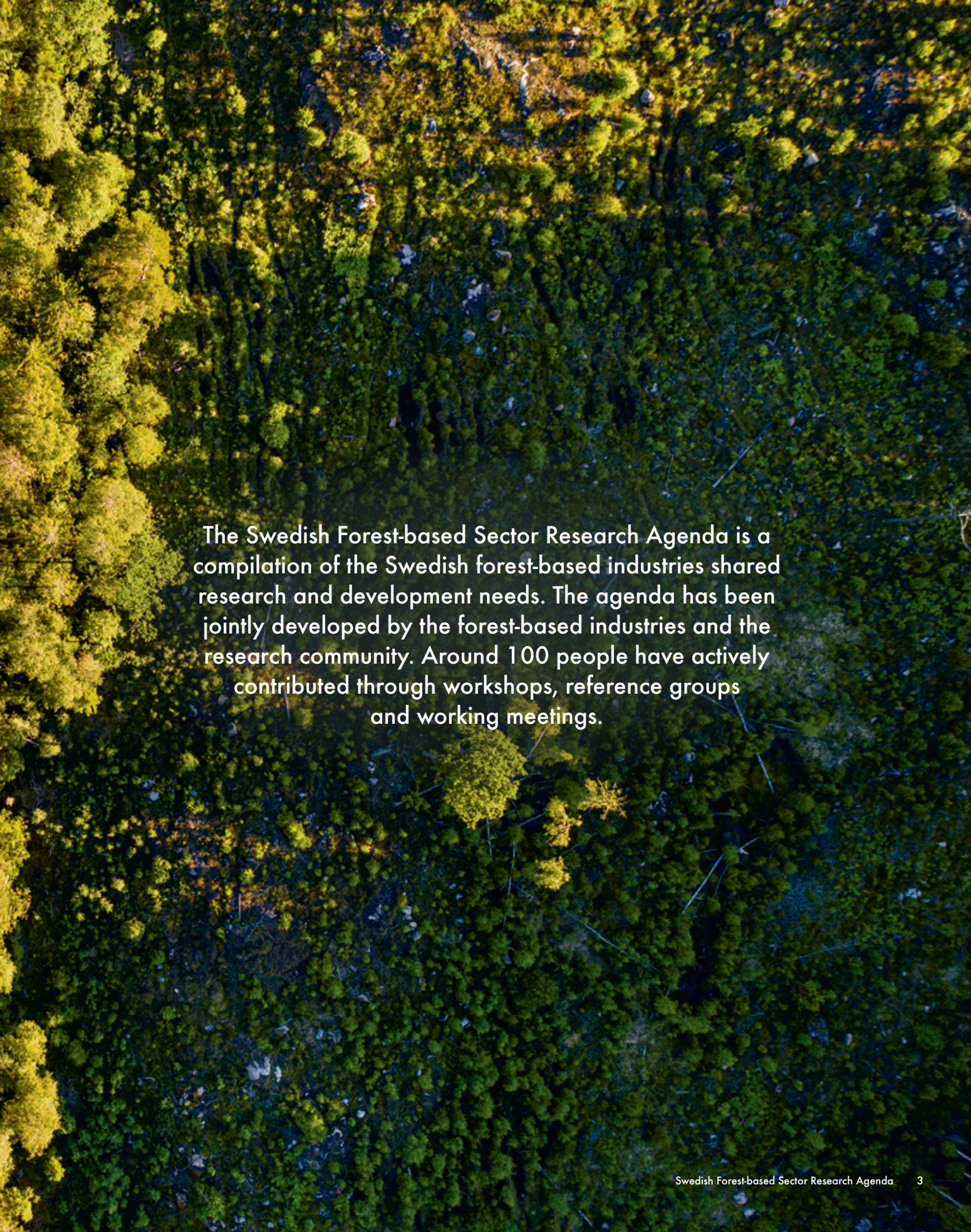
Swedish Forest-based Sector Research Agenda

For a circular bio-based society

The forest industry is an important part of the solution to major societal challenges, pointing out the path towards a circular bio-based society. However, more research is needed in order to achieve Sweden's climate goals and the UN's goals for global sustainable development.



The Swedish Forest-based Sector Research Agenda is a compilation of the Swedish forest-based industries shared research and development needs. The agenda has been jointly developed by the forest-based industries and the research community. Around 100 people have actively contributed through workshops, reference groups and working meetings.

Qvillestaden is a multi-family housing in central Gothenburg. The whole projec t is Nordic Swan eco labeled and great consideration has been given to sustainability, the environment and to surrounding buildings.

Transition demands more research

Torgny Persson,
Director of Research
and Innovation
at the Swedish Forest
Industries Federation

Forests play a crucial role in the transition to a circular bio-based society, contributing significantly to Sweden's economic growth, creating social benefits, and enabling the whole country to develop.

Sweden is the world's fifth largest exporter of forest-based products. Swedish forestry and the forest-based industries are in an expansive phase and are world leading in the research areas driving the transition to a circular bio-based society. In other words, the Swedish forest-based industries has fantastic opportunities for powerful contributions to the development of a society which is socially, economically and environmentally sustainable. The journey has already begun and by increasing research investment, existing processes and products can be developed and supplemented with new competitive technologies, as well as new products and materials.

To achieve strong research initiatives, a large number of representatives from the forest-based industries and the research community have jointly identified the areas that need strengthening, in order to exploit the potential of our renewable forest raw material. The result is the research agenda you are holding in your hand.

Using the Swedish Forest Sector Research Agenda as a starting point, dialogue with funding agencies and decision-makers both in Sweden and internationally is underway. The agenda is also important in establishing the cross-border research collaborations that are vital to maintain a high academic level of research, to be of global benefit and to accelerate the transition to a circular bio-based society.

The agenda has been developed jointly by the forest-based industries and the research community. Heartfelt thanks to everyone who has rolled their sleeves up, and participated in the important work of finalising the The Swedish Forest-based Sector Research Agenda!

The Swedish forest and the forest-based industries create both the conditions and the solutions for sustainable development and societal benefits for people all over the world. The industry and the researchers are developing the climate-smart society of the future, and showing that it is possible to reduce the daily use of fossil materials and products through bio-based solutions.

In the near future, high-rise wooden buildings and extensions will provide resource-efficient and climate-efficient solutions for the world's cities, and industrial wood construction will continue to contribute to more sustainable buildings.

World-leading processes and technologies are used to manage and process forest raw materials from actively managed forests. Research is helping to ensure that the forests can continue to be the basis for a variety of ecosystem services, with knowledge and dialogue as a foundation for management and stocking in the future.

The forest-based industries packaging materials, textiles and hygiene products are supplied to world markets and they contribute to a global reduction in the use of fossil materials. Fibre from the forests can be recycled and reused for new products. Materials from renewable forest raw materials are further developed and new products are created.

The forest-based sector is an important part of the solution to major societal challenges and is leading the way towards a circular, bio-based and resource-efficient society. However, more research and development is needed in order to get there. Founded on research and knowledge, the forest-based industries is helping to achieve Sweden's own climate goals and the UN's global sustainable development goals.

More products from the forest

Sweden aims to become one of the world's first fossil-free welfare states, and Sweden's climate goal is to have zero net emissions of greenhouse gases into the atmosphere by 2045. Forests and

forest-based industries products are crucial to achieving these climate goals. Renewable forest raw materials create benefits both for society and for the environment by replacing plastics, concrete and other materials with greater climate impact.

The forest-based industries not only contribute to more bio-based products, but also to the Swedish economy and to employment. The forest-based industries products provide climate benefits in other countries, but also bring great export earnings to Sweden. Being competitive in global markets creates jobs throughout Sweden and invigorates rural areas.

Growing trees store carbon and reduce the amount of carbon dioxide in the atmosphere, besides which carbon continues to be stored in the long-lived products made from forest trees.

Increased knowledge and research create even more opportunities to replace fossil raw materials - to the benefit of both the environment and the climate. Research into improving the efficiency of industrial processes is needed in order to secure the industry's competitiveness, and to contribute to the Swedish economy and employment. ●

→ 80% of forest-based industries products are exported, thereby contributing to global sustainable development and to climate benefits beyond Sweden's borders.

Research for resource efficiency

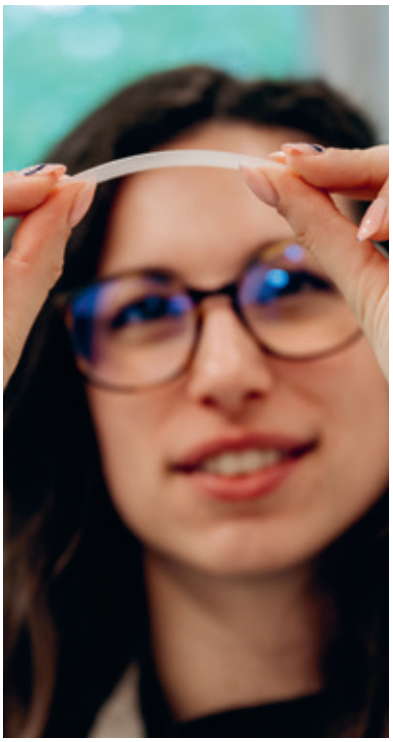
Every part of a harvested tree is used where it creates the most value – this is an important principle for the environment and the climate, but also from a financial perspective. The strongest part of the trunk becomes timber for long-lived products such as houses and furniture. The thinner part becomes pulp for the production of packaging materials, printing paper, toiletries and textiles. Branches, tops and sawdust are processed into bioenergy, for example.

Research into resource efficiency facilitates new and further developed processes where forest raw material and energy are both used even more intelligently and efficiently, and where an increased proportion of forest raw material is used in durable products. ●

Research for excellence

Research not only contributes to new results; it is also a prerequisite for a supply of expertise and competence. The role of forestry in the transition to a circular bio-based society creates a need for skills that requires high-quality education at secondary school, vocational college and at university level. Investment in research also increases Sweden's competitiveness as a research country, and helps to establish strong research teams in areas promoting a sustainable forest-based industries. So, research and education are closely interlinked.

Research produces qualified research leaders and teachers, as well as relevant training courses that ensure a skilled workforce for the future. ●



Research for sustainably managed forests

Forests are valuable – for the plants and animals that live there, for people and for society as a whole.

Large, well-managed forests form the basis for a growing Swedish bioeconomy and are of great importance in working with climate change. Swedish forests are managed according to production and environmental objectives based on the Forestry Act. Therefore, preserving and developing biodiversity, while at the same time achieving increased growth and efficient production, is an important objective. Ambitions are equally high in terms of dialogue with the public to achieve a common understanding of forest management and addressing conflicting objectives.

Growth and wood supply are both steadily increasing, and at the same time the habitat for several critical species is continuously developing, something made possible by many years of research. By gaining a deeper understanding of forest processes, forest management is evolving regarding all the different values we associate with forests . A common knowledge base benefits societal dialogue as well as decision-making about the forests, both of which are often characterised by great complexity.

Increased knowledge and research into forest management enables a balance between growth, production and nature values, providing factual information as a firm foundation for evidence-based dialogue, informed decisions and collaboration. In this way we can promote interplay between the various values of the forests. ●

→ Sweden has twice as much forest as it had a hundred years ago, and at the same time gets more products out of the timber harvested than ever before. Carbon dioxide equivalent to 80% of Sweden's fossil fuel emissions, is sequestered in the Swedish forests every year.

→ Around 26% of the harvested tree becomes sawn timber, such as glued laminated timber/glulam beams for houses - as shown in the picture. 30% becomes pulp, which is used to produce paper, cardboard and hygiene products. The remainder is mostly used for bioenergy.

The Tree Tee from Houdini is made from 100 percent Tencel lyocell, a textile from the forest.

→ Products made from forests are crucial to achieving the climate goals. The renewable raw material creates benefits for society and the environment since it replaces plastics, concrete and other materials that have great climate impact.

Materials for recycling

The forest is part of an eternal cycle. Cardboard and other fibre-based packaging materials can be recycled dozens of times without energy-intensive processes. The collection rate for packaging materials is high, as is the proportion that is recycled. A circular society needs to develop recycling systems for other bio-based products, such as textiles and wood. In addition, forest raw material is fully renewable.

Research on design for circularity is needed, to enable even more forest-based materials and products to be recycled, and so that today's fossil-based linear products can be replaced by more bio-based, circular solutions. ●

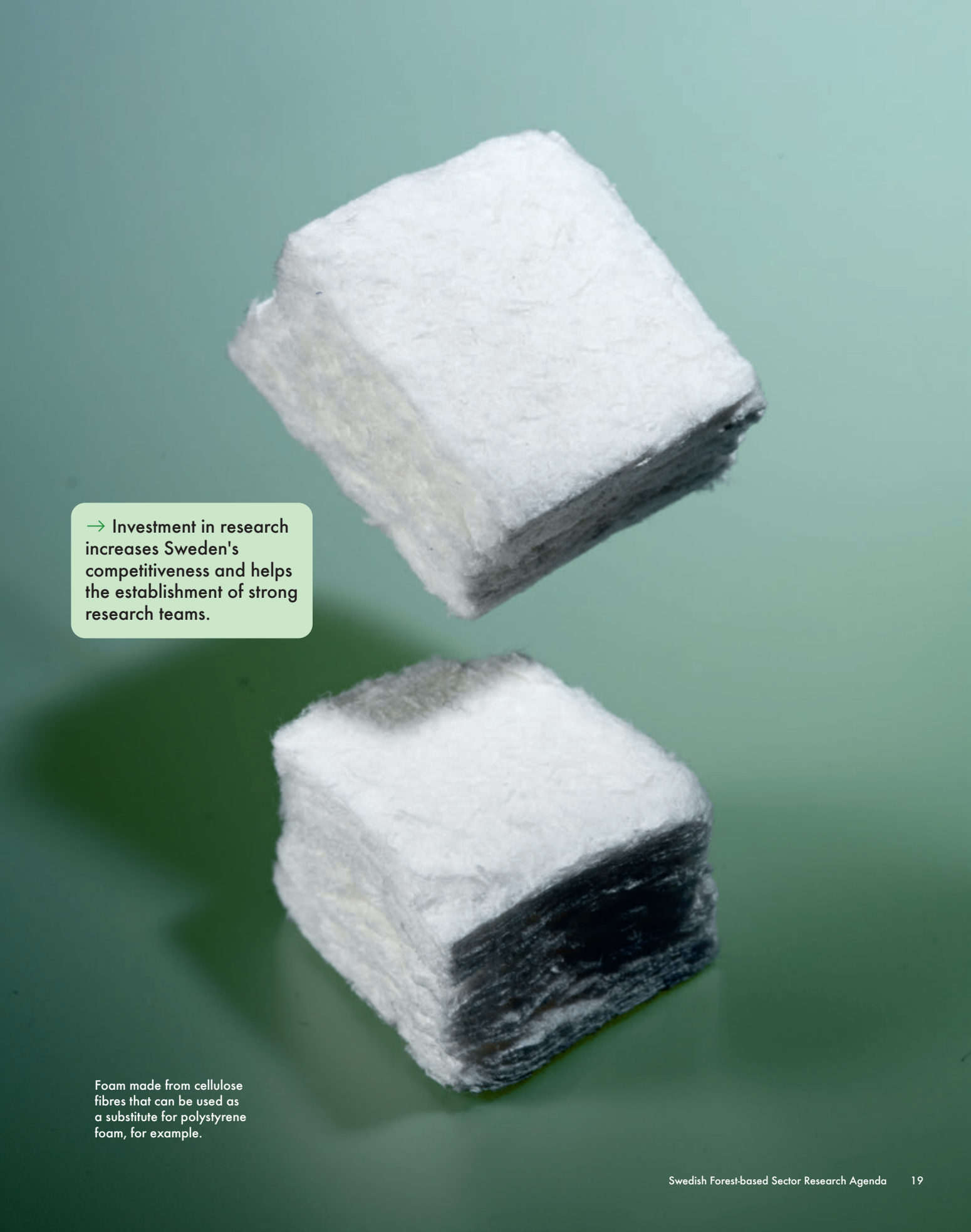
Collaboration for greater impact

Both Sweden and the wider world need a circular bioeconomy to tackle the major challenges facing society. The renewable forest raw material is a significant part of the Swedish pathway, but broad collaboration is needed between all the green industries and within the bio-based process industries. The entire bioeconomy – with raw materials and products from forests, fields and water – must be developed jointly.

Forestry and forest industry research also needs international collaboration to maintain the highest level, and to have global impact.

By making better use of EU financial support for research projects linked to sustainable development, the forest-based sector can accelerate the pace of the green transition. ●

→ Investment in research increases Sweden's competitiveness and helps the establishment of strong research teams.



Foam made from cellulose fibres that can be used as a substitute for polystyrene foam, for example.

The Tree-Kånken backpack is made from Pine Weave, a material made from forest raw materials using sustainable methods.

→ The forest-based industries employ 120,000 people throughout Sweden.

Simulation models are combined with forest data from laser scanning to develop autonomous functions, and to predict which routes are the easiest to navigate and the most environmentally friendly. Here we see a simulation model of the XT28 concept forwarder in a virtual forest.

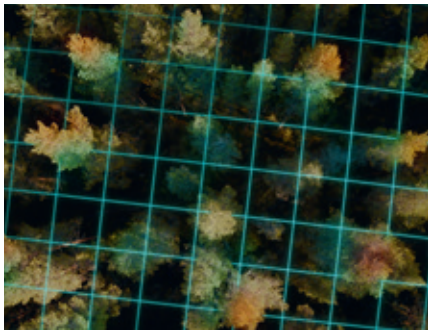
Research priorities on the road to a circular bio-based society

The forest-based industries are well placed to be the driving force in the development of a circular bio-based society. Research creates the basis for the forest-based industries to invest in and develop solutions with long-term profitability and global competitiveness. Solutions that contribute to more sustainable consumption and to worldwide climate benefits. The forest-based industries is well on its way, but strong joint research programmes create the opportunities for going even further.

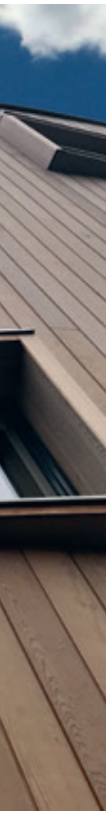
The forest-based industries see the following research priorities as paving the way for the transition →

The right research priorities ensure profitability and global competitiveness.

Increased growth of forest raw material in a forestry system that is digitalised and sustainable, that ensures functioning ecosystems and biodiversity, and that minimises the risks of damage and fires.



Increased use of wood in construction as a significant and cost-effective climate measure, and as a natural part of sustainable development in society.



More bio-based materials and products to replace fossil alternatives, and to pave the way for an increased number of bio-based solutions in new markets.

Further developed production processes as the basis for continued global competitiveness, and to ensure efficient use of forest raw material, and energy.

→ Almost a third of a tree consists of lignin, which could be used as a raw material for batteries, glues, bio-fuels and other products in the future.

Developing efficient and recyclable barriers for food packaging is crucial.

Forests contribute to the Global Goals

The growing forest and forest-based industry operations provide solutions that contribute to the 17 UN Sustainable Development Goals (SDGs), in particular to six of them, and to the European Green Deal, the EU's strategy for a green transformation.

Forest-based sector research is linked to these frameworks, and the industry's potential to contribute is described in four key words: sustainability, circularity, resource efficiency and fossil-freedom. The next spread gives a picture of what these key words mean for the forest-based sector.

These keywords are the foundation for our research areas (pages 34 to 65) which provide an in-depth presentation of the needs and opportunities for further development towards a circular bio-based society.

Global goals which forests and the forest-based industries contribute to in particular

How the forest-based sector contributes to the Global Goals and the Green Deal

Sustainability

The forest-based sector has great ambitions for ecological, financial and social sustainability, for the benefit of society as a whole. Forests are a recreational area for people and a home for countless plants and animals. Forest biodiversity is important for the survival of the entire planet. Environmental stewardship in forest management is a prerequisite for all forest ecosystem services, and through further research these can interact and be better exploited.

Forest raw materials are used to make fibre-based products, health care products, hygiene and protective products, food packaging that reduces food waste, sustainable textiles, furniture and furnishings, components for the manufacturing industry, as well as durable housing, offices and public facilities. Bioenergy production contributes to long-term sustainable energy supply. Wood construction on an industrial scale contributes to creating attractive workplaces and beautiful, sustainable and inclusive homes across the country. The forest industries also contribute to the replacement of fossil-based products with bio-based ones.

Circularity

Renewable forest raw material from a sustainably managed forest carries circularity in its DNA. The forest and its products are part of a perpetual cycle that begins with the sequestration of carbon dioxide by growing trees. After harvesting, the renewable forest raw material then becomes products that are recycled and that store carbon throughout their lifetime. A single wood fibre can be recycled dozens of times, and when the wood fibre is finally converted into bioenergy or decomposes, carbon is released as carbon dioxide and absorbed by growing trees. This cycle is central to reducing the climate impact of society as a whole.

Today's well-established collection of cardboard and paper allows for efficient recycling, and the fibre is recycled without energy-intensive repurposing and recycling processes. However, similar systems need to be developed for other bio-based products such as textiles and wood. Research expands the uses of forest raw materials, reduces waste and increasingly adds value to the industrial processes.

Resource efficiency

The forest-based industries do not let anything go to waste, instead it uses the whole tree – every part being used where it generates the most value. As much of the tree as possible becomes timber while the thinner part of the trunk is used for pulp production. At the sawmills and within the industry, bark, sawdust and residual streams are all reclaimed and processed into products such as chemicals and bioenergy. Research is ongoing to increase resource efficiency in the use of raw materials in manufacturing processes. The forest-based industries are also developing environmentally friendly technologies that reduce energy and material consumption in the industrial processes.

In forestry, resource efficiency includes careful balancing of planting, thinning, harvesting and transporting. Among other things, research contributes new digital systems that promote resource-efficient and considerate forest management, based on data concerning trees, terrain, biodiversity and so forth.

Fossil-freedom

Renewable forest raw materials play a key role in the transition to a fossil-free society. Through research, some of the energy and products currently produced from fossil raw materials can be replaced by bio-based alternatives in the future.w This is an important development for the climate, so the objective of research is to ensure that bio-based products perform as well as, or better than their fossil-based predecessors. Research linked to areas such as construction, textiles, chemicals and manufacturing is expanding the uses of forest raw materials, and helping these sectors to reduce their climate impact.

Residues from forestry and forest industries are used as fuel in combined heat and power plants to generate fossil-free electricity and heat. The remainder is used by the forest-based industry itself, to produce its own bioenergy. Today, 96% of the Swedish forest-based industries processes are fossil-free – all that remains is to phase out the final fraction of fossil energy from factories, machinery and vehicles.

Research areas for the forest-based sector of the future:

The forest-based industries have great potential to pave the way for sustainable development in several areas. The areas presented in the following section are based on a joint assessment, by the forest-based industries and the research community, of the areas where increased research will create opportunities to accelerate the move towards a circular bio-based society.

The research areas are divided into sections for Forest and Forest Raw Material, Wood Processes and Wood Products, as well as Fibre-based Products and Biorefineries.

Needs and objectives are described within each research area. We also clarify the contribution of these areas based on the key words: *sustainability*, *circularity*, *resource efficiency* and *fossil-freedom*.

Forests and Forest Raw Materials

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- Cultivation and management of forests for different purposes
- Forests for sustainable development
- Prerequisites of forest ecosystems for sustainable management
- Forest raw material: availability, properties and new opportunities
- Value-adding harvesting and efficient transportation

Wood Processes and Wood Products

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- Wood for sustainable community development
- Resource-efficient industrialised wood construction
- Tailor-made wood-based products
- Processes for the manufacture of wood products
- Resource efficient process in sawmills
- Renewable wood-based products in circular systems

Fibre-based Products and Biorefineries

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- Improved utilisation of residual streams
- Fibres with higher wood yield
- More resource-efficient processes
- Fossil-free chemicals
- Recyclable packaging solutions
- New materials from forest raw material
- Fibre-based products in circular systems
- Pulp and paper mills in a fossil-free energy system

Forests and forest raw materials

Cultivation and management of forests for different purposes

RESOURCE EFFICIENCY

A circular bio-based economy requires an increased and reliable supply of forest biomass. In order to achieve this, knowledge, technologies and methods for sustainable forest cultivation and production are needed.

How the research field addresses societal challenges

In the Swedish and European context, biomass from the forests is an important source for achieving fossil-independence Renewability and circularity give forest biomass an advantage over many other materials.

At the same time, many claims are made for other benefits and different functions of the forests. It is a societal challenge to balance these for the greatest possible combined benefit and sustainability. Therefore, research on new forest management practices is imperative.

Descriptions and motivations from the perspective of the forest industries

For the forest-based bio-economy to grow and be competitive, raw material production and existing and new end products must be continuously developed. At the same time, development must be sustainable. A changing climate could increase the risk of damage from weather, insects and fungi. Longer growing seasons can be utilised to increase production and sequester more carbon in the growing forest, and in forest-based products. In this way, the amount of carbon dioxide released from fossil alternatives can be reduced.

The condition of the forest seen in Swedish forestry today is the result of the management of many generations. This has resulted in historically large timber stocks and harvests with sustained great potential. At the same time, both growth and quality aspects are negatively affected by wildlife and insect damage to seedlings and young forests, while well managed regeneration is an important factor for success.

Profitability, nature conservation and the objectives of different forest owners also influence the prospects for forest production and for the production of other ecosystem services.

Vision

New knowledge is implemented in effective regeneration of forest stands, including mechanised and automated forest management. Developments are based on knowledge of ecosystem functioning, of plant physiological advances, genetic and biotechnological advances, effective pest control and increased digitalisation. Natural regeneration methods and management without clear-cuts are used as an alternative to traditional harvesting practices. Production intensity is varied depending on the conditions and objectives for the specific area. Forest management also aims to create a diversified forest at landscape level.

Information from harvested forests is used to develop greater precision in the choice of measures, silvicultural products and forest management, so that the production of forest raw material can be significantly increased. IT as well as measurement and monitoring technologies provides the means to monitor the results of the regeneration measures implemented.

Relevant research

Research for efficient, mechanised and automated forest management in different management systems is of great importance. Continued long-term investment in genetic improvement and efficient propagation methods that provide full access to well-adapted plant material is needed. This will increase the potential for higher and more value-added production, as well as readiness for mixed forests and wider use of more tree species, such as birch. Continued research to detect, prevent and manage forest damage remains a priority. Long-term trials and fixed reference sites are of great value in validating results and climate effects, and in rapidly investigating emerging issues.

Research is also important in the development of sustainable systems for the production of increased biomass and added value. This includes modelling the production and quality effects of clearing and thinning in tract-based forestry and non-clear cutting practices. Digitalisation for precision forestry using data including forests, soils, water, cultural and ancient monuments in combination with production data on growth and characteristics of harvested trees is also a priority.

Communication, education and advice are key to how growing stock and management models can best be combined.

Forests for sustainable development

Sustainable development in line with UN Agenda 2030 guides the forest-based industries research and operations going forward.

How the research field addresses societal challenges

Society and industry are facing a series of decisions on complex issues related to fossil-freedom, climate adaptation, biodiversity and a variety of societal aspects. At the same time, welfare and competitiveness must be maintained and improved. Research and syntheses, often with an interdisciplinary approach, which provide actionable evidence are indispensable and crucial elements in making the decisions mentioned above.

Descriptions and motivations from the perspective of the forest industries

Sustainable development requires development and innovation that balances financial, environmental and societal aspects. Forests and forest land are valuable societal resources that are owned and managed by private forest owners, forestry companies, the state and municipalities, the church and foundations. Continued sustainable development is achieved by providing all these categories of forest owners with the knowledge and tools they need to set sound economic, environmental and societal objectives based on their own situations. Sustainability, clarity and transparency are key words when the forest-based industries and society formulate the research and development needs that promote long-term management and forest ownership. Interdisciplinary research on forest-related issues and dialogue between different societal stakeholders needs to increase. Research for knowledge-driven development of technologies and sustainable practices that take the whole value chain into account is another fundamental prerequisite.

These days, society has a broad understanding of humanity's impact on the climate, but there are also different views of how best to manage forests to achieve climate goals. This is where more foundational understanding is needed on issues such as existing and potential effects of active and passive carbon sequestration, sustainable materials and energy substitution, as well as the opportunities of developing both wood production and ecosystem services.

Vision

In collaboration with society and industry, research has developed a common understanding of the importance of forests and their sustainable management. There are easy-to-use tools for analysing different objectives and well-developed decision support tools that highlight financial, environmental and societal impacts, allowing concrete proposals for action to be assessed.

Tools and support for comprehensive and transparent reporting on life cycle assessment and sustainable development are available. They are used for the environmental declaration of forest-based products and in the continuous improvement process.

Relevant research

A holistic approach is crucial. In many cases, competition between value chains is greater than between individual companies. Therefore, research needs to focus on how value chains and sustainable flows of forest raw materials can be developed and optimised. Here, research needs to highlight the roles of actors, integration in different value chains, and the impact of other ecosystem services and societal demands. Research into sustainability in general, and in various value chains that promote increased biomass production, higher value yield from the forest and increased contribution to achieving the climate goals, is prioritised. The forest's ability to replace fossil-dependent products is one important aspect. Ongoing method development of standards for life cycle analysis, and the like, requires data and calculations from forests and forestry.

The role and the importance of the forestry industry for a sustainable society needs to be highlighted, through syntheses of existing research for example. Climate, biodiversity, forest raw materials and other ecosystem services are important components. Decision support for sustainable use should be developed in order to underpin and anchor objectives and action plans for both forest raw materials and other ecosystem services.

Understanding of alternative management methods needs to be translated into impact and sensitivity analyses for different scenarios and management plans at landscape and regional level. Behavioural science research that clarifies the motivating forces of the land owners is an important component in this, but also the contribution of rules and standards.

The potential of forest ecosystems for sustainable management

SUSTAINABILITY

Knowledge of how forest ecosystems function, their untapped potential and their limitations is fundamental to sustainable forest management.

How the research field addresses societal challenges

Forests contribute to products that replace fossil fuel and materials, and are very important for climate change responses. Sometimes the public debate on forest-related issues can be characterised by polarisation, with different arguments being pitched against each other. Knowledge in the field of research should help to ensure that different opinions and values are discussed on the basis of commonly accepted facts, to the fullest possible extent.

Descriptions and motivations from the perspective of the forest industries

Active and sustainable management of forests and forest land requires a good understanding of the functioning, potential and limitations of ecosystems. The impacts of climate and environmental change on forests and forestry is of particular importance. Knowledge of forest ecosystems is the very foundation for the development of techniques and practices that promote biodiversity, ecosystem services and a healthy forest that produces valuable timber.

Research on forest production and forest land has been a longstanding activity, accumulating a wealth of knowledge about the potential of different forest ecosystems for sustainable timber production, and the risks of damage. The challenge is to develop key understanding that enables sustainable and effective synergies between high, value-adding timber production, low risk, valuable production of other ecosystem services and the prerequisites for biodiversity.

Despite their economic importance for timber producers, Swedish planted forests are perceived primarily as "nature" by people outside forestry. Surveys show that many people have no affinity with forest management and often lack basic understanding of forests and forest ecosystems.

Vision

Understanding of the impact of different types of forest management on ecosystems, as compared to the most common management practices today, is growing. Individual system components and interactions are analysed and used to develop ecological models for individual ecosystems and for interactions at landscape level. The models are used to predict the effects of changes in management, plant materials, nutrient conditions, climate and pests. The environmental, financial and societal status of the ecosystem is monitored through continuous measurement, monitoring and analysis.

Knowledge powers technologies and methods for sustainable precision forest management. New, digitalised information services are revolutionising both research and implementation.

Relevant research

Developing forest management requires increased knowledge in areas such as plant physiology, genetics, soil science, hydrology, ecology, biometrics, climate science and ethology. Together, they provide solutions to how timber production, other ecosystem services and active conservation practices can best interact in individual stands, and from a landscape perspective. Other important research concerns how the growth and resilience to damage of trees and other species is affected by different scenarios of climate and environmental change.

Long-term experiments and reference plots in the field are needed to map and verify research results. The reference sites need to be monitored through continuous measurement, control and analysis of production results, environmental impacts and societal values. It is important that the data collection is structured, stored and made accessible long-term.

More research and innovation is needed on sustainable methods in order to create and maintain forests with special recreational values near densely populated areas. Increasing knowledge of biodiversity from the perspective of managed forests is needed. The impact of set asides and environmental measures on species protection requires further analysis.

Forest raw material: availability, properties and new opportunities

RESOURCE EFFICIENCY

In-depth knowledge of the availability of forest raw material and its properties is crucial for the investment decisions of industrial customers, that is to say forestry customers, and for planning sustainable production.

How the research field addresses societal challenges

A circular bio-based economy requires the sustainable use of forest raw materials throughout the chain, from forest owners, through industry and society, to the end consumer. The raw material must be sufficient to meet ever increasing demands. Therefore, more efficient use is key, with less waste, more recycling and more products to replace more energy-intensive and fossil-based alternatives.

Descriptions and motivations from the perspective of the forest industries

Knowing how much forest raw material is available and what its properties are is crucial for both producers of forest raw material and industrial customers, such as sawmills. Increased knowledge of the standing forest provides crucial advantages for more reliable business decisions, planned integration with industrial customers' manufacturing processes as well as management of harvesting, enrichment and transportation. It is essential to increase and to share understanding about the importance of raw material diversity, efficiency, enrichment and management opportunities. Because this knowledge can help to influence costs, revenues and environmental impacts throughout the value chain.

As trees approach harvest, the availability of detailed information on tree size and properties is important in order to describe the potential range for industrial customers, both of stem wood and other biomass. New opportunities for the economic exploitation of small dimensions from thinning, contribute to a changing supply of this type of raw material. The potentials for ecosystem services other than timber production are also considered.

All major forest enterprises have systems in place to inventory and describe their forest land, forest resources and their potential for developing various ecosystem services. A national standard (Forestand) for data on forests and forest management has been established. It provides a basis for information from different holdings to be processed through technologies and methods using the standard. Digitalisation opens up new opportunities for analysis and production management through linking forest data and industry data.

Vision

Sustainable extraction of raw materials is planned on a commercial basis, contributing to sustainable solutions to several societal challenges. The raw material properties of forests can be described in more detail and at higher resolution. Digitalisation and the possibility of combining different data sources enables better planning, management and production for different requirements and different time frames. Therefore, precision planning with well-defined business agreements, reliable delivery plans and a refined analysis of different production and delivery options is possible. Information transfer can take place seamlessly throughout the value chain from the forest to the final consumer.

Relevant research

The availability of national remote sensing data needs to be secured and developed. Technologies and methods for remote sensing, aerial and ground scanning, 3D photography and other sensors are being developed with regard to resolution and price, supporting applications that also extend beyond the forest-based sector.

Research and development are needed to efficiently collect data from forest machines in different contexts, and to use them to calculate impacts on raw material availability, growth and properties. This is also important in order to promote ecosystem services and biodiversity as well as related business models. Methods to measure and calculate dimensions, properties and traceability to real outcomes, can provide new opportunities to effectively describe and exploit a raw material that is both product adapted and process adapted. Information systems need to be further developed and linked into digital value chains with industrial customers' systems.

Development of tools is required in order to carry out scenario analyses for the use of forest raw material and the interaction with other ecosystem services and landscape perspectives. Methods and tools for valuation of raw material according to the requirements of industrial customers need to be developed to support clearer business decisions and better logistical and transportation planning.

Value-adding harvesting and efficient transportation

Harvesting, enrichment and transportation are key processes in forest management and in raw material supply.

How the research field addresses societal challenges

Energy efficiency and the transition to fossil-free vehicle propulsion in the forest-based sector are crucial to achieving climate targets, and meeting other commitments. Another important area is research and development to minimise the negative impacts of forestry operations on land, on the environment and on people.

Harvesting, enrichment and transport systems need to be designed so that the right products are prepared and distributed to the right application/usage. The systems need to be highly efficient to be sufficiently competitive.

Descriptions and motivations from the perspective of the forest industries

The results of the whole cultivation process of planting and producing trees, according to the requirements of the ecosystem, has to be used in the best possible way. In Sweden, around 80 million tonnes of raw biomass are harvested and enriched annually, going to various types of industrial customers.

Harvesting, transportation and forest roads account for an average of 80% of forestry running costs, and most of its greenhouse gas emissions. There is an opportunity here, to develop cooperation between large and small forest owners, suppliers, logistics organisations and the customers involved. Technology and method developments are both needed to increase accessibility without risking damage to the environment. Digitalisation is an important enabler.

Raw material procurement and timber flows are mainly based on large-scale systems with a focus on high efficiency, high productivity and efficient transportation. Thematic map support has begun to be used for harvest planning and considerate off-road transportation. The trend has been towards fewer, larger industrial units, but regional coverage is still a distinctive feature of the forest sector. The transport of timber and wood chips by truck from the forest to industry or to terminals accounts for about 20% of heavy truck traffic in Sweden. Therefore, more efficient vehicle technology and logistics solutions are both important areas for research and development.

Vision

The management system has been streamlined in terms of financial, environmental and societal considerations. All trees are characterised in order to produce and enrich properties that create financial and environmental value. New technologies and digitalisation provide greater precision in production management. Data relating to product characteristics and traceability is passed and refined throughout the chain, linking industrial customers' systems and the forest.

The productivity of forestry machines has increased. Fuel consumption and tracking damage have been minimised. Transport, terminal and road systems and technologies have all been streamlined. Driver support and road safety systems allow increased load capacity and reductions in costs, fuel consumption and emissions. Autonomous and semi-automated systems contribute to increased and considerate efficiency.

Relevant research

Sustainable raw material supply requires research and the development of technology and methods for value creation, efficient and careful harvesting. Therefore, research into system development and analysis of how harvesting, preparation and efficient handling of the various parts of the tree, transport flows and subsequent industrial processes can be integrated most effectively, are all key areas. Introducing and analysing new high-productivity and sustainable operating systems for harvesting, off-road and onward transport that take a good working environment into account, is a high priority. Research and development into fossil-free drivelines (vehicle propulsion) as well as autonomous vehicles, semi-automated processes and control systems, has great potential.

Measurement and calculation techniques and artificial intelligence (AI) for automation and increased value utilisation, are important development areas. The development of decision support such as thematic digital map layers, and driver support is also central. The far-reaching possibilities of digitalisation demand the continued standardisation of concepts and data flows. This will make it possible to achieve efficient and seamless communication throughout and across different value chains and actors.

Effective forms of collaboration in forestry operations for small forest owners are an important research area, as are impact analyses of various proposals for new regulations.

On the screen, the harvester operator sees a map of the area, called a tract directive. In it, the plot planner has marked paths, trees that are not to be felled, cultural heritage areas and so on.

Magasin X in central Uppsala is the largest office building with a wooden frame in Sweden.

Wood processes and wood products

Wood for sustainable community development

The need to reduce the construction sector's carbon footprint means that we must make radical changes to the way the communities of tomorrow are planned, designed, built and used.

How the research field addresses societal challenges

Globally, around 40% of greenhouse gas emissions can be attributed to the construction sector. An important part of changing this is to replace non-renewable, fossil-based building materials and systems with circular, flexible building systems using renewable materials. Sustainability, aesthetics and inclusiveness are all values that can be achieved through the development of wood buildings.

Descriptions and motivations from the perspective of the forest industries

It is of great importance to know how each part of the value chain affects the emissions and the sustainability of the building, from the product stage with choice of raw material and production to the construction phase, the use stage including repair to the end-of-life stage with de-construction and re-use. All of the decisions and material choices made at the initial design stage have an impact on the climate footprint.

Consideration must be given to surrounding natural resources, energy use, water and land. It is also important to work in a resource-efficient way, with renewable materials and energy sources and to create opportunities for recycling and reuse.

Society's focus on aesthetics and inclusion in community building means that future industrial timber construction has to be developed to cope with the demands for varied and appealing architecture. There is also a development towards building for adaptability, to be able to change the use of a building over time.

In order to meet net zero emissions from the building sector, the industry must continue to develop building systems that enable a lower carbon footprint. This means increased modularisation, new kinds of hybrid and composite structures, more efficient joining technology as well as optimisation for moisture, fire, noise and stability. Increased modularity leads to greater freedom to link different types of building systems together. This increases the potential for variation and makes it possible to create buildings that are adapted to the specific site. It also entails a new way of thinking about design, inspired by industrial design. From an international perspective, the Swedish wood building industry is at the forefront of technology, and there are considerable opportunities for exporting timber products as well as know-how.

Vision

Building systems based on timber solutions are the first choice for housing, and compete well with other material choices in commercial, office and other structures, such as bridges and wind turbines. Consumer demand for bio-based housing is one of the cornerstones of development in the sector, which is really buzzing with new business activities and the creation of new jobs. The transition to being a supplier of living/working environments has been implemented, changing the business models. A variety of customised options are available on the market.

Relevant research

On the technical front, there is a need for basic research on fire safety, durability, building physics, acoustics, load-bearing capacity, and stability as well as heat and moisture transport. These are linked to changing energy requirements, climate declaration requirements and changes in the construction process. This also includes the development of embedded sensors for monitoring, assessment and follow-up.

Research on different simulation models for timber structures is also needed, for example in the form of digital twins. The models show the aesthetic appearance and function, but also provide information on the structure of the building, production considerations, costs, and the environmental impact. In this way, it becomes possible to optimise the final product early in the design process. This development gives customers confidence in their choice of wood as a structural material and provides the stakeholders in the value chain with the tools they need to develop new rational building systems. The development of hybrid structures between wood, steel, concrete, polymeric materials and glass is also required.

For more challenging structures, such as sports facilities or timber for civil engineering purposes, new structural solutions, new products and new production approaches need to be developed. Another important area to focus on, in order to achieve the vision, is the further development of simulation models for components and systems.

Research on business models for " housing and habitats" rather than " buildings" is driving development. Modern timber structures also provide an opportunity to develop original architecture and design, based on modularisation, which in addition to its potential aesthetic benefits, offers industrial process advantages, and promotes circularity.

Resource efficient industrialised timber construction

RESOURCE EFFICIENCY

Industrialised timber construction is a driving force in the transition of the construction sector to more sustainable building.

How the research field addresses societal challenges

Ongoing research shows that building with wood is economical, sustainable and has the potential to become even more profitable with new approaches to management of the construction process, manufacturing, and logistics. This provides a sound foundation for achieving society's goal of sustainable and cost-effective buildings. The industrialised building process being developed in timber construction can also be an inspiration for the transformation of the traditional building process.

Descriptions and motivations from the perspective of the forest industries

The development of new value chains and building processes is important in the development of a successful European bioeconomy. The development and adoption of new processes is often about balancing risks in terms of technology, prices, markets and policies. For a new bio-based construction to have an impact, efficient co-operation between stakeholders in the value chain and a collaborative development of processes is needed. A managed knowledge transfer process and working methods which embrace continuous improvement need to be established.

These days, there are suppliers of wood-based building systems for the construction of large structures and multi-family houses. Development is being driven by the off-site timber frame building companies who produce multi-family houses using a highly industrialised factory construction process. This type of construction process is currently undergoing major development with digitalisation and automation both in information management, and in production. The information value chain needs to be developed, in order to easily transfer harmonised and standardised data between different stakeholders.

This provides the opportunity to create entirely new processes and promotes greater variety and additional digital solutions, by drawing inspiration for modularisation from other industries. Digitalisation allows for greater customisation, but also for production efficiency through knowledge transfer. The development of digital twins gives further support for optimisation based on life-cycle calculations, production, logistics and cost.

In conventional construction, a movement towards timber construction by major contractors and real estate companies is needed. This development is largely being driven by the evolution of mass timber building system suppliers. Sweden has a strong international position in timber construction, but the competition is increasing.

Vision

The industrial construction of the future is based on an innovative development process that entails continuous improvement throughout the value chain. The new industrial era is characterised by flexibility, circularity and modularity - that is, dividing a product into a number of parts, modules which each contain a number of different components. Different timber building systems can be used together and are easy to assemble and disassemble. A truly industrialised construction process involving knowledge feedback has been developed throughout the construction sector, inspired by the process in the timber construction industry.

Relevant research

Research and demonstration of models and new industrial value chains that promote collaboration, all the way from forest-based industries processes to the construction process, are necessary. The evolution of the design process towards design based on modularisation is an important element in the further industrialisation of the process. This also favours the development of digital solutions in systems such as Extended Reality (XR) and Building Information Management (BIM), as well as circular financial criteria for product design linked to new bio-based buildings.

A more industrialised construction process also enables a higher degree of automation in the wood industry, for example the development of human-robot interaction systems in factories. Research on robotic industrial construction is likely to favour the use of more complex construction components and systems. These systems may be based on Engineered Wood Products such as CLT (Cross-Laminated Timber), veneer wood products and glulam with new types of bonding systems that allow greater variety, and more efficient production and assembly.

New generations of industrially produced wooden building components need to be developed in order to meet the requirements of smart and energy-efficient buildings and building elements. There is also an urgent need to develop support processes adapted to the traditional construction process.

It is essential to conduct research into new ways of enabling knowledge transfer as well as developing working methods and production processes.

Customised wood-based products

SUSTAINABILITY

We come into contact with wood products everywhere in our daily lives. This highlights the need for research on customisation, sustainability, quality requirements and health aspects.

How the research field addresses societal challenges

We humans have always used wood products, but to some extent wood has been replaced by fossil-based materials in consumer products such as furniture, interior design and joinery. Currently, sustainable development demands are resulting in a return to renewable bio-based materials, such as wood. Market demands mean that the wood products on offer today must evolve to satisfy more demands regarding customisation, quality requirements and health aspects. These demands are applicable to products sold directly to the final customer, as well as those sold for further processing.

Descriptions and motivations from the perspective of the forest industries

The main use of wood products is in the construction and housing sectors. Products for visible applications and interior solutions have the greatest value-adding potential for Swedish wood raw material. In a future sustainable society, demands for resource efficiency and recycling will be set against increased volumes, creating a need for innovative, efficient bio-based products. These products must meet the societal requirements and end-user demands for economic, environmental and social sustainability. For example, they must be produced in a resource-efficient way, meet health-related requirements and be both recyclable and reusable.

The building supply and interior design markets account for an ever-increasing share of total sales of wood products. We are now seeing everything from traditional to high value-added products being sold in a market which is progressively moving to virtual showrooms and e-commerce sites. Wood is an easy material to work with, allowing many consumers to use it in do-it-yourself projects. Here, additional modularisation and prefabrication can contribute to better integrated solutions.

Demand is increasing for products with inherent values as well as a high degree of customisation. Sweden produces Engineered Wood Products such as glulam and lightweight beams, and for some time has also had a significant production of Cross-Laminated Timber (CLT). Now the next generation of products needs to be developed, with a greater focus on resource efficiency and customisation of components. With a more well-developed domestic production and new resource efficient and customer efficient products, the potential for increased exports grows.

Vision

Wood-based products have largely replaced fossil-based materials and found new areas of application. Attitudes towards wood, and joinery and furniture products, are consistently positive among decision-makers and consumers. The wishes, requirements and values of the customers are all creating a stronger demand for components and products, both domestically and internationally.

Relevant research

Knowledge and skills in perception and design, as well as communication with clients and end-consumers, are fundamental. The technical, aesthetic and tactile values of wood products need to be highlighted in order for wood-based products to be profitably manufactured and sold by industrial stakeholders. Knowledge about added value is important in order to maintain the customer base and to increase profitability.

More research is needed to identify the effects of products on human health. This also includes research on consumer needs, and how they experience wood. Test beds and "living labs" where new wood products can be evaluated under realistic conditions are necessary. There is a pressing need for expertise about business models adapted to wood products.

Research is needed in order to develop materials in terms of hardness, durability, colour retention and fire resistance, and also in respect of a changed raw material. There are also issues related to the treatment or the modification of wood with bio-based adhesives, varnishes and paints. Further research into "intelligent products" combining electronics with bio-based products is also important. This includes the development of maintenance systems, reuse and quality assessment of recycled products and new services.

Research needs to focus on the development of new wood-based products, such as Engineered Wood Products for load-bearing structures, high-performance bio-based thermal insulation, and wood products with improved properties with regard to flame retardancy, durability and acoustics.

The technology of cross-laminating timber has made it possible for timber to replace most of the other structural materials in a building.

Carpenter and designer Fredrik Paulsen has produced the chair called Röhsska. The frame is made of beech from Skåne, with a seat and back in pine plywood.

Processes for manufacturing wood products

Customer requirements – from both the manufacturing industry and from the end user – mean that the processes for manufacturing and assembly of wood products, ranging from simple planed products to furniture and interior products, need to be developed and integrated.

How the research field addresses societal challenges

Wood products play an important role in the transition from fossil-based to bio-based materials. It is essential that development and production processes are sustainable, and that they result in wood products that meet the needs of the end user. The wood product industry is present throughout Sweden and is an important socio-economic factor, especially in rural areas. An efficient industrial process contributes to the sustainable production of value-added wood products for a variety of purposes.

Descriptions and motivations from the perspective of the forest industries

Domestic processing creates value and provides employment throughout Sweden. The difference in the degree of refinement can vary greatly between different sectors. In the furniture and joinery industries, products have about twenty times more value added than wood products for the construction industry. Totally, the value added through processing as well as the volumes can be significantly increased.

Swedish joinery and furniture industries operate in several segments. These include products with high demands on design, finish and traceability in the higher price range, but also volume products adapted to advanced, highly automated production methods. The manufacture of wood products often takes place in rural areas and in smaller companies where support for increased digitalisation, improved process technology, increased automation and improved business systems are particularly important.

Wood products for the construction industry are undergoing a transformation requiring an increasing degree of processing of the wood raw material, among other things to enable increased prefabrication. Further development are needed to meet the requirements of industrialised construction. The demands placed on wood products in terms of customisation, durability, quality and health aspects mean that the wood product needs to have specific properties, such as hardness and resistance to fire and moisture. The need to create fully bio-based products is stimulating the development of adhesives and treatments to modify properties and finishes.

Increasing global demand for Engineered Wood Products and other products, such as bio-based insulation, is enabling investment in the industry as well as the marketing of materials from side streams..

Vision

The joinery and furniture industries have replaced fossil-based materials and found new uses for wood products. A high degree of automation has been achieved, production processes have become more efficient and products are of better quality. The digitalisation of the industry is also well advanced. Innovative production processes have been developed. They enhance the sought-after characteristics of different types of wood, but also the environmental, societal and not least, the health-related properties of wood products.

Relevant research

Research should focus on which properties of the wood material that can be used for better automation and quality, but also which properties inhibit automation. Research is needed to develop new and/or more efficient processes for the production of wood products. The processes need to be adapted to new customer requirements and partly new raw materials, such as by-products and recycled materials. New processing techniques for wood, joining, modification (surface, durability, fire) and measurement techniques also need to be developed.

Examples of innovative processes are surface modification for increased fire resistance or increased hardness, durability, moisture repellance, mould and dirt repellence, and retention of colour, texture and structure. Further examples are chemical modification to radically alter properties of the wood material, thermal treatment for both reduced moisture movement and ability to control the colour of the wood surface.

In addition, communication and business models in the value chain are developed to track information flows, both upstream and downstream. One much sought after development is for systems to easily produce Environmental Product Declarations (EPD) and the ability to integrate these systems with other data for object-adapted products in commercially viable design programs and registers.

Digitalisation of the information flow becomes a sales argument that gives the information itself a customer value in terms of origin and labelling. Questions about organisation and leadership linked to product development and innovation are also raised, in order to optimise the value chain from sales, design, production and storage to delivery.

Resource efficient processes in sawmills

RESOURCE EFFICIENCY

Increased knowledge about resource-efficient processes for fragmenting logs, drying and grading of sawn timber is important in enabling adaptation to specific customer requirements. In turn, this is a prerequisite for sustainable industrial processes.

How the research field addresses societal challenges

Using a higher proportion of Swedish forest raw material in bio-based products with a long lifespan is an important way of contributing to Sweden's goal of becoming fossil-free. An important part of this work is the development of more resource-efficient processes for production that is more strongly driven by customer orders. For sawmills, it may also be a matter of adapting to a changed raw material base.

Descriptions and motivations from the perspective of the forest industries

Sawmill companies are often located in rural areas and are the main employer in the area. Technology, communication and business models need to be of high quality if these industries are to survive the competition. Currently, two thirds of the production of sawn timber is exported without further processing. Changing raw material bases in the form of other tree species and circulated wood will require changes and development of the processes.

In many respects, Swedish sawmills have been modernised, to reduce energy consumption in the process and to increase precision, but productivity basically remains at the same level as before. Development in the scanning and grading of logs, and a greater ability to optimise sawing for higher yields of the quality and dimensions demanded by customers, would increase resource efficiency. Development in collaboration between machine suppliers, sawmills and their customers are crucial. Wood drying is a key process from a resource and quality point of view. A more well-developed drying process could allow the properties of the end products to be customised.

The sawmilling process creates a huge quantity of by-products, the material value being more than halved when the solid wood volume is converted into sawdust. Further processing of these by-products into products with a longer lifespan increases value and improves raw material use, while at the same time sequestering carbon.

A prerequisite for increased use of wood products is that sawmills can consistently supply components that are easy to integrate into downstream processes, without additional interventions. Increased digitalisation of processes, linking information from the forest with information that needs to accompany the final products, can improve efficiency throughout the whole chain.

Vision

Process and raw material efficiency have increased, leading to significant productivity improvements. Processes for new types of raw materials have also been developed, contributing to increased productivity. Thanks to effective digitalisation and traceability of raw materials, knowledge about incoming raw materials has increased. Among other things, this has resulted in the development of new technologies for fragmentation. Research and development in drying control has made significant progress in terms of knowledge and understanding of the interaction between the process and the wood material. Swedish sawmills enjoy world-leading productivity, and the majority of sawmill production is driven by customer orders.

Relevant research

In order to achieve the goals set, technology needs to be improved and efficient. Primarily, this involves more flexible fragmentation technology, drying technology, measurement technology and new methods for customer-ordered sorting. Aspects linked to increased availability through logistics and maintenance systems is also a development of great significance. Research initiatives into the value-adding of sawmill by-products is important in order to increase the use of raw materials, as well as for the future bioeconomy. The exploitation of changing raw material flows, such as other species and recirculated wood, is another area of particular interest.

Communication and business models for controlling the flow of information, both upstream and downstream in the value chain, need be developed. The digitalisation of information flows, inside and outside the sawmill, provides important and useful process and product information. In internal logistics, autonomous trucks and automated warehouses can replace current traditional management.

In addition, it is important to develop support systems for pilot trials and prototype development, where new processes, for example for fragmentation and drying, can be tested under realistic conditions. The ability of sawmills to deliver the right components to the next stage of the value chain is another important research area.

Renewable wood-based products in circular systems

Sustainable development requires that wood-based materials and products are repaired, upgraded and ultimately recycled to a greater extent.

How the research field addresses societal challenges

The issue of circularity can be found on several levels. It concerns climate efficiency in the construction sector and the built environment, requirements for reuse and recycling of materials, components and buildings, increased longevity of the existing building stock, and the densification of cities. Circularity requirements will be imposed on all new products, and both products and buildings will have to be designed to be flexible throughout their life cycle. It is also essential that products and materials can be reused at the end of their initial life cycle. Wood has a strong link to circularity as it is a flexible and renewable material.

Descriptions and motivations from the perspective of the forest industries

The most sustainable option is not to produce any products and buildings at all. However, by using renewable materials, minimising resource use, thinking in circular terms and seeing waste as a potential resource, the environmental and climate footprint is minimised.

In production, all new products and new buildings should be made ready for changing needs and for easy substitutions. For example, substitutions may involve the need to repair something due to wear and tear, or to use a building in a different way. It is important to facilitate the reuse and recycling of components in products and buildings from the initial design stage.

Densification and prolonging the life of our existing buildings through refurbishment and extensions, is another important area of development where work is underway, but where much remains to be done. Systems and business models for renovation, remodelling and extension is another area that is currently largely project-based, but where a circular perspective can improve efficiency and create a new industry. An industry for new products and systems, but also an industry for upgrading recycled products.

At present, there is no complete process for reusing and recycling sawn timber in new products if requirements are set on strength and other properties. Energy recovery is the normal process, and there is an almost untapped raw material potential here. There is a great need to develop new business models, but also solutions around digitalisation, traceability and logistics..

Vision

Circularity is a natural part of the process for the use of all wood products, and does not need to be a separate area in future research agendas. This means that all new products and buildings are adapted to facilitate future remodelling, as well as the re-use of building products and materials. Established systems for the measurement and quality control of existing buildings, in order to produce replacement products such as stairs, doors, kitchens and bathrooms are in place. Established systems for the recycling of wood products and materials have also been developed, and are working well in a new market..

Relevant research

Concepts related to renewable materials and circularity are of great importance for policy development, founded on a research-based systems perspective for the entire value chain. Research linked to business models demonstrating the financial and sustainability benefits of higher ratio of renewable materials and circularity is essential.

Research is needed into new wood products for the remodelling and extension of existing buildings. This can be expressed as "design for repair", "design for adaptability" and "design for disassembly". This also means that it will be important to develop processes and systems where wood products are already prepared for recycling and reuse at the design stage.

To facilitate the reuse of wood products, it is important to develop modularised systems with well-developed assembly systems. Digital solutions, with building information models that also include information about the building as a material bank, need to be developed. Traceability of products and materials is another area of development.

Processes for the development of measurement techniques and for the quality assessment and reuse of wood products are of great value. Development are needed to enable CE marking of reused wood products. The next step is to develop treatment methods in the form of varnishes, glues and paints that work for recycled wood, and for upgrading reused wood products.


ICA
i eco
EKOLOGISKA
KROSSADE TOMATER
Paketet innehåller solmogna, krossade tomater från ekologiska odlingar.
390 g e
KRAV
IT-BIO-009
Italienskt jordbruk
BÄST FÖRE
FÖRP. DAG
KRAV
NY
GRÖNARE KARTONG
Arla
eko
MELLANMJÖLK
80 nya ekologiska Arlagårdar på två år. Mera EKO!
1,5% FETT
1 LITER

Fibre-based products and biorefineries

Improved utilisation of residual flows

RESOURCE EFFICIENCY

Biomass is a limited resource. New technologies make it possible to make the most of under-exploited resources, and forestry residue streams.

How the research field addresses societal challenges

The diverse use of raw materials and by-products from forestry and the forest-based industries creates an opportunity to make significant contributions to the transition of society from the fossil-fuel dependence of today and from reliance on the rest of the world, to the long-term, sustainable and safe production of materials, chemicals and energy.

Processes that exploit the intrinsic properties of materials with maximum resource efficiency and cost-effectiveness are a prerequisite for the achievement of a bio-based economy.

Descriptions and motivations from the perspective of the forest industries

Forestry production chains are constantly evolving and becoming more efficient. Current production prioritises saw logs and pulpwood, but also gives rise to other ranges such as firewood, branches and tops, which are currently poorly exploited. Sawmills and the pulp and paper industry generate relatively clean wood streams, such as chips, sawdust and cuttings, but also bark, fibre sludge and other ranges that are more difficult to tackle. Pulp processes also produce residual streams such as lignin, hemicelluloses and extractives. These residual streams have mainly been used for tall oil and turpentine and for internal energy production, but increasingly efficient processes now allow them to be used more extensively in other applications. Industrial and combustion processes give rise to residual products, such as green liquor sludge and ash. They contain nutrients that are currently under-utilised. Burning biomass also emits biogenic carbon dioxide, which can be recovered through carbon capture, and so contributing to negative carbon emissions.

Currently, by-products from the forest-based industries are primarily used for large-scale production of electricity and heat, contributing to the Swedish supply of renewable energy. The financial and environmental value in the use of raw materials and by-products should be maximised before they are used to produce energy.

Better use of residual flows from forestry, sawmills and pulp mills, and a higher level of processing of forest by-products are of high priority for the forest industries.

Vision

Increased use of forestry and forest industry residues to produce value-added products that further improve the financial and environmental performance of the forest-based sector, strengthening the competitiveness of forestry in boreal areas. Nutrients in sludge and ash generated from the incineration of residual streams for energy production are increasingly recovered. Biochar is being developed into new forest industry products. Biogenic carbon dioxide from forest-based industries combustion processes is recovered through carbon capture, creating opportunities for negative carbon emissions.

Relevant research

Raw materials represent a significant proportion of the forest-based industries running costs. Research aimed at producing a higher proportion of value-added products as well as a more efficient use of low-value residual streams is urgently needed. To minimise the environmental impact of the forest-based sector, the conservation of material resources is also important. For example, forestry generates decayed and bark beetle-damaged wood, bark, sawdust and cuttings. Chemical pulping processes result in residual streams such as lignin, hemicelluloses and extractives. Other industrial residues include rejected fibrous material, ash and sludge.

There is an urgent need for research aimed at developing processes that make valuable components from these residual streams available, thereby improving the efficiency of the production of chemicals, polymers and advanced materials. Solutions in the forest-based industries could also contribute to increased sustainability through the re-utilisation of nutrients and the capture of biogenic carbon dioxide from combustion processes. Systems analysis research is vital to provide insights into how the introduction of new technologies for reprocessing residual streams would affect other processing steps, the energy balances of pulp mills and the environmental impact of the forest-based industries.

Fibres with higher wood yield

RESOURCE EFFICIENCY

Increased production and use of higher wood yield fibres can improve the raw material efficiency of the industry.

How the research field addresses societal challenges

The annual global production of paper materials is several hundred million tonnes. Just under half of this volume is made from fresh fibre, mainly from wood, the remainder coming from recycled recovered paper. The annual production of fossil-based disposable packaging is a couple of hundred million tonnes. In order to replace a large proportion of this plastic packaging, to produce other types of fibre-based products while maintaining the current level of forest raw material extraction, packaging will have to be made from fibres with a higher wood yield. At present, the material yield is only roughly half of the raw material.

Descriptions and motivations from the perspective of the forest industries

Currently, three quarters of the world's new fibre production is made up of pulp in which the fibres are released from the wood by chemical means. The yield, that is the proportion of wood weight obtained as pulp, is about half for chemical pulps. The fibres are of very high quality and are used in the majority of paper products where there are stringent requirements, such as for strength and brightness.

Semi-chemical pulp, which is produced through a combination of chemical and mechanical treatment of the wood, has a significantly higher wood yield. This type of pulp, which is currently being used on a very small scale, could well be developed to partially replace chemical pulps in certain products.

In the manufacture of mechanical pulp, almost all wood raw material is included in the pulp. At present, this type of pulp accounts for about a fifth of all pulp and is typically used in printing paper, some hygiene products and as a middle layer in cardboard. There is great potential, and a number of challenges, in extending the use of this type of pulp, for example to replace chemical pulp entirely or partially in products such as single-use packaging. Achieving this requires both a carefully modified fibre grade and new or modified manufacturing techniques.

Of particular interest for further development towards increased resource efficiency and sustainability is the type of high-yield pulp known as CTMP (Chemi-ThermoMechanical Pulp). It can be produced energy efficiently by heating and mechanical fragmentation of chemically pre-treated wood. Major capacity building is currently underway aimed at increasing the use of CTMP in packaging, and as an alternative to fossil-based materials. For example, this pulp has shown the potential to be utilised in single-use moulded packaging.

Vision

The amount of wood required to produce paper products has been clearly reduced, without any deterioration in the properties. In some products, a proportion of the chemical pulp has been replaced by higher wood yield alternatives, in other cases the manufacturing technology and product design have been changed to enable a full transition to such alternatives. The wood yield of chemical pulp has also increased, resulting in significant impacts due to the large output volume. The transition to higher-yield pulps has increased the amount of material in the global recycling cycle, despite constant wood extraction.

Relevant research

The main challenge for increasing the proportion of higher-yield fibres in packaging, for example, is to achieve sufficiently high strength properties. Research is needed on how both fibre modification and manufacturing processes can be adapted so that even stiffer fibres can be effectively bonded together. For both semi-chemical pulp and CTMP, the whole chain needs to be considered, through raw materials, chemical treatments, process solutions and control of process conditions, focussing on how the different elements contribute to fibre properties and material properties.

One promising process that has not yet been commercialised is the hot pressing of high-yield CTMP pulp. The strength of the materials produced is on a par with what can normally only be achieved with chemical pulp. High-yield pulps have also worked well for 3D moulded products. Consequently, further development of this type of manufacturing technique is encouraged.

Chemical pulps will continue to dominate in many applications. Therefore it is important to carry out research and development that also enables higher yields in chemical pulp production.

Resource-efficient processes

RESOURCE EFFICIENCY

The industry's footprint is reduced through innovation and the further development of process solutions that lead to better use of raw materials and lower energy and water consumption.

How the research field addresses societal challenges

To increase sustainability in the forest-based industries, the use of forest raw materials, energy and water in production all need to be reduced. Society The drive of society towards a bio-based economy is increasing the demand for forest raw material, but despite Sweden's good supply of biomass, there is a limit to the amount that can be extracted. Therefore, resource efficiency in the pulp and paper industry is vital in order to make the most of the available raw material.

Descriptions and motivations from the perspective of the forest industries

The pulp and paper industry operates in international, and highly competitive markets. The majority of manufacturing costs can be attributed to forest raw materials and energy. One prerequisite for production to flourish economically in a country like Sweden, is that the raw material is used efficiently. This also applies to the viability of bulk products from forest raw material residues in the future.

Resource efficiency is achieved in two ways, either through reduced direct input of fibre raw material, energy and water or through improved process performance. The latter results in fewer resources being required to deliver an equivalent function downstream in the value chains. Resource-efficient changes in the process could, for example, be that the strength of a paper material is increased and therefore less material is needed to deliver the same performance as before. The advantage of focusing on reducing the use of forest raw material for the same amount of equivalent product (lightweighting) is that the total amount of material that needs to be managed is reduced, resulting in efficiency savings throughout the production chain.

Due to historically good access to untreated water, reducing water consumption in the pulp and paper industry has not been in focus in the same way as in countries where water is a scarce commodity. However, the European perspective on the use of natural resources is expected to result in regulations that impose higher demands on the conservation of water resources, including within Sweden. Therefore, there are strong incentives for the Swedish paper and pulp industry to promote reduced water usage.

Vision

The amount of biomass required for each product has been steadily reduced to significantly lower levels - while still maintaining functionality. Further development and innovative process solutions have led to a significant reduction in the energy required to produce paper, pulp and biorefinery products, both by the unit of weight produced and by the product function produced. Production processes with closed water reuse systems have resulted in water consumption at a level that is sustainable, even under extreme weather conditions. The foundation for these advances has been established through new knowledge, models and experimental methodology adapted to process studies.

Relevant research

Pulp milling processes need to be developed to reduce the side effects that lower energy efficiency and to reduce the need for lignin as a fuel. Chemical recycling needs to be improved through new recovery methods and modification of the cooking liquor used in the chemical pulping process (the cooking liquors). Changes in this process can contribute to the development of fibre properties, reducing the need for materials further down the value chains. This requires newly developed experimental tools, theoretical models and simulation tools to study effects at the molecular and supramolecular level.

In paper processes, the properties of the material formed need to be developed in order to reduce raw material requirements. Reducing the amount of energy used in drying needs to be prioritised, for example through better mechanical dewatering, and by modifying the interaction of the raw material with water. This requires research on the interaction of manufacturing processes and material properties - from the molecular scale up to the product scale.

System-wide process simulation models are needed. With the help of new digital tools, they can achieve resource efficiency by reducing the level of unwanted process variations. To take advantage of these tools, the development of advanced information and sensor technologies for process and product monitoring is a prioritised area.

Achieving sustainable development demands resource-efficient processes for the efficient use of bio-based raw materials.

Fossil-free chemicals

Renewable alternatives to fossil-based chemical additives can enable fossil-free processes in the pulp and paper industry, as well as in other sectors.

How the research field addresses societal challenges

Today's chemical industry is largely dependent on fossil-based raw materials. When burned, this leads to emissions of fossil carbon dioxide. For some types of products, the problem can be reduced by a substantial degree of recycling, but it cannot be completely eliminated. Therefore, it is important to move away from dependence on fossil-based raw materials wherever possible, particularly in cases where recycling is complex. An example of just such a case would be where fossil-based material is included as a small, difficult-to-separate component alongside other materials.

Descriptions and motivations from the perspective of the forest industries

Paper, cardboard and other fibre-based products are mainly made of wood fibres. However, the manufacturing process, as well as the properties of the product, are dependent on the addition of chemicals. Although the most common additive, starch, is bio-based, a high proportion of the other chemical additives are produced from fossil-based raw materials. Achieving fossil-free processes and products demands the replacement of additives with alternatives that do not rely on fossil carbon sources. Examples of priority areas are binders, hydrophobic agents and liquid-absorbent materials in hygiene products.

The situation is similar in other industries. As the pulp and paper industry has access to biogenic carbon through forest raw material, there is an opportunity to convert unused portions of this carbon into fossil-free platform chemicals that can be utilised by other value chains. One example that has undergone initial studies is the gasification of forest residues into syngas, synthesis gas. This is then converted into a suitable organic chemical for further refinement. Gasification also produces a large amount of surplus heat that can be converted into electricity or steam. The development of other similar processes could increase the climate benefits of forest raw materials. It is essential that the benefits of possible solutions are evaluated from a systems perspective at an early stage, as the raw material is limited. Different options for using biogenic carbon need to be compared and contrasted.

Vision

Fossil-based carbon has been excluded from paper, cardboard and other fibre-based products. This has been made possible by the development of alternatives to the fossil chemicals used to control the processes and to obtain the required product properties. The raw material for the fossil-free alternatives comes from the forest-based industries own biomass, or from external sources. Methods have been developed to produce bio-based platform chemicals as an integrated feature of pulp and paper mills, providing a basis for green chemistry in other value chains. This development has taken place with due consideration of the climate benefits that biomass could have had, if it had been used in other ways.

Relevant research

Eliminating fossil-based chemistry from processes and products demands the development of new chemical alternatives that produce the same effect. To achieve this, research is needed on how current additives interact with the fibre material during processing, for a better understanding of the basic mechanisms, and of how to produce bio-based molecules that can provide the equivalent function. One important aspect being to identify suitable raw materials that can constitute the basis of the chemistry.

It is expected that a better understanding of the mechanisms of additive chemicals, and the use of customised chemicals, will lead to improved performance, resulting in savings in raw materials and energy. One supplementary strategy to explore is the impact of modifying the fibre material so that it interacts more effectively with the chemicals.

In order to assess the feasibility of manufacturing platform chemicals, possible side streams and conversion processes need to be evaluated. In particular, research is needed on how to integrate the manufacturing systems into existing processes, and on system analysis tools that clarify the overall climate benefit of the biogenic carbon.

Recyclable packaging solutions

Fibre-based packaging has great potential to replace fossil-based alternatives, but sustainable solutions are needed for functions such as barriers, and for recycling processes that preserve the potential of the raw material.

How the research field addresses societal challenges

Packaging is everywhere, and the volumes of material are large. Therefore, it is imperative to develop packaging that is suitable for reuse and efficient recycling, and that also has minimal environmental impact if it were to leak out of the recycling stream. Paper materials have many advantages, but there are applications where they cannot yet replace less sustainable alternatives, or where they have to be combined with other materials to achieve the right functionality. Resolving this would lead to more sustainable packaging solutions.

Descriptions and motivations from the perspective of the forest industries

The demands of society for sustainable packaging solutions are on the increase. Several European legislative initiatives will have a major impact on the packaging industry, by requiring cost-effective recyclability, for example. Major stakeholders, particularly in consumer packaged goods (CPG), have responded by setting ambitious sustainability targets themselves. These may include commitments to substantially reducing the weight of packaging and moving to materials that can be reused, recycled or composted.

Fibre-based packaging has very high potential for recycling, and the rate of recovery is high. The raw material is renewable and if clean paper materials leak into the natural environment, they biodegrade easily. However, the potential of fibre-based packaging is not fully exploited. In some applications, the demands are greater than what fibre and bio-based packaging can currently cope with. One important example is the necessity for effective barriers against oxygen, moisture and liquids in food packaging. Other requirements may be related to the conversion process, such as the ability to heat seal the packaging. Currently, these requirements are being met by the use of materials such as plastic or metal, alone or in combination with paper-based materials.

Due to the high degree of recycling being pursued, the entire life cycle of materials must be taken into account when developing solutions. For example, in the case of barriers, the barrier material has to be separable from the other components, and recoverable with minimal degradation of the material. By addressing these challenges and increasing the proportion of fibre-based packaging, the forest-based industries can contribute to reducing its environmental and climate footprint.

Vision

Fibre-based solutions contribute to a substantial increase in the circularity of packaging, and to a significant reduction in the climate and environmental footprints. Recyclable bio-based solutions replace laminated plastic and metal barriers in paper packaging. Developments in properties and functionalities mean that fibre-based materials are replacing less circular alternatives in new product ranges. Recycling processes are now recovering all the material in the packaging, whilst also retaining its value.

Relevant research

Developing efficient and recyclable gas and moisture barriers that can serve as alternatives to plastic and metal laminates is crucial. In part this is to gain a better fundamental understanding of how lignocellulose and water interact. This knowledge is also critical in addressing accelerated creep in moisture-exposed paper materials under pressure, which is a significant practical problem leading to oversizing of cardboard packaging. Another pressing issue is the development of recyclable solutions for sealing packaging.

To reduce plastic dependency, fibre materials can replace plastics in 3D-moulded products and foam materials that provide shock absorption during transport. This requires the development of scalable moulding processes, and research is needed to investigate how the properties of fibre-based materials can be enhanced. In particular, tensile properties and the reduction of material degradation under repeated deformation both need to be significantly improved.

Processes for efficient recycling need to be developed hand in hand with material development, so that the maximum proportion of components can be reused in value-added products.

New materials from forest raw materials

Lignocellulose can provide the basis for new sustainable materials with advanced functionality and high performance.

How the research field addresses societal challenges

Climate change accelerates the need to replace materials with alternatives that have a smaller footprint, so-called substitution. Increased substitution with functional fibre-based materials such as lignocellulos, has the potential to reduce carbon dioxide emissions in many areas, such as electronics, textiles, vehicles and construction. In addition, sustainable lignocellulosic materials can provide a basis for entirely new technologies and new applications.

Descriptions and motivations from the perspective of the forest industries

Swedish forest industries can produce increasing quantities of raw materials to substitute other materials, creating new jobs, export opportunities and major sustainability effects.

In recent years, there has been increasing interest in entirely new types of fibre products based on forest raw materials, such as cellulose-based composites and optical materials. Forest-based textiles, such as viscose and lyocell, can help to replace water-demanding cotton. Threads spun from nanocellulose can provide great strength and stiffness, which could be of interest for technical materials. Lightweight lignocellulosic materials could have applications within packaging and as insulation in buildings. In other words, there are numerous possibilities.

The development of lignocellulose materials benefits greatly from general developments that are taking place in polymeric materials, binders and additives, organic electronics and many other areas. The challenge for the forest-based industries is to transfer and adapt this knowledge to lignocellulose materials, and to develop processes for the efficient production of the new materials. In some cases, it will be possible to base production on existing production infrastructure, in other cases entirely new processes will be required. Issues related to the scaling up of these processes will need to be addressed.

However, given that these challenges are met, there is great potential to develop a whole new generation of bio-based materials from forest raw materials.

Vision

New materials and products from forest raw materials have reached the market. Some of these have advanced functionality – with applications within electronics, for example – while others are produced in large volumes for use in large-scale applications, such as forest-based textiles, lightweight materials for packaging, and energy storage. Sustainable manufacturing processes have been developed that allow products to substitute for fossil-based alternatives, for example, resulting in substantial climate and environmental benefits. In parallel with the development of new products, processes for efficient recycling and reuse of materials have also been developed and implemented.

Relevant research

Lignocellulose has long been used as a structural material, in the production of paper and cardboard, for example. But the unique chemical, mechanical, optical and electrical properties of these polymers make it possible to use them in a wide range of new functional sustainable materials and applications, in areas ranging from construction materials, to electronics applications, to the release of drugs into the body.

To exploit the potential of lignocellulose materials, fundamental research on chemical and physical interactions at different structural levels is needed, and into how these can be modified for enhanced processability and functionality. One challenge of particular importance in order for these applications to reach widespread use, is to develop processes in a way that allows production on a commercial scale. It is critical to the targeted substitution effects, that processes and recycling systems are developed, to allow the materials and components to be recycled extremely efficiently.

Fibre-based products in circular systems

CIRCULARITY

Fibre-based products have to be designed for increased reuse and recycling, in multiple use cycles, and with minimised loss of value.

How the research field addresses societal challenges

Society is currently undergoing a major transition from fossil-based to bio-based materials. Combining bio-based materials and product properties enabling circularity, reduces the need for virgin raw materials. Fibre-based products play an important role in achieving Sweden's vision of a circular, bio-based economy that contributes to political climate policy goals as well as meeting consumer demands for more sustainable products.

Descriptions and motivations from the perspective of the forest industries

The European Commission's Action Plan for the Circular Economy, Sweden's climate policy framework for fossil-freedom 2045, and the roadmaps developed within Fossil-free Sweden are all examples of strong legislation and initiatives that promote a circular and bio-based economy. These necessitate a raw material supply with increased use of local raw materials and recycled fibres. Sweden is an innovative stakeholder, conducting cutting-edge research in fibre-based materials and products. The bio-based raw material is used in many applications, such as packaging, automotive and bio-based electronics. There are now increasing demands, from both Swedish and international markets, for these products to contribute to the circular systems of their respective markets.

To achieve circularity, there is a pressing need for increased collaboration between existing actors and new stakeholders along the value chains, as well as between different sectors. The design of materials and products, including value cycles adapted to circular systems, is expected to become a given. Realising this requires knowledge and sharing of experience between stakeholders, as well as the creation of industrial symbioses where by-products or waste from one activity is used as a valuable raw material in another value chain.

A cornerstone of the principles of a circular economy is to decouple value creation from resource use, to the greatest possible extent. Therefore, an increased level of recycling without loss of value in fibre-based products, means an opportunity for the forest-based industries to increase the value that can be generated from the existing quantity of resources. In order to support this, it is essential that a body of knowledge is developed that highlights the systemic impacts of different policy choices.

Vision

The excellent opportunities for recycling fibre materials are fully exploited in both shorter and longer-lasting products, replacing less circular alternatives. New materials that improve the ability of fibres to be incorporated into products intended for reuse, repair and recycling have been developed.

Products are manufactured using energy-efficient processes, designed to facilitate the recycling of fibres and other components. Additives that are difficult to separate are avoided.

Efficient recycling processes have been developed. They preserve the maximum value of the fibre material, and enable industrial symbioses based on the by-products and residual streams that arise.

Relevant research

For fibre-based products to contribute to increased circularity, interdisciplinary research is needed on how product design and processes can be devised to take into account the full life cycle, including reuse opportunities and recycling in various forms.

Although fibre-based products are widely recycled, current processes and technologies have not been developed to consider the whole life cycle of the material fully. Research is needed on how different stages of the materials cycle interact, and how they can be designed to avoid loss of material value. Partly, this means further development of mechanical, chemical and biological recycling processes that return more of the material as separated and clean streams with high value-added potential.

Resource-efficient manufacturing processes that take into account by-products and residual streams need to be further developed. All components of the raw material should be used optimally. To get the best effect, collaboration is needed with other value chains that can use such materials.

Efforts need to be made to develop successful circular business models. This requires the development of tools for life-cycle analysis and techno-economic sustainability assessments that include adjacent value cycles in larger circular systems in a relevant way.

Photo from the pulp and paperboard mill in Gruvön where among other things there is a development centre with expertise in packaging optimisation.

Pulp and paper mills in a fossil-free energy system

FOSSIL-FREEDOM

Large-scale industrial plants can contribute to a sustainable energy system in several ways, for example as suppliers of biofuels and energy, by balancing the power grid, and with carbon capture and storage solutions.

How the research field addresses societal challenges

Pulp and paper production is energy-intensive and the industry is an important part of Sweden's energy system. This means that the production facilities have the potential to support the challenges facing the country's energy supply, as wind power and other renewable energy generation, the supply of which cannot be controlled, increases. The pulp and paper industry can contribute to stability by balancing consumption in the power grid, for example.

In addition, forest biomass is a source of biogenic carbon that can be used for fossil-free fuels.

Descriptions and motivations from the perspective of the forest industries

The drive to tackle climate challenges will have major implications for the energy system. A greater proportion of renewable electricity generation from energy sources that are difficult to direct, such as solar and wind, is expected to lead to greater volatility in electricity prices. This has implications for energy-intensive industries. Pulp and paper mills produce electricity for their internal use, but large volumes are also purchased from the electricity market. The pulp and paper industry will have to adapt to changes in the electricity supply.

The industry can choose to make itself less dependent on the electricity markets by increasing its own power generation and storage capacity. Alternatively, industrial processes could be developed to allow greater flexibility in power output, and thereby adapt to the on-going situation in the power grid. Measures such as these would allow the pulp and paper industry to take a greater future role in balancing the power grid by providing system services, particularly if the market for these were to develop further.

Chemical pulp production liberates large amounts of organic matter, which is burned to generate electricity and steam. The biogenic carbon dioxide produced is currently being released into the atmosphere. Through carbon capture and storage, there is an opportunity to allow pulp mills to act as carbon dioxide sinks. One future alternative is to harness the biogenic carbon to produce substances that can replace fossil-based base chemicals or be used as bio-based electro-fuels.

In order to use the carbon, green hydrogen, which can be obtained through electrolysis, is required. The downside is that both carbon capture and electrolysis are energy-intensive, but through technology and process development, electrolysis and hydrocarbon production could provide flexibility in the pulp mill's need for external electricity, and promote the use of biogenic coal..

Vision

Pulp and paper mills contribute significantly to the stability of an energy system with a substantially higher proportion of renewable electricity production from solar, wind and other sources, where supply varies. Balancing services for the grid, based on electrification, energy storage, self-generation of electricity and heat, and flexibility in power output from the common grid, have all been effectively integrated into the production processes.

Biogenic carbon dioxide from the proportion of biomass that cannot be converted into carbon-containing products, is used optimally. It is useful, for example, as a carbon sink, as a source of biogenic hydrocarbons for further refinement, and for conversion to electro-fuels.

Collaboration with other industries, and with society in general, has been strengthened to enhance the impact of the measures taken..

Relevant research

To fully realise the potential of industry to provide balancing system services, standards and protocols are needed for how industrial systems should be characterised and connected to the power grid. Related to this, the question of how the electricity market can be commoditised also needs to be analysed. This will provide the industry with the necessary basis for techno-economic assessments.

Current production processes were developed focusing on energy efficiency. The potential to modify processes and system design in order to achieve future flexibility in power demand from the grid, needs to be explored. Digital developments are likely to increase these opportunities. There is a shortage of studies that consider both the supply and use of electricity in an integrated way.

The potential for capturing biogenic carbon dioxide in the pulp and paper mills needs to be explored in more detail. The aim is not only to find cost-effective solutions, but also processes for conversion into electro fuels and other products. Synergies with solutions that balance electricity consumption are an important aspect.

How pulp and paper mills can interact with the district heating system in a changing energy system, also needs to be investigated and developed.

The organisation behind the the Swedish Forest-based Sector Research Agenda

The National Support Group Sweden (NSG Sweden) has been initiated by the Research and Innovation Committee at the Swedish Forest Industries Federation. NSG Sweden is the unifying force behind the Swedish Forest-based Sector Research Agenda and is also the Swedish component of the European Forest-based sector Technology Platform (FTP).

NSG Sweden's activities are carried out within three reference groups with representatives from public stakeholders, industry, institutes and academia. The three reference groups are Forest and Forest Raw Material, Wood Processes and Wood Products, and Fibre-based Products and Biorefineries.

The Reference Group process leaders coordinate the development of the research agenda, promote the work, and inspire new projects and programmes.

A Programme Secretariat at the Swedish Forest Industries Federation manages the day-to-day work and organises contacts with stakeholders, funders and decision-makers.

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