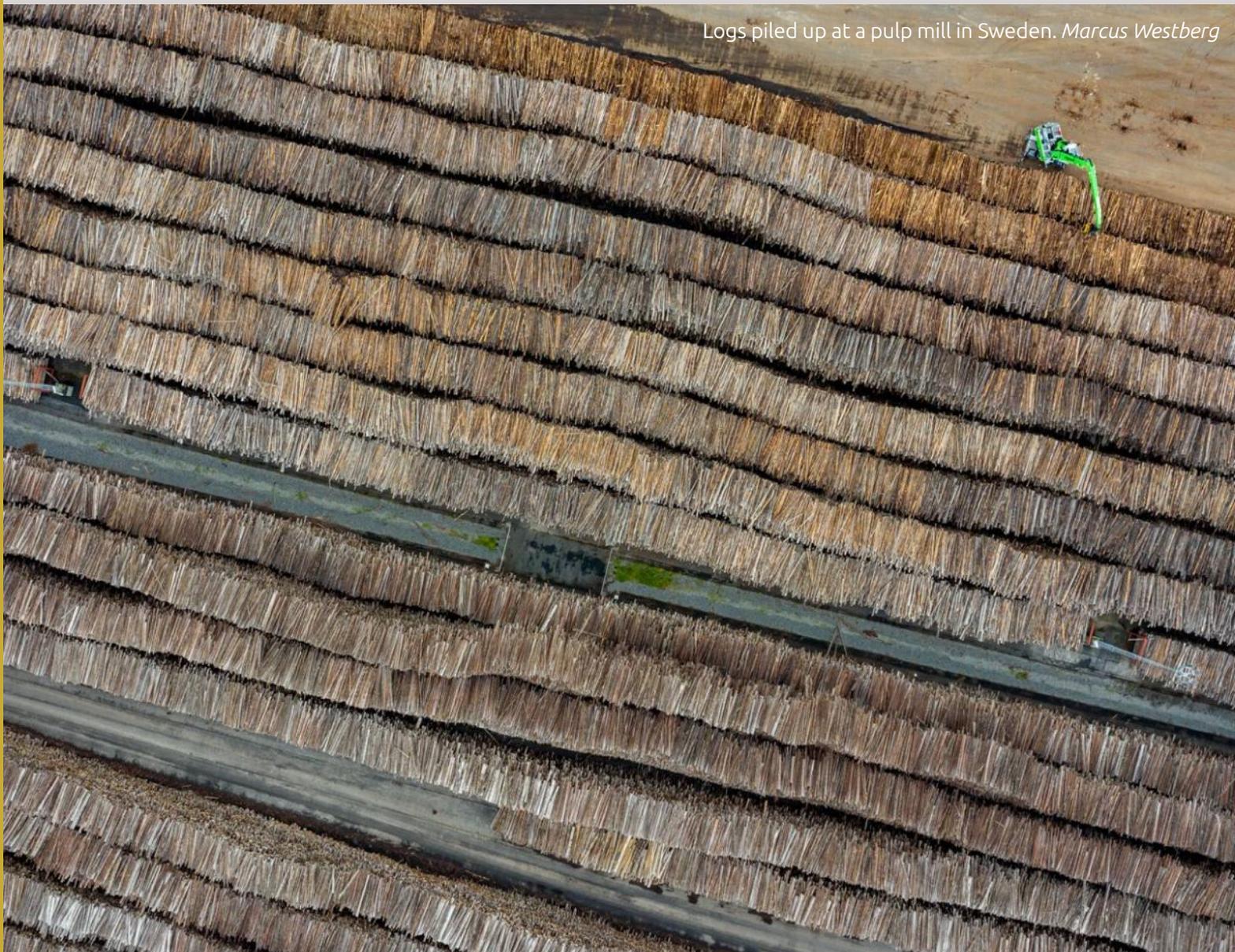
The pulp and paper industry [receives up to 600 million Euros a year in renewable energy subsidies for the biomass electricity it produces](#), some of which is produced by burning primary forest biomass and industrial by-products that could be put to alternative, lower-emission uses. The pulp and paper industry also does not pay carbon tax, nor does it have to buy emission rights for the [approximately 18 million tonnes of CO₂ it emits each year](#), which is another financial incentive, equivalent to 1.7 billion Euros a year.

Pulp producers have relied on these electricity related tax breaks for many years, as they protect the highly energy intensive industry from the costs of high energy prices. Pulp and paper company Stora Enso, for example, has underlined this by [threatening to move its mills abroad](#) if the Swedish government were to

consider reforming these subsidies. Stora Enso receives more subsidies for generating electricity than any other company in Sweden, followed closely by SCA.

More generally, in the last year for which there is publicly-available information (2019), [seven out of the top 10 most heavily-subsidised companies in Sweden were pulp producers](#), and this trend persists today. More public money was spent in 2019 on [subsidising these highly-polluting companies](#) than on Sweden's entire budget for climate change mitigation measures. In 2021, [Protect the Forest \(Skydda Skogen\)](#) calculated that the electricity-related tax breaks received by the forest industry in just two to three years—which incentivises the logging of highly biodiverse forests—would be enough to pay for the protection of the entire and unique chain of mountain forests in Sweden.

Logs piled up at a pulp mill in Sweden. *Marcus Westberg*



Primary woody biomass burning at pulp mills in Sweden

As part of this case study, every pulp-producing company in Sweden was contacted for further information on their use of biomass for energy generation. Only three responded, all refusing to provide the information specifically requested, reflecting a significant lack of transparency in wood sourcing throughout Sweden's forest industries.

Without company provided data, estimates of biomass use have been made using the limited available information found in online searches of annual company and environmental reports and websites, as well as media articles. Eight pulp-producing companies operating in Sweden were identified as having recently burned primary woody biomass to generate energy

and/or providing it from their forestry operations to other energy generators. Between them, we estimate that they burn the equivalent of 4.5 million m³ of woodchip directly from logging operations a year and deliver around one million m³ to other energy users. This is equivalent to almost a third of the total primary woody biomass burned for energy each year in Sweden.

Company	Pulp mill(s)	Estimated primary woody biomass consumption (m ³)	Estimated primary woody biomass delivered to other energy generators (m ³)
Billerud	Gruvön, Gävle, Frövi/ Rockhammar, Karlsborg and Skärblacka	100,000	
Metsä	Husum		100,000
Nordic Paper	Bäckhammar	30,000	
SCA	Obbola, Munksund, Ortviken and Östrand	1,660,000	750,000
Stora Enso	Fors, Skoghall and Skutskär		194,000
Södra Cell	Värö, Mönsterås and Mörrum	2,500,000	
Sylvamo	Nymölla	240,000	
	Total:	4,530,000	1,044,000

Table 1: Pulp-producing companies and their estimated contribution to the use of woody biomass for energy.



Billerud

Billerud is a Swedish pulp and paper company which [operates five pulp and paper mills in Sweden](#), one in Finland, and three in the USA. [According to the company](#), around 75% of the wood used in their Scandinavian pulp mills comes from Sweden, the rest mostly from Norway, Finland and the Baltic States. Wood comes directly from forests as well as from 90 different sawmills. Billerud [co-owns and manages around 350,000 hectares](#) of forests and plantations in central Sweden, [some of which are within Sápmi](#), the traditional territory of the Indigenous Sámi People.

Of all the pulp mill operators in Sweden we contacted, Billerud is particularly non-transparent. They

Metsä Group

Metsä Group operates one pulp mill in Sweden, in Husum. The mill [mainly burns black liquor and bark to generate energy](#), and similarly to Metsä Group's pulp mills in Finland, it appears unlikely that primary biomass is burned for energy. However, according to [Metsä Group's 2023 Annual Report](#), Metsä Forest, the Group's forestry subsidiary, delivered a total of 30.4 million m³ of wood, and its operations procured 29 million m³ of wood. It is possible that the difference between these two figures is energy wood, which would mean that in 2023, 1.4 million m³ of primary forest biomass were delivered to other operators in the power sector (such as CHP plants providing district heating) or to other Metsä Group mills that burn primary woody biomass (such as sawmills). Given that 7.3% of the wood Metsä Group uses comes from Sweden, we estimate that

responded to a query as to how much energy is generated in Billerud's pulp and paper production and how much of this is primary woody biomass (i.e. comes directly from forestry operations) by saying, *"Unfortunately this is not information that we share."* The only publicly available information about the primary woody biomass that Billerud burns is from its [latest Annual Report](#), which states that it uses forestry biomass residues internally produced in Sweden as a part of its heat and power production. We estimate that around 100,000 m³ of primary woody biomass is burned by Billerud each year in its Swedish mills.³

100,000 m³ of the wood it procured directly from forestry operations in Sweden was delivered to other operators as energy wood, although it should be stressed that the company has refused to confirm if this estimate is accurate.

It should also be noted that other Metsä Group operations, such as sawmills and panelboard factories, may well burn primary woody biomass to generate energy, but that this is outside the scope of this study. In addition, Metsä Group has faced much criticism from civil society groups due to the company's logging practices and the huge amounts of wood required by its new "bioproduct mills" (pulp mills), some of which are covered in more detail in the Finland case study.

Nordic Paper

Nordic Paper is a Norwegian paper company operating five mills, three of them in Sweden. Only [one of the Swedish mills is an integrated pulp and paper mill](#), whereas the other two are pure paper mills. The Swedish pulp and paper mill is located in Bäckhammar, Värmland County. According to a [2022 Environmental Report](#), the mill has a recovery boiler and a solid biomass boiler. Although the Bäckhammar mill sold around 90 GWh worth of bark that year, it also burned 23.9 GWh worth of wood purchased externally. The company has ignored requests for more information about the type of externally purchased wood. However, there is no sawmill nearby, and [the company states that in 2023](#), a certain amount of fuel wood was consumed. Given the lack of more detailed publicly-available information and the company's refusal to provide it, we estimate that up to 30,000 m³ of primary woody biomass could be being burned at the mill each year.



Nordic Paper's Bäckhammar pulp mill. *Marina Ilaria*

Svenska Cellulosa Aktiebolaget (SCA)

Svenska Cellulosa Aktiebolaget (SCA) is a vertically integrated Swedish forest industry company that produces pulp, packaging paper, sawn timber, wood pellets and transport biofuels, generates energy and conducts logging operations. It operates two pulp mills, Ortviken and Östrand, and two pulp and paper mills, Obbola and Munksund, which produced almost one million tonnes of pulp in 2023. In 2022, [SCA's production facilities used 10.3 million m³ of wood](#), 94% of which was sourced from Sweden and 58% from forests and plantations managed by SCA. Almost all of the wood sourced by the company was from northern Sweden, falling within Sápmi.

In 2023, [SCA produced 11.1 TWh of bioenergy](#), 9.3 TWh of which was used in SCA's mills and 1.8 TWh was delivered to external customers. Of the external deliveries, 0.7 TWh was wood pellets, 0.6 TWh was unprocessed biofuels such as bark, sawdust and primary woody biomass from logging operations, and 0.5 TWh was district and waste heat. SCA describes itself as *"one of the largest suppliers of forest-based biofuels in Sweden, including unrefined by-products from the forest and industry, as well as refined fuels in the form of pellets."*

In terms of deliveries of primary woody biomass to other users, [one study describes how](#) SCA's forestry division, SCA Skog, delivers around 40,000 tonnes (130,000 m³) of logging residues annually to the Lugnvik CHP plant and Strömsund district heating boiler, and purchases a large share of logging residues from the private forest owners in the Östersund area. SCA has not responded to specific requests for information relating to the types and proportions of woody biomass the company burns to generate energy. However, using the information available, we estimate that the company delivers up to 750,000 m³ of primary woody biomass to energy producers from its own operations,⁴ and burns up to 1,700,000 m³ of primary woody biomass to generate energy in its own power plants.⁵

SCA is also increasingly investing in pellet and liquid biofuel production, which will significantly increase its need for biomass. In the case of its pellet production, it is using sawmill residues which could otherwise have other uses, including panelboard production, which from a climate perspective is preferable to being burned. The competition for sawmill residues also drives up the total demand for woody biomass, and therefore logging pressures in the region.

Producing transport biofuels from pulp mill by-products and primary woody biomass

SCA is [co-investing in a biofuel refinery](#) being built jointly with the oil company ST1 in Gothenburg, with a total annual production capacity of approximately 200,000 tonnes of liquid biofuel. The refinery, which is under construction, is meant to be capable of producing biofuels for road vehicles and aviation. SCA claims its 25% ownership *“corresponds to 50,000 tonnes, equivalent to the total fuel requirements of domestic flights in Sweden.”* SCA will supply tall oil, which is a by-product of pulp production. Using tall oil for biofuels is very concerning because it is in high demand by the chemical industry. If tall oil is used for energy generation purposes instead, the chemical industry will most likely replace the tall oil it had been using with fossil fuels. [According to a 2017 study](#), these significant indirect greenhouse gas emissions mean that using tall oil as a fuel is even worse for the climate than using fossil fuel equivalents.

SCA is also [trying to develop transport biofuel production](#) from *“solid biomass, such as sawdust and bark”* at its newly expanded Östrand pulp mill. They

admit that the technology for using solid biomass for transport biofuels is still under development (and [research suggests](#) that technical success is unlikely any time soon, if ever). Nevertheless, SCA is trying to open up a big new market for transport biofuels that will create more demand for tall oil and solid biomass.

In 2020, [Södra announced](#) the opening of the world’s first bio-methanol plant at Mönsterås, supplying methanol to a biodiesel producer.⁶ It has a [capacity of 5,250 tonnes a year](#), and the methanol is made from woodchip. Södra sells methanol as part of its [“Liquid Forest”](#) brand. Its other Liquid Forest products are turpentine and tall oil. Both are now routinely produced from pulp mill byproducts around the world. However, Södra is also a [partner and shareholder in SunPine](#), a company that produces drop-in biofuels (i.e. hydrocarbons from biomass which have similar chemical properties to fossil fuels)⁷ from tall oil. Tall oil is already used in biodiesel production, and using it to produce drop-in biofuels would open up an even larger market.

Stora Enso

Stora Enso is the world’s [fourth-largest pulp and paper company](#) and the largest one in Europe. In Sweden, Stora Enso operates the Skutskär pulp mill, as well as two paperboard mills, a plant producing paper products for packaging and two sawmills. Stora Enso also [describes itself](#) as *“one of the largest private forest owners in the world,”* owning and leasing more than two million hectares of tree plantations and forests worldwide. Of those, around [1.14 million hectares are located in Sweden](#).

Similarly to its Finnish mills, Stora Enso’s Swedish pulp mill is unlikely to burn primary forest biomass due to company policy. However, the company’s forestry division is also a major supplier of energy wood to external energy producers. According to its [2023 Annual Report](#), 300,000 m³ of wood for energy generation was harvested from its forestry sites across all of the countries it operates in. If this value is extrapolated to third-party forestry lands, the figure

rises to 843,000 m³. It is therefore likely that, in Sweden, the company delivered around 194,000 m³ of energy wood from primary sources to third-party customers in 2023, most likely customers in the industrial heat sector.⁸

Stora Enso also has a 16% shareholding in Pohjolan Voima, which is one of Finland’s largest users of primary woody biomass for energy, discussed in more detail in the Finland case study.





A logging truck in Sweden carrying pulp wood. *Marina Itaria*

Södra

Södra operates three pulp mills in southern Sweden: in Mönsterås (Kalmar County), Mörrum (Blekinge County) and Värö (Halland County), as well as seven sawmills. It [describes itself as](#) “a forest industry group that processes the forest products delivered by its 53,000 owners.” Södra and its members [own and manage around 2.8 million hectares of land](#), mostly spruce and other conifer plantations, in southern Sweden. The vast majority of these are not biodiverse forests but even-age monoculture plantations. According to their [quarterly report in December 2023](#), they took “nature conservation measures” on just 2,010 hectares. In addition, Södra [manages 16,000 hectares of forests in Estonia](#) and ships Estonian wood to its pulp mills.

Syvalmo

Syvalmo is an international pulp and paper company based in Tennessee, USA. In January 2023 they acquired the Nymölla pulp and paper mill, located in Skåne County in the southeast of Sweden, from Stora Enso. In 2022, prior to the takeover, the [mill burned 632,000 tonnes of biomass](#). According to the mill’s [Environmental Report for the same year](#), 93% of the mill’s energy is produced from biofuels, and 100 GWh of surplus heat a year is supplied to district heat networks in Bromölla and Sölvesborg. The plant has a recovery boiler and a solid fuel boiler, which burns woodchip alongside pulp mill residues such as bark and

[Södra reports](#) having produced 1,885 GWh of electricity in 2023, of which 432 GWh were sold to the grid. According to its [latest Annual Report](#), 54% of the solid biofuels burned in Södra’s power plants, equivalent to almost 2,000 GWh of energy, comes directly from forestry operations, compared to 46% mill by-products such as bark. This is equivalent to around 2.5 million m³ of woodchip.⁹ Södra’s biomass electricity generation attracts generous subsidies: they state that they are “one of the largest producers of green electricity eligible for green electricity certificates in Sweden.”

sludge. The company provides no information about the origin of the woodchip, nor the quantities of different feedstocks, and has ignored requests for further information. However, it indicates in its Environmental Report that primary woody biomass is used, referred to as “fuel chips.” There is no adjacent sawmill, which makes it more likely that the woodchip is made from primary woody biomass. It is therefore possible that up to 70,000 tonnes (240,000 m³) of woodchip from primary woody biomass are burned for energy each year.¹⁰

Sawmill residues: Wood pellet production and burning sawdust for energy

As well as burning primary woody biomass for energy, Sweden's pulp industry is also burning large quantities of sawmill residues such as sawdust and offcuts, or turning them into pellets. This diverts these by-products away from alternative uses such as panelboard production and other more durable wood products, which would have a lower climate impact. Using sawmill residues for energy generation drives up the total demand for woody biomass and therefore increases logging pressures on forest ecosystems.

Examples of pulp producing companies that burn sawdust include ATA Timber, which describes in a 2022 Environmental Report for its Waggeryd Cell pulp mill that its solid fuel boiler "mainly" burns sawmill residues, alongside pulp mill by-products (bark and sludge). Arctic Paper's upgraded biomass boiler at its Grycksbo mill [will also mostly burn sawdust](#). Another example is Holmen, a forestry company which owns three pulp and paper mills in Sweden, and one in England. It uses sawmill residues to produce electricity and heat for its pulp mills, such as its Braviken pulp mill, which is co-located with a company-owned sawmill. Its [operators reported in 2018](#) that the mill's solid fuel boiler was burning large quantities of sawmill residues.

A number of Sweden's pulp-producing companies are also building or have recently built new wood pellet mills. SCA has the largest production capacity, and its [five fully or partially-owned pellet mills can now produce up to 340,000 tonnes per year](#). In 2023, a new pellet plant adjacent to its Rundvik sawmill began operating in order to supply the recently replaced lime kilns at the Obbola and Munksund pulp mills, which run on wood pellets instead of fossil oil. This requires [around 38,000 m³ of wood pellets](#) (or [26,000 tonnes](#)).

Two of SCA's largest pellet mills are certified by the Sustainable Biomass Partnership (SBP), indicating that the pellets are produced for industrial and not domestic use. According to the Supply Base Audit for the 180,000 tonne capacity Härnösand pellet plant,

sawmill residues are sourced from up to 10 sawmills using wood from Sweden, Finland and Norway. SCA holds [9% of shares in and supplies the wood to](#) a pellet plant operated by Luleå Energi, with an annual capacity of 100,000 tonnes. According to the mill's [Supply Base Report](#), it uses sawmill residues from up to 12 sawmills, which receive wood from Sweden and Finland.

Stora Enso also operates two pellet plants in Sweden, each with a capacity of 100,000 tonnes per year. They are co-located with the company's Gruvön and Ala sawmills, making it likely that the wood used comes from sawmill residues. Arctic Paper is another pulp-producing company expanding into the wood pellet market, and is [constructing a pellet plant with a capacity of 50,000 tonnes](#) a year at its Grycksbo site. It expects to commission the plant in 2025, and the pellets are destined to be sold rather than used internally. Södra is also diversifying its manufacture of wood-based fuels, and [operates a pellet mill with a capacity of 40,000 tonnes a year](#) at its Våro mill, and [another with a capacity of 45,000 tonnes a year next to its sawmill in Långsjö](#).

Sweden produced 1.8 million tonnes of wood pellets in 2022, meaning that at full capacity pulp-producing companies would account for around 50% of Sweden's pellet production. The vast majority of the feedstock used for pellet production associated with the pulp industry is sawmill residues, equivalent to around 1.4 million tonnes of wood.

Pulp industry lobbying for large increases in primary woody biomass combustion

Sweden's Bioenergy Association (Svebio), representing several large pulp producers, including Arctic Paper, SCA and Södra, is *advocating for a massive increase in the amount of primary woody biomass burned for energy each year*. It claims that 148 TWh of forestry residues are left in managed forests annually, whereas only 10 TWh is collected and used for energy. According to the group, an increased harvest of 60 TWh of residues is possible while complying with EU Renewable Energy Directive's sustainability criteria.

In making this claim, Svebio is ignoring the scientific evidence around the key problems involved in burning primary woody biomass: first of all, pulp producers are logging forests that should not be logged at all. In addition, they log biodiverse forests via a harmful logging method: the FSC-certified so-called regeneration forestry (otherwise known, and in this report referred to as clear cut logging). . Which in effect results in monoculture tree plantations due to the fact that forestry companies had been replanting clearcut areas with single species plantations. Therefore, all types of primary woody biomass from these practices are unsustainable.

Today, clear cut logging is the *most common harvest method in Sweden*, and *accounts for 97% of all logging operations*. Given that boreal forest ecosystems store an enormous amount of carbon, these logging operations release *large amounts of the carbon stored in forests and soils*. Put together, the trees, plants, soils

and peatlands common to Boreal ecosystems store more carbon than the world's tropical forests. Boreal forests are the *single largest terrestrial carbon stock on the planet*, and *most of the carbon is stored in soils*, making clear cutting particularly harmful for the climate.

It has also been established that in Sápmi, *approximately 40% of today's clear cut operations* are likely to take place in forests that the EU wants to protect (the last remaining forest that never been clear cut). In addition, across the whole of Sweden, current logging plans in forests with confirmed high conservation values *amount to 40,179 hectares*. Already intensive logging rates coupled with existing low levels of protection will threaten Sweden's last remaining old-growth forests, meaning that virtually all unprotected natural forests in non-mountainous areas are *projected to be lost in the coming decade*.

Logging site in Sweden. Marcus Westberg





Today, [only 6% of Swedish forests are formally protected](#). The Swedish Forestry Agency's [2024 annual review of its environmental objectives](#) states that *"There is a negative trend regarding the state of the forest. At present, there are insufficient measures to ensure that forest biodiversity is preserved and that forest ecosystem services are maintained over time."* In addition, [government data shows](#) that 14 out of 15 forest habitats have an unfavourable conservation status, and the conservation status of 10 out of 11 woodland-living priority species is also listed as "bad". On top of this, [about 2000 forest species are red-listed in Sweden](#) according to the Swedish Species Information Centre, who state that *"Three out of four red-listed forest species are declining because of the conversion of natural forest with a long continuity into tree plantations. Swedish forestry methods, in particular clear-cutting, therefore have a strong negative impact on forest species."* To highlight how wide-spread these impacts are, [it is estimated that](#) 39% of the important biologically-sensitive habitats in Sweden were negatively affected by harvesting during 2014-2017.

This systematic conversion of irreplaceable forests into environmentally-harmful tree plantations is also threatening the rights of Indigenous Sámi communities. The reindeer that their indigenous culture rest upon have survived the harsh arctic climate for time immemorial, but after only 60 years of

Sweden's prevailing clear cutting forestry model, [71% of lichen-rich forests in Sweden](#) - crucial for the survival of the reindeer and indigenous culture - have disappeared. Sámi communities are sounding the alarm and letting the world know that *"the reindeer are starving,"* and have sent an [open letter to the government](#).

Sweden's FSC-certified forestry model is therefore a [guarantee of increased emissions](#), a continual loss of biodiversity and a systematic violation of Indigenous Peoples' rights. Halting the destruction and fragmentation of forest ecosystems as well as restoring and protecting more forests is fundamental; not least for [strengthening the resilience of ecosystems](#) during a period of extreme climate change. At a time when reducing emissions and safeguarding every possible carbon sink and carbon storage is critical, FSC-certified regeneration forestry (otherwise known as clear cutting) continuously [moves large amounts of carbon out of the forest stock](#) and into the atmosphere via its [logging methods and end-products](#).

The important question therefore is not how many TWh of bioenergy is produced by burning so-called forestry residues left behind during logging operations each year, but whether pulp producers can guarantee that the biomass does not stem from these destructive logging practices, which they cannot.

Climate impacts in the Swedish context

Sweden has experienced a sharp decline in its forest carbon sink (25% decline over a decade between 2011 and 2021¹¹) in recent years despite claims that its forestry practices are sustainable. Data from the Swedish Environmental Protection Agency highlights a “substantial reduction” in the forest and land carbon sink due to recent declines in tree growth and high logging levels and [acknowledges that](#) “The sharp decline in net storage may mean that Sweden will find it difficult to reach the EU’s common climate goals linked to the land use sector.” Any increase in the biomass extraction rate from Sweden’s forests would, therefore, clearly further reduce the ability of forest land to act as a carbon sink.

In addition, over a 50-100 year perspective, [burning woody biomass has a higher climate impact than fossil fuels](#) and emits more CO₂ per unit of energy. Studies also show that using primary woody biomass for energy production can [increase carbon emissions by around](#)

[40% compared to fossil fuels](#), if losses of soil carbon during harvesting are taken into account.

The science is clear: society urgently needs to reduce all greenhouse gas emissions, [including from burning forest biomass](#), while simultaneously and rapidly scaling up forest protection and restoration. Burning forest biomass does the opposite however, and over the all-important future years and decades, it will both increase emissions and decrease forest carbon stocks, moving enormous amounts of CO₂ from forests into the atmosphere. Scientists are also clear: in 2018, close to 800 scientists [signed a letter to the European Parliament](#) with a clear warning to parliamentarians that burning forest biomass will worsen our climate impact in the coming decades. The European Science Advisory Council (EASAC) [has also emphasised that](#) the burning of forest-based products could increase CO₂ emissions in the EU.

Logging site in Sweden. *Marcus Westberg*





The impacts of logging for pulpwood and bioenergy: The Swedish Forestry Model

Sweden has the [largest area of tree cover in the EU](#), at 23 million hectares (non-mountainous areas), and about 50% of Sweden's total land area [falls within Sápmi](#), the traditional lands of the Indigenous Sámi People. [Logging rates are constantly increasing](#) due to the competing demands from forest industries to produce timber, pulp, paper, bioenergy, biofuels and other products, with more than half of [Sweden's annual wood harvest being turned into pulp](#) or used for energy generation.

The Swedish Forestry Model is based on the clearcutting of older forest stands, natural and near-natural forests, and replacing them with planted tree-stands. The model [exists for the benefit of large industries](#), and [allows forestry companies to police their own practices](#), thereby simultaneously adhering to standards of conservation and carrying out highly-destructive and extensive clearcutting predominantly of old growth forests, since most of the country's plantations are still too young to harvest.

In practice, only a few small islands of trees are retained for conservation purposes after forest clearcuts. These logging practices are [contributing to biodiversity loss and the decline of vital forest ecosystem functions](#), such as water quality and other essential elements that life requires in order to flourish.

The model of forestry carried out by Sweden's pulp and paper industry is part of a green colonial paradigm which exploits the traditional lands of the Sámi, causing deep fractures in the Sámi's way of life and a mosaic of oppressions created by the industries, politics, policies

and institutions that uphold the model. The Sámi have traditionally lived through reindeer herding, hunting, fishing, trading and *duodji* (arts and crafts), but their livelihoods have been severely affected by many colonial exploitations such as forestry. The Swedish state has systematically forced the Sámi from their lands, forbidden them to speak their languages and practise their culture and spirituality.

Sweden's forestry practices [have been described as "a disaster for the Sami, biodiversity, the countryside's development, the small-holding land owners, and the nature tourism industry."](#) Reindeer in particular [rely on older and lichen-rich forests](#), which are often the forests that the forestry companies are now logging. Sweden has [lost over three-quarters of its old growth forests since the 1950s](#), and the remaining pockets of relatively intact forest ecosystems are being logged at an alarming rate. The Council of Europe's Committee of Ministers have even published a resolution sharply criticising Sweden's treatment of the Sámi, and specifically calling on the Swedish government to protect their cultural practices on their traditional land, particularly reindeer herding.¹²

Sweden's state-owned forest company sells more than half of its annual harvest to the pulp and paper industry

Sveaskog is a state-owned forestry company that is Sweden and Europe's largest forest land owner, with 3.9 million hectares. According to the company, 68% of those overlap with reindeer herding areas (Sápmi). Sveaskog supplies pulpwood to around 20 pulp and paper mills, equivalent to 5.5 million m³ of wood in 2022, which was 51% of the total volume sold by the company. It also supplied 0.45 million m³ of primary woody biomass for energy generation to around 50 customers in Sweden in 2022, equivalent to 1.2 million m³ of woodchip.¹³ According to National Geographic Explorer Staffan Widstrand, "most of the clearcut logging on Sámi land is carried out by Sveaskog, and often at a direct loss. So we can say that the Swedish taxpayer is actually continuously subsidizing the deforestation of Sámi lands, for the good only of the privately-owned industry giants."

Sveaskog claims that its "biofuel is a by-product from felling and consists of branches and tree tops that would otherwise be left in the forest after felling. The natural decomposition process releases the same amount of CO₂ that is emitted during controlled combustion with heat extraction in a heating plant," but offers no scientific reference for this claim and contradicts studies showing that significant amounts of carbon remain locked in forest soils as biomass decomposes. It also describes how "The customers for Sveaskog's biofuels are power and heating plants as well as the energy-producing forest industry...Sveaskog felt that the consumption of biofuel generally increased as a result of several co-generation plants having increased electricity production compared to previous years," showing how electricity generation and therefore state-funded incentives are directly driving increased use of primary woody biomass for energy generation.

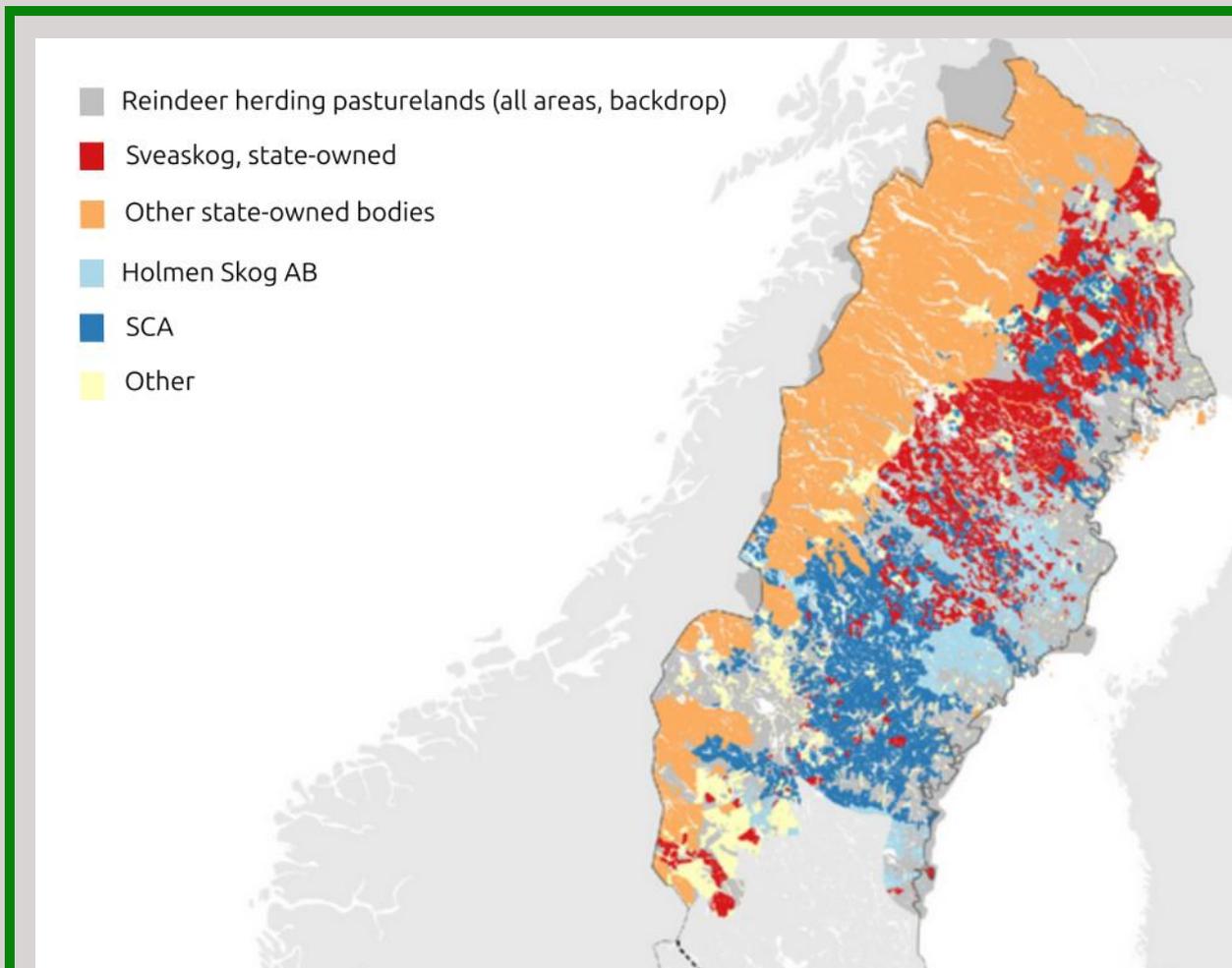


Figure 1: Map of large forest property owners in Sweden within reindeer herding areas.
Adapted from: [David Harneskinland \(2022\)](#)

SCA: Systematic harm to irreplaceable ecosystems and Indigenous Peoples

SCA is Sweden and Europe's largest private forest owner, accounting for 2.6 million hectares of forest land, *much of which falls within Indigenous Sámi reindeer herding areas (Sápmi)*. SCA's logging practices are *extremely controversial*, and have *attracted numerous protests from Swedish civil society groups* over their extensive clearcutting of irreplaceable forests.

Protect the Forest has *recently collected 500 examples* showing how the company has systematically logged natural forests with high conservation values. The group also highlights the high number of similar cases that go unreported, and the many examples of biodiversity-rich forests that SCA plans to log in the near future. *Another study conducted by Protect the Forest* analyzed data on all forests notified for clear-cut logging by SCA, and found that more than a third (37%) consist of so-called probable continuity forests, which are forests that have never been clear-cut before. In February 2024 alone, a total of 36,802 hectares of continuity forests was notified for clear-cut logging by the company. The analysis also highlights examples of where SCA has logged its own previously set-aside areas for nature conservation, and what proportion of the forests that SCA has clear-cut have been converted into tree plantations. Essentially, these studies show how SCA is systematically converting naturally regenerating forests into tree plantations.

As another example, in 2021, SCA felled an area of ancient forest in the municipality of Arjeplog with centuries-old firs and pines, even though the site was due to form part of a nature reserve in order to protect its high biodiversity value. SCA originally requested a logging permit for 120 hectares on the Maskaure reindeer administrative association's land, which included 25 hectares of

an especially rare and ancient forest type. The average age of the trees was around 180 years-old, with some as old as 300 years, and the forest had abundant lichen as well as being a habitat for 16 red-listed species.

According to Amnesty Sápmi, SCA has received a number of fines for illegal logging in recent years, and in one case defied a logging ban in a reindeer grazing area on six different occasions.

SCA has also caused harm to Sámi reindeer herders due to their replacement of natural forests with contorta pine (*Pinus contorta*, also known as lodgepole pine), which is non-native. In addition, contorta spreads outside plantation areas, and has *even been found on mountain areas 820 metres above sea level* (on Grönfjället in Härjedalen).

SCA's Munksund pulp mill. *Marina Ilaria*



Successful campaigns against logging of precious forests for pulp production

Recent successful campaigns against logging operations linked to pulp-producing companies include:

- In March 2024, Södra began [felling a highly biodiverse forest](#) in a proposed nature reserve north of Lake Risten in Östergötland, which is an important habitat of several protected bird, insect and plant species, among them a red-listed species of moth (*Baptria tibiale*). Following legal action by the Östergötland Nature Conservation Society, the [court ordered an immediate halt to logging](#).
- Despite ATA Timber's "sustainable forestry" claims, [forest campaigners had to launch a fortunately successful campaign](#) to stop the company's plans to log a forest at Kulla in Småland, which has 300-year old trees and is a habitat for numerous red-listed species.

Contorta pine was introduced on a large scale from North America in the 1970s, and its introduction is, [according to the Swedish University of Agricultural Sciences \(SLU\)](#) "a large-scale ecological experiment." Contorta plantations today cover approximately 600,000 hectares in Sweden and [SCA is responsible for managing half of this area](#). More than 85% of contorta plantations are located on Indigenous land (Sápmi), and it is notable that the Swedish Forestry Act actually prohibits, with some exceptions, contorta pine to be planted south of the 60th parallel. Reindeer herding areas start just north of the 61st parallel, meaning that contorta pine plantations are almost exclusively allowed on Indigenous land. [Studies show that](#) reindeer avoid areas with contorta pine and that the forest industry's choice to plant them has strongly contributed to the significant loss of lichen-rich forests over the last 60 years.

Sámi communities have a [zero-tolerance policy](#) towards planting contorta pine, but SCA does not respect the Sámi communities' [rights to free, prior and informed consent \(FPIC\)](#). Contorta also suffers [more than twice as much damage from wind and snow](#) compared to

native trees, making these dense plantations particularly difficult for reindeer to pass through. In Sweden, contorta is used almost exclusively to produce pulp, as it [does not pass the standards](#) that would allow it to be used in construction. [Forestry companies prefer contorta pine](#) as it is faster growing, can be planted more densely and is resistant to some of the diseases that can affect Swedish pine.

[Other impacts of SCA's logging and plantation operations](#) include the intensive use of fertilisers, which reindeer herding associations say harms lichen growth and reduce the amount of light that reaches the forest floor due to denser tree growth. SCA's [numerous wind farm developments](#) involving hundreds of turbines being installed on traditional Sámi lands have also been particularly controversial, as the company has pursued becoming "one of Sweden's leading suppliers of fossil-free electricity produced by wind power." Wind developments are [another threat faced by the Sámi](#) alongside industrial transmission lines, forestry, mining, hydroelectric and infrastructure developments.

Conclusions

Sweden's pulp and paper industry, as the central pillar of the forest sector as a whole, plays a substantial role in bioenergy generation and the combustion of primary woody biomass. Up to a third of the primary woody biomass burned each year can be attributed directly and indirectly to pulp-producing companies, with SCA and Södra playing the most prominent role.

Although Sweden's forest industries claim that the primary woody biomass they use to generate energy is residual biomass from logging operations, and that trees are not cut down specifically for energy purposes, lucrative incentives offered for burning biomass and generating biomass electricity are key to the industry's profitability as a whole. Burning biomass, of which primary biomass plays a substantial role, therefore underpins the entire viability of the pulp industry and enables the logging of whole trees and the clearcutting of forests, regardless of what fraction of a tree is used in a sawmill, pulp mill or burned for energy.

Sweden's pulp and paper companies are also responsible for a significant proportion of the sawmill residues that are burned each year, in particular through wood pellet production. Pulp-producing companies oversee around 50% of Sweden's pellet production, and almost all of the feedstock used in the process comes from sawmills. This diverts wood away from alternative uses such as panelboard manufacture,

which would have a lower climate impact, and indirectly results in increased logging pressure due to the additional demand for biomass that is created.

Underpinning the use of primary woody biomass for energy generation in Sweden is a forestry model that, despite its tremendous efforts to paint itself as sustainable and socially-responsible, is resulting in the decimation of Sweden's remaining highly-biodiverse forests, and directly threatening the livelihoods of the Indigenous Sámi peoples. The pulp industry is at the heart of the continued logging of precious forests, exemplified by the fact that more than half of the volume of wood harvested by state-owned forestry company Sveaskog (Europe's largest forest owner) goes to pulp mills, and that one of Sweden's largest pulp producers, SCA (Europe's largest private forest owner) has been fined on multiple occasions for illegally logging high-value forests both on and outside of Indigenous land.

A pine seedling. *Marina Ilaria*



Notes

1. Statistics were calculated by using SEA data and this converter: <https://www.convert-measurement-units.com/conversion-calculator.php>
2. This figure includes energy generated by burning black liquor, as well as primary and secondary woody biomass such as logging residues and bark. Source: <https://www.energimyndigheten.se/forskning-och-innovation/forskning/bioenergi/biokraft/>
3. Billerud has a long-term agreement to purchase one million cubic meters of wood annually from its subsidiary, Bergvik Skog Öst. If on average 10% of wood harvested from Swedish forestry operations is burned for energy (<https://link.springer.com/article/10.1007/s12649-020-00947-0>), that would equate to 100,000 m³ of primary woody biomass being burned at Billerud's Swedish mills each year.
4. 600 GWh of delivered unprocessed biofuels is equivalent to 750,000 m³ of woodchip.
5. In 2023 SCA produced 972,000 tonnes of pulp and 1,879,000 m³ of timber and solid wood products. Its total fuel consumption from biofuels was 9,280 GWh, and pulp mills consumed 5,393 GWh from biofuels. 972,000 tonnes of pulp would produce around 194,000 tonnes of bark, equivalent to 648,000 m³ (if one m³ is equal to 300 kg: <https://www.osti.gov/etdweb/servlets/purl/951488>), which is equivalent to 389,000 MWh (0.6 MWh/m³). 1,409,400 tonnes of black liquor would also be produced (145t DS/ADt) = 1691280000 (12 MJ/kgDS) = 4,735,584 MWh (1j=0.00028MWh) = 4,736 GWh. 4,736+390 GWh = 5126 GWh. Equivalent to an extra 134,000 tonnes of bark. Total biomass fuel consumption other than pulp = 3,887 GWh = 4,858,750 m³ woodchip. Waste wood produced through solid wood products = 4,697,500 m³ sawdust and woodchip. Wood pellet production 300,000t = 450,000t wood required = 1,500,000 m³ woodchip. Therefore an additional 1,660,000 m³ of woodchip would be required to achieve total fuel consumption from biofuels.
6. Biodiesel is made by reacting vegetable oils or animal fats with methanol, which is almost always derived from fossil gas.
7. Hydrotreated Vegetable Oil (HVO) is chemically similar enough to fossil fuels that it can be used in combustion engines in unlimited quantities without further refining (although for use in aviation further refining is needed).
8. Stora Enso harvested "10.5 million m³ forest cubic meters" from owned and leased forests in 2023, and delivered 10.2 million m³ to its mills. 0.3 million m³ (3%) was therefore energy wood. Total deliveries to all mills were 28.1 million m³, excluding energy wood. If energy wood is harvested at the same proportion, then all energy wood is equivalent to 843,000m³. Sweden (and Norway) represents 23% of total wood use, equivalent to 194,000 m³ of energy wood.
9. Assuming that woodchip has an energy density of 0.8 MW/m³.
10. If the Nymölla Mill's annual production capacity is 340,000 metric tons of pulp, this would be equivalent to around 68,000 tonnes of bark and 493,000 tonnes black liquor, or a combined 561,000 tonnes. If the total biomass use is 632,428 tonnes, then 70,000 tonnes of biomass could have been primary woody biomass.
11. National Inventory Report, Sweden (2023). Greenhouse Gas Emission Inventories 1990-2021 Submitted under the United Nations Framework Convention on Climate Change.
12. Kuhn, G. (2020) *Liberating Sápmi: Indigenous Resistance in Europe's Far North*
13. One m³sub is equivalent to 2.63 m³ of loose woodchip (<http://woodenergy.ie/media/coford/content/publications/projectreports/cofordconnects/ht21.pdf>).